# THESIS

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**FULL TITLE:**
Advanced training of nurses in oral health care and oral assessments to formulate and deliver comprehensive preventive oral care plans to improve oral health of residents with early dementia: A Feasibility study.

**SHORT TITLE:**
Can nurses assess RACF residents to formulate and deliver comprehensive oral health management through scheduled preventive interventions in care plans?

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**Responsible Institutes:**
Centre for Education & Research on Ageing, (CERA) Concord Clinical School, University of Sydney & Department of Aged Care and Rehabilitation, Concord RGH.

Dementia Collaborative Research Centre (DCRC), The University of New South Wales.

Montefiore Aged Care Nursing Home, Woollahra Campus

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# ABBREVIATIONS

| | |
|---|---|
| Assistant in Nursing | AIN |
| Better Oral Health in Residential Care | BORC |
| Compound Therapy Oral Care Plan | CTOCP |
| Comprehensive Oral Care Plans | COCP |
| Decayed Missing Filled Teeth | DMFT |
| Fixed Dental Unit | FDU |
| Human Research Ethics Committee | HREC |
| Nurse Scheduled Comprehensive Oral Care Plans | NSCOCP |
| Oral Health | OH |
| Oral Health Assessment Tool | OHAT |
| Oral Health Impact Profile14 | OHIP14 |
| Oral Health Therapist | OHT |
| Registered Nurse | RN |
| Residential Aged Care Facility | RACF |
| Salivary Gland Hypofunction | SGH |
| Silver Fluoride | AgF |
| Silver Fluoride and Stannous Fluoride | AgF+SnF |
| Sublingual Resting Saliva | SRS |
| Sublingual Resting Saliva pH | SRSpH |
| Summated Xerostomia Inventory-Dutch Version | SXI-D |
| Total Oral Bio-Burden Index | TOBI |
| Whole Resting Saliva | WRS |

# SIGNIFICANCE

## Why the Research Is Necessary

In 1975, the Australian generation aged between 65-84 years represented less than 1 percent of the population. By 2015, those aged 65-84 years were estimated to be 13 percent of the population or 3.1 million people.  By 2055 this cohort will grow to about 18 percent of the population or 7 million people.   In 2015, around 2 per cent of the population or 500,000 people were estimated to be aged 85 and over. By 2055, those aged over 85 years will be around 5 per cent of the population or 2 million people.(1)

The prevalence of people with complete tooth loss decreases with each subsequent generation from 35.7 percent for those born pre-1935 to 1.7 percent for people born 1950-1969 and is virtually non-existent among people born between 1970–90. Similarly, the percentage of people with fewer than 21 teeth was 55.1% for those born pre-1930, 6.8% for 1950-1969 and 0.4% for 1970-1990.(2)

Previous generations of older people entered Residential Aged Care Facilities (RACFs) with many missing teeth and wore dentures that could be easily removed from the mouth to be cleaned. The current "baby boomer" generation has invested more heavily in complex restorative and rehabilitative dental care than previous generations involving crowns, fixed bridgework and increasingly implants and implant retained dentures. Future generations entering RACFs, with substantially intact dentition and with past complex dental treatment, will consequently have a need for more sophisticated daily maintenance to prevent late-onset dental disease. The greater the number of teeth that cannot be maintained, the greater will be the pathological bio-burden originating from the mouth. Further, each broken down tooth may be a source of pain and infection in the body and results in degradation of normal oral function and adversely affects the quality of life of the elderly and those suffering dementia.

A study involving 243 elderly medically compromised residents with a mean age 83 years residing in 19 Melbourne RACFs found a prevalence of 67.9% of participants with untreated coronal caries and 77.4% with root caries.  Residents had a mean of 14 teeth present and 14 missing teeth. Older residents, predominantly pre-1930 females had significantly fewer teeth.(3)

In 2011, there were an estimated 298,000 people with dementia in Australia, of whom 62% were women and 70% lived in the community. Almost 1 in 10 (9%) of Australians aged 65 and over had dementia. Among those aged 85 and over, 3 in 10 (30%) had dementia. The number of people with dementia is projected to triple to

around 900,000 by 2050. In 2009–10, 53% of permanent residents in residential aged care facilities had dementia. Residents with dementia were more likely than those without dementia to require high care (87% vs. 63%).(4)

Reviews of the literature confirm the high rate of caries in the elderly.  When annualised coronal and root surface caries increments were combined in older people, this cohort was found to be a caries-active group, experiencing new disease at a rate which is at least as great as that of adolescents, between 0.4 and 1.2 new carious surfaces per year(5). A Japanese study of 287 independent elderly reported 39%  having at least one decayed tooth.(6) Review of caries incidence in the elderly report the range of caries varies from 12% to 77%.(7)

A South Australian study found coronal caries surface rates in 7 RACFs was 64.4% and root caries surface incidence was 48.5%.(8)  In a study by Elefson et al, coronal and root surface caries was significantly higher in subjects with a diagnosis of dementia. Subjects with a diagnosis of Alzheimer's disease had a significantly higher mean number of root surfaces with caries (mean = 4.9) than subjects with other dementia diagnoses (mean = 2.3) and those without dementia (mean = 1.7) People with Alzheimer's disease also had a significantly greater mean total caries score than subjects without dementia (7.8 vs 2.7).(9)

These studies also noted that the behaviour of dementia patients may improve once painful decayed teeth are treated or removed.

In summary, future generations will live much longer, will have higher rates of dementia, will retain and need to maintain many more teeth longer than any other generation before them. The relationship between oral health and systemic health, particularly aspiration pneumonia is well established.(10, 11) Future generations of elderly will have a greater impact on medical, dental and community services with the increased number of elderly enter nursing homes and the absolute number of inadequately maintained mouths progressively rises.(12)

# PHILOSOPHY OF APPROACH TO THE STUDY

The author of this thesis is the principal investigator in a collaborative feasibility study with the Dementia Collaborative Research Centre (DCRC) NSW University, Centre for Education and Research in Ageing (CERA) Concord Repatriation Hospital, Sydney University and Montefiore Aged Care Jewish Nursing Home.

This project investigates whether the oral health of the frail elderly and people suffering dementias in RACFs can be improved by combining two new approaches to deliver multicomponent interventions.

Poor oral health is a multifactorial health condition requiring multi-component interventions in which more than one risk factor is related to outcome.

Multicomponent interventions may be a more effective strategy than concentrating on a single risk factor and its associated single preventive intervention. Multifactorial assessment of risk allows development of care plans to deliver multicomponent interventions in the form of combination therapies.

There are two underlying themes to oral health risk management of older people tested in this project:
i.) The periodic use of professionally applied silver fluoride as the basis for clinical prevention and management of dental caries in frail and dependant people.

ii.) The daily maintenance of oral health care for frail elderly through a scheduled comprehensive preventive regimen managed by appropriately trained nurses within the aged care facility to carry out these individualised daily oral health procedures. The two components are linked, however the central aim of this study is to test the feasibility of the nurses training program within the context of overall management of vulnerable residents.


## Silver Fluoride Therapies

In the context of preventing and arresting dental caries in frail and dependant people, a number of clinical techniques and materials based on various silver fluoride compounds have been advocated. (Table 1)

Silver fluoride (AgF+SnF) applied topically to teeth by dental professionals on a 3, 4 or 6 monthly basis can prevent, arrest and manage dental caries. This approach, developed by the author, is discussed in greater detail in articles referenced at the end of this section.(13-15)

The use of AgF+SnF, in the authors hands, appears to be an effective technique to arrest, prevent and manage caries and could be used routinely in Residential Aged Care Facilities to treat frail elderly people, and dementia patients showing resistive behaviours.

However, the effectiveness of AgF+SnF to arrest, prevent and manage root caries in the elderly, in general practice and in RACF settings needs to be verified in large randomised control studies.

If the feasibility of having a sustainable daily scheduled multi-component preventive regimen conducted by residents' nurses is shown to be feasible, then further studies will be conducted to test the combination of the two elements to significantly reduce the burden of oral disease in RACFs.

Topical application of AgF and AgF+SnF is a low cost method of controlling dental caries involving only minimal patient co-operation. The intervention does not require complex training, and appears to be useful in preventing and arresting caries in all teeth and all surfaces.(16)

AgF+SnF is a rapid, non-threatening intervention particularly suited to treat frail elders, patients with dementia exhibiting challenging behaviours and patients with multiple rapidly progressing decaying teeth. AgF+SnF requires minimal equipment and can be easily used in RACF.

Studies using silver diamine fluoride (SDF) (16-19) and aqueous AgF+SnF (20-22) showed silver fluorides to be effective in arresting and preventing caries in children and adolescents. SDF was also shown to be effective in reducing caries in high risk adults (23, 24)

Literature reviews of silver fluoride confirm that SDF has been used more widely than other silver fluoride based preparations.(25-27)

SDF followed immediately by potassium iodide (SDF+KI) has also been proposed as method to prevent or reduce the black discolouration associated with silver fluoride techniques.(28)

SDF is less suited to treating older people at high risk of root caries. SDF may cause a gingival burn particularly if used over a large area as in the case of multiple carious lesions. Most studies recommend SDF be applied only once a year. However, caries may re-activate during this time if oral hygiene and salivary function are poor. By contrast, AgF+SnF does not cause a gingival burn/irritation and can be applied 3, 4 or 6 monthly.(14, 15)

Table 1 Summary of silver fluoride techniques

| Summary of AgF Techniques | AgF + SnF$_2$ | SDF | SDF + KI |
|---|---|---|---|
| Turns caries black | YES | YES | NO |
| Arrests / Prevents caries | YES | YES | NOT KNOWN |
| Gingival burn/discomfort | NO | YES | YES |
| Suitable over large areas, multiple lesions | YES | NO | NO |
| Frequency of application | 3, 4 or 6 monthly | Yearly Caries may re-activate (6 monthly ?) | As needed per restoration |
| Location of lesion | Non aesthetic areas Elderly may accept compromise anteriorly | Non aesthetic areas Elderly may accept compromise anteriorly | Aesthetic areas |
| Size of carious lesion | Any size | Any size | Smaller lesions with sound boarders |
| Delayed Restorative Technique / Monitor only | YES | YES | NO |
| Threatening to patient | NO | NO YES, if gingival burn | NO YES, if gingival burn |

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Various silver fluoride techniques to prevent, manage and treat caries in the elderly in both community and RACF settings.(13, 29)  These include:-

- Arrest caries with delayed restoration (preferred treatment option)
- Arrest caries with immediate restoration
- Caries control;  Definitive treatment with regular monitoring
- Palliative care;  Caries prevention with 3-4 monthly applications
- Protect crown margins
- Caries detection
- Desensitising

# Comprehensive Oral Care Plans Instituted by RACF Nurses

The second concept underlying this approach to maintaining oral health in frail elderly people involves altering conditions in the mouth from an unhealthy environment to a healthier oral environment by using multiple scheduled preventive procedures and products throughout a 24 hour period.

This main focus of this study is to assess the feasibility of training "lead advocate" RACF nurses with advanced training to carry out multi-factor risk assessments, especially of early dementia RACF residents and create Nurse Scheduled Comprehensive Oral Care Plans (NSCOCP) based on an individual risk profile. Trained RACF nurses would be able to assess new residents and institute oral care plans soon after a person enters a RACF. Trained RACF nurses are in the best position to be responsible for and monitor daily compliance of NSCOCPs. NSCOCPs will enable the daily delivery of scheduled intensive preventive combination therapies by untrained staff over 3 working shifts in a 24 hour period.

It may not be practical for a dental professional to create oral care plans for all people soon after admission into a nursing home whereas it may be possible for trained RACF nurses to do so. Nor may it be practical for a dental professional to monitor care plans for compliance on a daily basis. Despite this limitation, dental professionals can introduce oral care plan programs into RACFs and periodically review these programs as a whole, as well as spot check individual care plans. With advances in electronic RACF management software, it may be possible for dental professionals to monitor nurse created care plans remotely.

This study investigated the feasibility of training RACF nurses to make oral assessments of RACF early dementia residents, to select and schedule appropriate multi-component preventive interventions and be responsible for implementing these plans. Both nurses and the monitoring dental professional need to appreciate the usefulness and limitation of interventions and products selected in a RACF setting. Although improvement in oral health was noted by nurses, participant numbers were too small and the 10 week time period precluded obtaining statistically significant results concerning changes to oral health. A larger study is required to determine the efficacy of the products selected individually or in combination.

The underlying philosophy of this approach, to the prevention of dental caries in frail dependant vulnerable older people with multi-morbidity and dementia is that both a professional periodic clinical regimen and daily multi-component scheduled preventive interventions delivered through nurse initiated comprehensive oral health care plans are required.

Both these approaches should be combined to maximise oral health benefits.  RACF nurses can deliver daily scheduled multi-component preventive interventions through NCOCPs while dental professionals could apply AgF +SnF on a 3, 4 or 6 monthly basis depending on risk.

This thesis, while focusing on training RACF nurses to create NSCOCPs assumes that a dentist or an Oral Health Therapist (OHT) is an integral part of the team providing advice, treatment and management of all aspects of oral health care. The dental professional's roles are based on minimal intervention strategies which can be delivered in a RACF setting.(30-33)

# SUMMARY of the STUDY

## Goal

To develop an education and training program for RACF Nurses which allows trained nurses to provide individualised comprehensive care plans with scheduled multicomponent interventions to be delivered by all nursing staff multiple times throughout 3 shifts during a 24 hour working day period. Trained nurses would be responsible for monitoring compliance of care plans and be able to refer to a dental professional when appropriate.

It is envisaged that using this method, trained nurses would be able to carry out oral health assessments and initiate oral health care plans soon after a resident enters a nursing home independent of a dental professional assessment.

## Research Questions

Are the methods used in this study suitable for:

- Training RACF nurses to assess the oral health risk of early dementia residents and select appropriate preventive products and interventions?
- Can trained nurses create, be responsible for and monitor comprehensive oral care plans for compliance by nursing staff?
- Can nurse assessments and care plans be verified by dental professional's assessments/care plans blind to each other's results?
- Can possible barriers to the implementation of comprehensive oral care plans within RACFs be identified and alleviated?

# RACF Nurse Assessments, Care Plans and Scheduled Combination Preventive Interventions

The main aim of the study is to assess the feasibility of training a relatively few RACF nurses (n=4) to perform comprehensive oral health assessments using tools such as Short Xerostomia Questionnaire (SXI-D, Dutch Version), 'OHIP14', Oral Health Assessment Tool (OHAT) and a modified commercially available saliva test kit to create individualised comprehensive oral care plans for early dementia RACF residents.

These comprehensive care plans allow scheduled multi-component interventions to be delivered by untrained nursing staff over a 24 hour period.

## Methodology

Four RACF nurses (n=4) were trained to perform comprehensive oral health assessments using the Short Xerostomia Questionnaire (SXI-D), OHIP14, Oral Health Assessment Tool (OHAT) and a modified commercially available saliva test to create individualised comprehensive oral care plans for early dementia RACF residents. The study was approved by the institutional ethics in clinical research committee. The preventive products used in the study in the training program are listed in Table 3.

The nurse education and training program was conducted over 12 hours during a 3 week period. Nurse comprehensive oral assessments were made on 6 volunteers and 8 consenting early dementia RACF residents. Baseline nurse assessments were validated by oral health therapists blind to each other's results. All participants underwent a clinical examination by a dentist and medication list and medical history collated. Oral care plans were reviewed for suitability by the dentist prior commencement of the study. An OHT re-assessed participants at 10 weeks.

## Principal Findings

At the end of the study period (+10 weeks), the pilot study found:-

1.) There was a high level of agreement between trained nurse interventions and care plans and OHT interventions and care plans made blind to each other at the beginning of the study.
2.) Untrained nurses (n>10), over multiple shifts in a 24 hour period, were able to

follow care plans created by trained nurses (n=4). Compliance with individual oral health interventions (n=4930) over the 10 week study period was found to be extremely high (96.2%).

4.) NSCOCPs were found to be an effective method to implement and deliver appropriate multi-component preventive interventions in a RACF by untrained nurses.

5.) Research hypothesis concerning feasibility and training outcomes appeared to be valid.

**Nurse Scheduled Comprehensive Oral Care Plans (NSCOCP)**

Trained nurses were able to create individualised NSCOCPs that could be followed by untrained nursing staff.

All care plans included a time log whereby nurses responsible to provide interventions at set times could be tracked for compliance. Some or all of the following combination intervention therapies were selected for use by trained nurses in care plans and scheduled at specific times to be followed by untrained staff and carers.

Table 2  Products used, Function, Time of day, Frequency

| PRODUCT | FUNCTION | TIME | FREQUENCY |
|---|---|---|---|
| Neutrafluor5000 toothpaste (Colgate – Palmolive Co.) | Remineralisation | Morning | 1 / day |
| GC Tooth Mousse Plus (GC Co.) | Remineralisation | Morning | 1 / day |
| Water | Hydration | Any time | Frequently |
| Oral7 Mouth Moisturising Gel  (Auspharm) | Lubrication Protection | Any time | Frequently |
| Xylitol Chewing Gum (Miradent Gum Hager and Werken GMBH and Co) | Chewing for Stimulate saliva flow Clearance Neutralise mouth acids | After meals or snacks or Anytime | 4 - 6 / day |
| Colgate Acid Neutraliser (Colgate – Palmolive Co.) | Neutralise mouth acids Re-buffer saliva | After meals or snacks | 4 – 6 / day |
| 0.12% Curascept Toothpaste (Curaden Swiss, Australia) | Anti-microbial | Evening | 1 / day |

The frequency of eating (food management in RACF) and hydration was part of nurse training. However, the tracking of hydration and frequency of eating, although possible through the printed care plan forms, were not monitored in this study as the participants were too independent to follow water consumption and eating habits.

## Ancillary Findings

Nurse education material and training appeared suitable and effective.

Nurse focus groups reported a very high nurse satisfaction with training sessions. With further development a similar training course can be used as a basis of future training of a new class of RACF nurse with advanced training in oral health able to create comprehensive oral health care plans.

The study looked at a number of the barriers to the introduction of oral health care within RACFs and where appropriate recommendations are made to overcome these barriers.

The primary purpose of including advanced oral assessments and saliva testing was its use as a teaching tool in educating nurses in oral health. Due to the limited training time and resources available to nurses in this pilot study, the collection of data in a strict statistically significant sense was not a practical objective. However, despite these limitations, useful data were collected showing trends that may help improve the oral health of dementia patients in RACF and the elderly in general.

A large, longer term randomised controlled study is required to statistically verify whether trends or inferences found during the course of this feasibility study are valid.

## Observations on Methods Used and Recommendations to Enhance Future Research

### 1.) Short Xerostomia Questionnaire and OHIP14
The Short Xerostomia Questionnaire (SXI-D) and OHIP14 may not be sensitive enough as tools or appropriate to determine risk in early dementia patients due to participants requiring nurse assistance to answer questions which may have biased their answers.

**2.) OHAT section related to teeth**

Despite being validated, the author believes the OHAT criteria of 3 or more decayed or broken teeth as 'Unhealthy' is too large a number of carious teeth before the classification 'Requiring referral for treatment' is triggered according to the current OHAT protocol. In the author's experience nurses are unable to detect early, lingual and interproximal caries and tend to only record gross caries or root stumps.

The OHAT section on teeth is not sensitive enough to adequately assess risk for caries.

**3.) New Saliva Consistency Categories**

The GC Saliva Check Buffer $^{TM}$ kit describes 3 categories of saliva consistency as: 'Normal' (watery, clear), 'Low' (frothy, bubbly) and 'Poor' (sticky, frothy, viscous). These three categories do not fully describe saliva consistency findings found in older patients in residential aged care.

Two additional new saliva consistency categories are proposed more suited to Aged Care.

>        'No saliva'- (mouth absolutely dry)
>        'Mucopurulent' – (mucous, thick, viscous)

These categories can be scored for research purposes. In this study the categories were scored as Normal (4), Low (3), Poor (2), No Saliva (1) and Mucopurulent (-1).

**4.) Sublingual Resting Saliva pH (SRSpH)**

Low Sublingual Resting Saliva pH (SRSpH) may be more clinically relevant than focusing on salivary flow in assessing caries risk in older people.  In dementia, assessing resting saliva pH, sourced from under the tongue using a disposable sponge applicator to wet pH paper, may be more appropriate than a 3-5 minute collection of saliva by the spit/drool method particularly where there is resistive behaviours or lack of co-operation. Sublingual resting saliva pH (SRSpH) assessment is non-threatening, rapid, and reliable and may be the only practical pH assessment possible.  In a 24 hour period, the default pH state of saliva is likely to be "Resting pH" as resting saliva is present for the majority of the time throughout the day.

The mouth progressively acidifies with poor oral hygiene and poly-pharmacy induced salivary gland hypofunction, allowing more aciduric pathogenic biofilm to form on all oral tissues.

**5.) Saliva Buffering Capacity**

This study found buffering capacity of stimulated saliva of participants was considerably poorer than volunteers. Buffering capacity is probably a very accurate

assessment tool for caries risk but requires co-operation to be able to chew wax and collect saliva over a 3 minute period.

### 6.) Mouth pH

Mouth pH at rest and after eating meals or snacks is of primary importance in assessing risk of oral disease. The lower the mouth pH, the greater the will be the risk of oral disease. Where a healthy oral pH cannot be achieved naturally, due to poor oral hygiene, inability to stimulate normal saliva function due to polypharmacy or disease frequent scheduled preventive interventions are necessary.

A higher oral pH can be achieved by:-

- Chewing:                          hard foods or gum
- Sodium bicarbonate:               toothpaste, rinse or swabs
- Stimulation:                      normal social inter-actions
- Artificial saliva preparations:  high pH artificial saliva preparations
- Oral exercises and physiotherapy:

### 7.) Chewing Gum

A focus on chewing sugarless gum to stimulate salivary glands to produce salivary buffers to neutralise mouth acids is an important yet simple intervention easily incorporated into nurses' daily routines. Dispensing gum after meals is very similar to RACF nurses dispensing medications and pills. Physiotherapy and oral musculature exercise, although not part of this study may achieve beneficial results and should be encouraged.

### 8.) Sodium Bicarbonate Toothpaste

Where chewing is not possible and/or salivary function is inadequate to obtain enough volume and flow of stimulated saliva containing buffers, the regular use of small increments of a sodium bicarbonate toothpaste used after meals was found to be an effective intervention to raise oral pH.

### 9.) Possibility of Maintaining a Higher Mouth pH Throughout the Day

This study implies that it may be possible to maintain higher (healthier) oral pH values by scheduling periodic daily gum chewing and application of small increments of sodium bicarbonate into the mouth in high risk dementia participants through care plans.

### 10.) A Dental Bio-burden Score is Proposed

A Dental Bio-burden score may be determined by multiplying the average plaque score from teeth in each sextant by the number of teeth in the mouth. Similarly,

average plaque score of dentures surfaces can be multiplied by the surface area of the denture. In this study multiplying by the number of denture teeth provided an approximation of denture surface area. Adding the dental and denture bio-burden scores together provide a measure of the over-all oral bio-burden of the mouth which may prove useful in systemic and dental risk assessment.

**11.) Colour Coding**

Colour coding is an easy method of summarising oral assessments and saliva test results. Colour coding of assessment and test results proved an easier method for nurses to understand oral health risk as results are simply put into a colour band (Normal = green; Changes/Poor=yellow; Unhealthy = red; Referral = black) without having to remember a large range of different numbers for each assessment.
The colour bands aid selecting the appropriate level and frequency of preventive interventions.

Colour coding is proposed for use in future oral health studies.

**12.) Nurse Scheduled Comprehensive Oral Care Plans (NSCOCP)**

Trained nurses were able to perform individual multifactorial risk assessments, create individualised comprehensive oral care plans and schedule multi-component preventive interventions as a form of compound therapy. The structure of the care plan allows the scheduling, tracking and compliance of interventions by untrained RACF staff under the direction of the nurses with this advanced training.

## Conclusion

This exploratory study was able to determine that it was feasible for nurses to assess and perform saliva tests on early dementia RACF residents to determine individual risk and create individualised NSCOCPs involving scheduled multi-component preventive products as a form of combination therapy.

The process is practical and within the scope of RACF nurse duties.

This study did not attempt to determine the effectiveness of the care plans due to the limited number of participants and short 10 week study period.

Anecdotally, nurses reported improvement in the oral health of participants with high nurse and participant compliance.

The effectiveness of using AgF+SnF and nurse created oral care plans using combination preventive interventions needs to be determined by much larger randomised controlled studies.

A future large randomised controlled study combining both approaches in the one study may significantly show greater improvement in oral health than if each approach is used separately.

# CHAPTER 1 - REVIEW OF THE LITERATURE

Dental management of frail and elderly people, especially those suffering cognitive impairment and from various dementias in general dental practice community settings and in RACFs is a relatively new field in dentistry and is not well managed or researched. There are over 100 diseases that may cause dementia. The most common causes of dementia include Alzheimer's disease, vascular dementia, frontal lobe dementia, dementia with Lewy bodies and alcoholic dementia. (34) The severity of oral diseases has been shown to increase with the severity of physical and cognitive impairment related with dementia.(35)

Conventional dental treatment for frail older people, especially those with dementia is often unsuccessful, places the patient at increased risk of systemic health consequences and leads to a deteriorating quality of life.

Traditionally, most dental care in Australia is delivered to younger people aged less than 65 years, predominantly through general practice in community settings and to a lesser extent through government institutions or friendly society clinics. The dental profession has been successful in preventing significant oral disease through a combination of population oral health measures (such as fluoridation) and private sector general practice settings where the importance of effective tooth brushing, use of fluoride toothpastes, diet management, regular dental examinations, professional applications of effective preventive therapies and early minimally invasive treatment is stressed and can be delivered on an individual basis.

To be effective, this approach however, involves a number of assumptions about the delivery of dental care that may not be appropriate or valid when planning for the oral health needs of the elderly. This traditional approach assumes that all people, irrespective of age, are able to understand and participate in the maintenance of their own oral care, are able to co-operate with preventive and treatment interventions, do not exhibit challenging behaviours, have the mobility to seek treatment, are able to give informed consent as well as making an assumption that the elderly have adequate salivary function, have systemic health and ingest sweetened foods all within general population norms.

With increasing age, the elderly may progressively lose the ability to maintain their own oral health either through dementia, frailty or illness and become dependent on others to do these tasks for them. These tasks will fall on relatives, carers or RACF staff and managers.(36-38)

The risk of oral diseases is influenced strongly by the individual's competence in maintaining their own oral care, their dependence on others and the degree of co-operation in complying with treatment and preventive interventions (Figure 1)

The author has defined dental competence as "the ability to understand treatment and maintain one's own oral health". Over time, frailty and the severity of dementias tend to become worse resulting in greater dependency on others to perform daily tasks including oral care.(37, 39-41)

Someone who is dentally co-operative is defined by the author as "someone who will comply with and allow preventive interventions and treatment". Vulnerable elderly with chronic co-morbidities and/or mild cognitive impairment may progress over time to increasing levels dependencies associated with increasing disease burden, frailty and dementia. The elderly with social, physical and health related problems who once managed at home may no longer be able to manage even with carer support and need to enter a RACF.

Figure 1  Risk assessment based on competence and co-operation



(29)
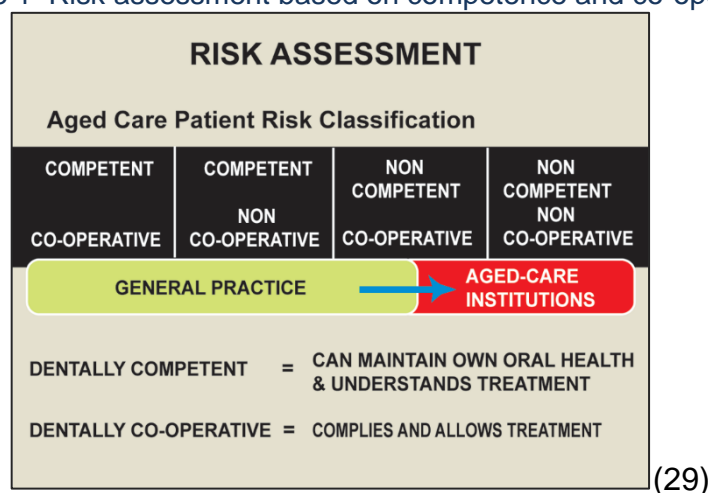
Polypharmacy, multiple medical conditions, swallowing dysfunction, dietary problems, functional dependence, oral hygiene care assistance and poor access to dental care have been identified as risk factors in the oral health of those with dementia. (37)

Although each risk identified above and the level of dependency is of primary importance, the degree to which co-operation exists directly impacts on outcome as any limitations in co-operation ultimately determines the type of interventions, preventive procedures and treatment alternatives that can be delivered to mitigate each risk and dependency.

Techniques, such as 'Rescuing, Distraction, Chaining, Hand-over-hand and Bridging' to help overcome resistance to challenging behaviours have been developed.(42) These techniques however, are more suited to carer provided preventive interventions, such as assisted brushing techniques, which can be stopped at any time without causing harm. Often even simple treatment is not attempted if there is a likelihood that a procedure may have to be abandoned midway through treatment when a dental operator suspects that co-operation will be lacking. Overlooking initial minor dental problems due to the possibility of resistive behaviours may result in multiple major problems over time.(43)

New less threatening dental treatment techniques and more intensive targeted preventive interventions tailored to the individual need to be developed, particularly for the most vulnerable in RACFs. This research study and thesis hopes to go some way to addressing both problems and setting a pathway for further research.

## Barriers to the Delivery of Dental Care to Older People

Within the general community, the accepted expectation is that dental professionals are solely responsible for treating and advising on preventive procedures related to oral health and that dental professional advice needs to be sought before preventive interventions can be delivered by non-dental professionals such as nurses or carers.

This expectation carries into the Aged Care industry and often acts as a barrier to oral health care.  At present, most dental practitioner contact with the elderly in RACFs and those people who are housebound is limited to emergency treatment with little or no ongoing preventive advice or services offered.(12, 44, 45)

Although routine dental professional examination of all residents in a RACF is a commendable ideal, it is not feasible to expect the human and physical resources or infrastructure to be readily available to fulfil this goal. Even if this were possible, findings and recommendations made at one point in time may not be appropriate when an elderly person's health changes over time.

Compliance with professionally prescribed preventive interventions and products is usually high when only one or two interventions are recommended. However, patients, carers and nurses have difficulty understanding and complying with multiple interventions particularly when multiple products are recommended for use many times throughout a 24 hour period. In both community and RACF settings it is not feasible for the daily oral care needs of these vulnerable people to be met or monitored remotely by dental professionals.

Oral care has to be performed on a daily basis. Once a person has lost the ability to maintain their own oral health, due to frailty, illness or dementia, the day to day oral health needs of that individual must be met by the person or institution looking after the day to day needs of that person.

Previous generations of older people entered nursing homes with fewer teeth and removable dentures. The changing dental epidemiological status of today's older people confirms the retention of many more teeth with extensive restorations including bridgework or implant retained fixed prosthesis making daily oral care even more critical.(2, 46)

For those elderly who cannot maintain their own oral health, particularly when salivary function is compromised, oral care interventions may have to be performed multiple times over a 24 hour period.

Most RACFs do not have sufficient resources, or a systematic educational and training approach to provide staff with the necessary incentives and skills required to maintain the oral health of residents who are dependent on others to do these relatively simple tasks. Despite the aged care industry having an awareness of the importance of oral health, these tasks are poorly undertaken or often not attempted due in part to nursing attitudes as well as managerial and industry practices that may be averse to change or concerned about the cost of implementing new nurse training and duties.(47, 48)  These factors effectively create entrenched barriers to the introduction of new procedures within RACFs able to improve the oral health of their residents.(49)

It is important to identify barriers within the aged care industry and develop education and training programs to facilitate the introduction of preventive oral health protocols able to become best practice procedures in the aged care industry.(44, 50)

Similarly, the dental profession may need to re-consider entrenched attitudes about how, when and where to treat the elderly.  A Victorian survey showed low levels of interest by dentists to provide dental care in RACFs. These attitudes effectively become barriers to the delivery of dental care to the elderly while the dental profession maintains a focus on treating people in private practice settings. (45)

Significant changes to the training of dental professionals in dental schools and within the education community to include management of the oral health of the elderly is critical.(51, 52)

The care of the frail older people, particularly in RACF involves a multi-disciplinary team approach involving a wide range of health professionals including medical practitioners, nurses, carers, physiotherapists, nutritionists and others.(45, 53, 54).

The dentist and other dental professionals should be an integral part of this team with responsibility to lead and establish procedures within RACFs to improve the oral health and quality of life of the elderly.(51)  These procedures and approaches will take on greater importance in the future as the absolute number of people over 65 years increases and enter RACFs. It will not be possible for dental professionals alone to carry out the daily oral health needs or even meet basic treatment needs of the elderly, particularly within RACFs. Current manpower requirements to meet these needs are simply inadequate and often not appropriate.

The delivery of future dental care of elderly people requires a co-ordinated multi-disciplinary platform involving medical practitioners, dentists, oral health therapists, nurses, carers, physiotherapist, allied health professionals and RACF managers.(12) It is important that this multidisciplinary platform is responsive to and incorporates new and emerging approaches to prevention and treatment of oral disease for frail older people.

In community and general practice settings, these tasks also have to be met by carers and relatives alone, without the support of RACF resources or institutions. The dental profession needs to educate relatives and carers in preventive procedures that can be delivered in a home setting and the importance of taking elderly people in their care for regular visits to a dental practice.

Depending on the individual's circumstances, a stage-appropriate treatment focus aimed at improving the quality of life of the very elderly either at home or in a RACF is a more appropriate philosophy than trying to deliver the most comprehensive of dental treatment plans.(55)  The use of silver fluorides to treat, prevent and manage dental caries in frail elderly people lends itself to a stage-appropriate philosophy. Further information on the development and use of AgF +SnF for frail elderly people can be found in the following publications written by the author.

1.      Deutsch A. Silver fluoride techniques for use in aged-care dentistry. Camperdown: Dental Outlook; 2014.

2.      Lewis A, Wallace J, Deutsch A, King P. Improving the oral health of frail and functionally dependent elderly. Aust. Dent J. 2015;60(S1):95-105.

3.      Deutsch A. An alternate technique of care using silver fluoride followed by stannous fluoride in the management of root caries in aged care.Spec Care Dentist. 2015 Dec 21.doi: 10.1111/scd.12153. [Epub ahead of print]

# Aged Care Facilities and Workforce

At 30 June 2012, there were 252,890 operational aged care places—an increase of 46% since 30 June 2002 (172,693 places). In relation to residential aged care, at 30 June 2012, there were 2,725 RACF facilities providing 187,941 places. (56)
The proportion of residents with dementia varies by age group. Around 31% of residents under the age of 65 suffer dementia and increases to 57% among residents aged 80–84 years.

In terms of health and physical care needs, people with dementia were more likely to have high care needs in relation to activities of daily living and behaviour, but not in terms of complex health care. Overall, residents with dementia were more likely than other residents to be assessed as requiring high care (90% compared with 70%, respectively).(57)

More than 240,000 workers are employed in direct care roles in the aged care sector. Of these, 147,000 work in residential facilities and 93,350 in community settings. Personal care attendants comprise 68 per cent of the residential direct care workforce, while community care workers comprise 81 per cent of the community direct care workforce.(58)

The average number of direct care workers to residential places is 0.6. For high care only facilities, the average number of direct care workers to places is 0.9 due to the higher care needs of residents. Across all residential facilities, the average staffing ratio was 0.8 direct care workers and is the same ratio found in facilities offering both high and low care (which are the majority of facilities). Personal care attendants were the most numerous occupational group providing direct care; nurse practitioners were the smallest group.(58)

Multiple barriers may negatively impact on daily oral healthcare provision, including lack of care provider education, oral health values, availability of resources and implementation of supportive policies, documentation and oral health assessment tools.(59-61)

RACFs are complex institutional organisations with different internal procedures and financial constraints. Daily care is delivered by nurses, carers, volunteers and allied health workforce who often come from different socio-demographic backgrounds, may have different educational levels, training and attitudes to oral health.

Additionally there is considerable mobility of nursing staff within the industry through migration within and out of the industry resulting in the high use of temporary staff and the loss of trained personnel.(62)

Considerable progress has been made in identifying the variables that influence oral health outcomes and barriers to care but there is much less information on the effectiveness of care strategies within the daily operations of a RACF and even less information on the quality of the programmes as a whole.(63)

# Factors Contributing To Dental Health Outcomes

Factors contributing to poor quality dental outcomes for older people are:

**Saliva**

Both unstimulated (resting) saliva and stimulated saliva have different protective functions and properties.

The total flow rate for saliva (both stimulated and unstimulated) ranges between 500 to 1500 mL per day in an adult, and the average volume of resting saliva present in the oral cavity is 1 mL. The resting saliva is derived from the submandibular gland (60%), sublingual glands (5%), parotid glands (20%) and other minor glands (15%). Parotid saliva (also termed serous saliva) is high in bicarbonate ions and amylase, while submandibular gland secretion (mucinous saliva) is high in mucins and calcium. In fact, the concentration of calcium in submandibular saliva (3.7 mmol/L) is considerably higher than that in plasma (2.5 mmol/L) or in pooled whole saliva (1.35mmol/L).(64, 65)

Saliva has multicomponent constituents performing multifunctional tasks. Normal saliva function plays an important role in the relationship between dental tissues, oral soft tissues, food and biofilm to maintain health. Some of the main functions of saliva are: Protection against demineralisation, remineralisation, lubrication, anti-viral, anti-bacterial, anti-fungal, digestion, taste, bolus formation and buffering capacity to neutralise mouth acids. (66, 67)

Degradation or loss of normal salivary function results in the loss of many important protective functions of saliva increasing the risk of oral and systemic disease. Low saliva flow rate potentiates dental decay rates and periodontal disease. Normal saliva flow varies in both Circadian and anticipatory patterns. Normal day time resting saliva has an average flow rate of 0.4ml/min, whereas stimulated saliva (anticipating or associated with eating) has an increased rate with an average of 1-2ml/min.(65, 67, 68)

**Salivary Gland Hypofunction (SGH)**
SGH is generally accepted as occurring when resting saliva flow rates are less than 0.1ml/min and stimulated saliva flow rates are less than 0.5ml/min, causing the loss of the normal protective functions of saliva.

Xerostomia is the subjective feeling of dry mouth and may or may not be associated with SGH.  Saliva is an essential component for good oral health, swallowing and

systemic health containing a supersaturated solution of calcium and phosphate ions, multiple buffers, anti-microbial agents, lubricants & digestive enzymes.(69-72)

Low saliva flow rate potentiates dental decay rates and periodontal disease. Normal saliva flow varies in both Circadian and anticipatory patterns. Normal day time resting saliva has an average flow rate of 0.4ml/min, whereas stimulated saliva (anticipating or associated with eating) has an increased rate on average of 1-2ml/min.(73)

In the absence of saliva, the pH of the mouth may remain depressed over considerable time, an observation that explains the presence of rampant caries in subjects who have lost or reduced salivary flow. (74)


**Polypharmacy**

Polypharmacy (taking of multiple medications, usually defined as 5 or more) is commonly used to treat systemic conditions associated with ageing and manage behavioural problems in dementia.(75)  Many individual medications possess anti-cholinergic activity and when taken together may act in a cumulative way to cause of both xerostomia and SGH.(76)  People subjected to polypharmacy may have greatly reduced saliva flow rates which may cause rapidly progressing decay in multiple teeth due to the loss of super-saturation of calcium and phosphate ions in saliva, loss of adequate buffering capacity and volume of saliva needed to pass over teeth to neutralise plaque acid.(69, 77-79)

Inadequate resting saliva results in loss of the protective/lubricating coating over teeth and soft tissues increasing decay, physical damage to soft tissues and bacterial infections. In health, saliva film thickness varies between 35 – 70 micrometres depending on location in the mouth.(69)  Saliva film thickness is an important determinant for the health and protection of both hard and soft tissues and the feeling of xerostomia.(65)

Lower saliva flow rates are associated with lower mucosal saliva thickness and with dryness symptoms when hypo-salivation was below 0.1-0.2ml/min. In people experiencing dry mouth, saliva film thickness on the hard palate was thinner than 10 µm.(80)

Dry mouth patients have difficulty chewing, swallowing, wearing dentures and speaking, often resulting in inadequate nutrition, bad breath and social withdrawal. Normally, the increased volume and speed of flow generated by stimulated saliva helps flush the mouth enabling food clearance, glucose clearance, dilution of both dental plaque acid and food acids allowing the mouth to return to a normal environment and pH. The loss of adequate stimulated saliva flow and volume results

in loss of buffering capacity, insufficient calcium and phosphate ions to re-mineralise teeth and causes a prolonged or permanent drop in mouth pH.(69, 79)

Mucins and agglutins in resting saliva allow agglutination and de-activation of oral pathogenic micro-organisms and aids in swallowing these organisms where they are destroyed in the gut. In dry mouth patients, pathogenic organisms remain in the mouth longer as they cannot be readily cleared (67, 78, 81) and consequently enhance deterioration of teeth and soft tissues within the mouth. Pathogenic biofilms are encouraged to grow as the mouth acidifies leading not only to rampant decay and periodontal disease but also the possibility of other infections and aspiration pneumonia. Death rates from aspiration pneumonia can be mitigated by intensive oral cleaning by dental health workers.(10, 82)

A cohort study found submandibular saliva flow rates were significantly lower among unmedicated patients with Alzheimer's dementia compared to controls, while parotid flow rates did not differ. The results suggest a selective impairment in submandibular gland function in essentially healthy patients compared with early-stage Alzheimer's dementia.(83)


**Frailty and Dependence**

Frailty and compromised physical and cognitive abilities result in associated dependencies in elderly people.

The deteriorating physical and mental capacity in frail older people prevents or reduces the individual from being able to maintain their own oral health on a daily basis. Progressive frailty, with or without cognitive decline will result in increasing levels of dependencies. The dependency is greater when frailty is accompanied with dementias and tends to become progressive over time. Each new level of physical and cognitive decline brings new levels of dependencies. In turn, each level of dependency brings its own particular set of risk factors and preventive interventions pathways suitable for that dependency.(40)

Carers and RACF nurses need to perform daily oral health maintenance tasks for those unable to do so due to increasing dependence. Most RACFs do not have sufficient resources, or a systematic educational and training approach, to provide staff with the necessary motives and skills required to maintain the oral health of residents dependent on another person to do these relatively simple tasks.(37, 84)

**Dementia and Communication**

People with dementia may not be able to easily communicate their dental pain or other dental problems. Verbal and non-verbal indicators of pain may be difficult to perceive or identify.(85) Dental pain may be expressed in behavioural problems.(86, 87) Mitigating these dental problems may improve behaviours and improve quality of life for both dementia suffers and care givers.

In one study, over 60% of dementia RACF residents assessed by dental professionals were considered to have a pain-causing condition, while geriatricians assessed only 30% as having dental related pain. This study concluded that dental pain and dental problems were under–detected.(88)

**Conventional Dental Interventions and Patient Co-operation.**

With advancing dementia, the loss of co-operation and challenging behaviours may make even simple dental interventions such as assisted tooth brushing difficult or impossible.(37, 42) Behaviour management and communication strategies require investment in time and resources to train dental professionals and RACF staff to be able to deliver interventions.(42, 89)

**Adverse Oral Effects of RACF Food Management.**

The author defines Food Management as the non-nutritious use of food to manage behaviours and the taking of medicines. The offering of frequent small snacks (often sweet and sticky) to RACF residents showing behaviour problems is compounded by poor oral hygiene, SGH and poor food clearance resulting in an oral environment that becomes and remains acidified for extended periods of time. Food management is often a common practice in RACF used to distract residents and manage challenging behaviours.

In a large Norwegian cohort study, 11% RACF residents and 17% of the patients in dementia special care units received drugs mixed in their food or beverages at least once during seven days. 95% of covertly administered medications were routinely mixed in food or beverages. Although physicians took the decision to hide drugs in the patient's foodstuff 57% of the time, this decision was documented in only 40% of patients' records. Only 23% of patient records were documented when the person who made the decision was unknown. Patients who were administered drugs covertly more often received anti-epileptics, anti-psychotics and anxiolytics compared with patients who were given their drugs openly.(90)

Food management is not readily understood as a cause of poor oral health in the aged care industry, and is not usually considered part of the scope of practice of a dental professional when giving advice to a RACF. Ideally there should be greater consultations with dental professionals, nutritionists and RACF management in how

food is used in an RACF. Simple methods to improve oral health in a RACF, such as watering down or eliminating cordial and reducing the use of sweet sticky foods may be overlooked if RACF management are not aware of the problem. Nutrition however, is a complex problem in the elderly with advanced frailty when the ingestion of calories is used to maintain weight.(91)

Saliva pH drops after each meal or snack. Normally saliva pH returns to resting pH values within 30-60 minutes due to the buffering capacity of stimulated saliva. People with poor oral hygiene have lower resting saliva pH values and suffer higher caries rates due to a greater and a more prolonged pH drop after meals. Enamel caries occurs around pH 5.5 and root caries around pH 6.0 depending on salivary calcium and phosphate concentrations. In SGH patients, the pH may remain well below 5.5 for over an hour or may not return to safe values depending on the frequency of meals and snacks.(79)

**Maintenance of Complex Dental Treatment**
Previous generations of older people entered RACFs with many missing teeth and dentures that could be easily removed and cleaned. The current "baby boomer" generation has invested in restorative and rehabilitative dental care often involving extensive amalgam fillings, crowns, bridges and increasingly implants and implant retained prosthesis which cannot be readily removed from the mouth to be cleaned.(12) Future generations will enter RACFs with substantially intact dentitions (92) and will consequently have a far higher need for more sophisticated daily maintenance of their mouths to prevent late-onset dental diseases.

The greater the number of teeth that cannot be maintained, the greater will be the pathological bio-burden originating from the mouth. Further, each broken down tooth is a source of pain and infection in the body. Behaviour of dementia patients may improve once decayed teeth are treated or removed.(93)

**Mobility**
Most frail older residents in RACF and those housebound lack the mobility to attend a dental surgery to have regular preventive and restorative treatment when needed. Conversely there is a lack of dental professionals willing to perform treatment in RACF settings.

**Education and Dental Professional Workforce**
Currently, post graduate continuing education and the undergraduate teaching of gerodontology has a low priority. Consequently many dental professionals may feel

they are ill-equipped to treat this cohort resulting in only a relatively few dental professionals working in aged care.(45, 51, 52)

The changing demographics and the increased numbers of elderly in society make it imperative that dental education and research move to focus on the needs and outcomes of this cohort, particularly as many older people will be the most at risk and vulnerable.

**Oral Health Literacy and Oral Care Training of Carers and RACF Staff**
Many carers and RACF nursing staff come from various socio-economic backgrounds, education levels and attitudes to oral health. Carers and institutions tasked with looking after the general health of people in their care may lack basic knowledge in the causes of poor oral health, lack the training, resource structures and support structures to be able to deliver oral care.(38, 44, 47, 54, 94)

The future use of electronic communications(95) and the making of appropriate dental health educational and training material aimed at carers, RACF nurses and managers adds to the poor health literacy environment in which carers and RACF staff work.(96-98)

# CHAPTER TWO - METHODS

## Study Rationale

This exploratory (feasibility) study hopes to provide information as to the effectiveness of a range of oral care strategies within the routine daily operations of a RACF.

## RACF Staff to Resident Ratios

The daily general care needs of RACF high care nursing and dementia residents cannot be met by one nurse alone and is shared by nursing staff rostered over 3 shifts in a 24 hour period. Similarly, daily oral care needs cannot be met by one nurse alone and should be shared by all nurses as needed throughout the day.

It is currently not feasible to train every nurse and temporary agency staff in RACFs in oral health education, assessments, preventive procedures and products.

The principal aim of this study is to test the feasibility of whether it is possible to train a relatively small number of nurses in advanced health assessments within a RACF to create comprehensive oral care plans tailored for each resident soon after a resident enters a nursing home. The primary aim of creating a comprehensive care plan is to establish a method whereby untrained nurses can deliver scheduled preventive procedures and products multiple times in a 24 hour period. Care plans would be able to be monitored for compliance by trained nurses on a day to day basis and be periodically reviewed by dental professionals.

Table 3 Nurse compared to resident ratios
Montefiore Nursing Home Randwick campus

| Montefiore Nursing Home (Randwick Campus) | | | |
|---|---|---|---|
| Resident : Nursing Staff Ratios | | 24 hour Period | |
| | | Residents | Nurses |
| High Care Dementia | | 30 | 13 |
| Low Care Dementia | | 30 | 9 |
| High Care Nursing | | 109 | 50 |
| Hostel - Independent | | 107 | 17 |
| | Total | 266 | 89 |
| | | | |
| | 10% Temp Staff | | 9 |

Table 3 shows the nursing staff to resident ratios in different sections of Randwick Montefiore nursing home for 3 shifts in a 24 hour period. Over a 24 hour period, 13 nurses are employed for 30 high care dementia residents, 9 nurses for 30 low care dementia, 50 nurses for 109 high care nursing residents where a large proportion have cognitive as well as physical deficits and 17 nurses for Hostel residents who live independently but with some nursing support. In total, Randwick Montefiore employs over 1000 employees per week to meet operational needs with much of the workforce consisting of part time or temporary staff.

See Appendix 22. for a more detailed breakdown of Montefiore Randwick campus nurse to resident ratios over 3 shifts in a 24 hour period.

Training a relatively small number of nurses within a RACF to perform advanced oral assessments and create comprehensive nurse oral care plans may allow:-

- Nurse advanced oral assessments and resultant care plans to be created for residents soon after entry into a RACF.
- A method whereby combination therapy using multiple products and interventions can be administered to residents by an untrained nurse workforce, multiple times throughout a 24 hour period by following the plan.
- Trained nurses to be responsible for monitoring compliance.
- Residents to not be dependent on unlikely or infrequent dental professional examination to recommend preventive products and procedures before preventive oral health interventions are commenced.
- Nurse assessments to act as a screening tool. Resident can be periodically re-assessed during a residents stay at a RACF and be referred to a dental professional for treatment if necessary.
- Greater flexibility and immediacy to change or option up care plan interventions as an elderly persons health changes over time.

It is important in this study to differentiate the roles between the dentist / oral health therapist clinical examination and nurse oral health assessments.

The primary purpose of a dental professional clinical examination is to determine if oral disease is present, to determine whether the condition may require active treatment or may involve recommendations to use various preventive procedures and products only.

The primary purpose of nurse assessments is to enable preventive oral health interventions and products to be used as soon as practical upon entry into a RACF, to screen residents for oral disease and if required, to refer a resident to a dental professional for treatment. Advanced nurse oral assessments and care plans should be part of the scope of duties of especially trained nurses working in the aged care

industry and need not need to be solely dependent on a clinical examination by a dental professional, particularly when a dental professional is not available.

The role of the dentist or dental professional within a RACF is to act as a team leader and should also involve advising RACF managers on methods to deliver advanced educate and training to a relatively small number of nurses able to assess residents and create comprehensive oral care plans.

It is equally as important that dental professionals monitor nurse care plans on a regular basis and ensure plans are appropriate. However, dental professional monitoring does not have to be on a daily basis. Dental professionals need to be involved in ongoing training and education of RACF nurses to develop these skills further and establish referral pathways back to dentists for treatment when required.

## Scheduled Combination Therapies

For older people entering a RACF facility, an ideal protocol would be to institute oral health care plans soon after entry into a nursing home facility. Unfortunately most RACF do not have the resources to employ a dental professional to create oral care plans, nor is it practical for dental professionals working outside a RACF to create care plans for all people soon after admission into a nursing home. Nor is it practical for a dental professional to monitor care plans for compliance on a daily basis. The workforce best suited for this purpose would be staff employed by a RACF.

Despite this limitation, dental professionals can introduce oral care plan programs into RACFs and periodically review these programs as a whole as well as spot check individual care plans. With advances in electronic RACF management software, it may be possible for dental professionals to monitor nurse created care plans remotely.

This study looks at methods to educate and train RACF nurses in advanced oral assessment and testing procedures to create nurse developed oral care plans for early dementia RACF residents.

This pilot study looks at the feasibility of training a new class of RACF nurse with advanced oral health training and responsibilities who are able to assess residents soon after entry into a RACF and implement and be responsible for individualised comprehensive oral health care plans. Only one or a relatively few nurses in each RACF would need to be trained to perform these duties. It is hoped that a new class of RACF nurse, with advanced oral health training, would enable the delivery of oral care more efficiently and with less costs than being solely dependent on dental professionals to visit a nursing home to perform these tasks.

After suitable education and training, a trained RACF nurse could be able to make comprehensive oral assessments and institute oral care plans soon after a person enters a RACF independently of a dental professional assessment. Trained RACF nurses would be able to periodically re-assess existing RACF residents over time, as a resident's health changes and alter care plans as needed, independent of dental professional. Trained RACF nurses are the best position to be responsible for and monitor daily compliance of NCOCPs. Trained nurses would be able to triage and refer RACF residents to dental professionals for treatment and complement the existing Better Oral Health in Residential Care (BOHRC) staff training guidelines. (97).

Nurse formulated comprehensive oral care plans could then be tailored to the individual utilising a range of simple preventive interventions that can be scheduled multiple times, over 3 nursing shifts in a 24 hour period, as part of normal RACF routines.
The author hypothesises that the use of scheduled multi-component preventive interventions can alter conditions in the mouth from an unhealthy environment to a healthier oral environment.

Trained RACF nurses would be responsible for the implementation of comprehensive oral care plans and ensure care plans are followed by untrained RACF staff and residents.

In summary, this approach will allow residents to start preventive procedures on entry to a home to help prevent or minimise oral health problems that would otherwise require future referral for extensive dental treatment if left unattended. Additionally, it is hoped that care plans will raise the profile of oral health in a RACF and trained nurses can educate untrained nurses.

# Study Design

This study design investigated multiple factors associated with the oral care of early dementia residents in a RACF.

One oral health therapist and the author delivered 12 hours training and education to four nurses.
(See section on Nurse Education and Appendices 12 and 13)

Four RACF nurses and two oral health therapists were trained to conduct the following procedures, initially on 6 volunteers and later on 8 study participants suffering early dementia:
- Short Xerostomia Questionnaire Dutch Version-(SXI-D)        Appendix 14.
- OHIP14 questionnaires                                        Appendix 15.
- OHAT assessments                                            Appendix 16.
- Modified saliva test                                        Appendix 17.
- Create individualised comprehensive oral care plans        Appendix 21.

Two oral health therapists (also called 'Dental Professionals' in this paper) repeated the same nurse assessments and testing processes to valid nurse results and care plans:
- OHAT resident assessments within 1 week of nurse testing
- Modified saliva testing of participants within 1 week of nurse testing
- Created separate dental professional care plans blind to nurse test results

Two oral health therapists also performed
- Plaque scores (Greene and Vermillion) at baseline and
  at end of the study period (+10 week)s                     Appendix 18.
- Supervision of nurse testing and assessments of volunteers and participants
- Advisory roles for nurses to help develop care plans
- Modified saliva tests on residents at baseline and 10 weeks    Appendix.21.

One research assistant assisted in
- Recruitment
- Participant and volunteer consent forms                     Appendix 7, 10.
- Next of kin information                                     Appendix 8.
- Participant and information                                 Appendix 9.
- Data collation and analysis                                Appendix 20.

The research assistant was also the lead author for a literature review on aspects of oral health and dementia. (See reference Emma Segal acknowledgements Page ii)

The author was responsible for:
- Developing HERC submissions and ethics approval process     Appendix 1–6.
- Clinical examinations: 8 residents at baseline and 10 weeks     Appendix 11.
- Developing and delivering nurse education material     Appendix 12, 13.
- Plaque scores (Greene and Vermillion) at baseline and 10wks     Appendix 18.
- Developing saliva test templates     Appendix 17.
- Developing NSCOCP and designing NSCOCP template form     Appendix 21.
- Collation and analysis of data
- Monitoring compliance of care plans
- Writing up the results of this study
- Developing Nurse NSCOCP and Saliva Test Questionnaires

The Dentist/Co-ordinating Investigator and author of this thesis was responsible for the general carriage, the basic design of the study, template forms used in the study and analysis of results together with generous assistance from his supervisors: Professor. Clive Wright, Assoc. Professor Vasi Naganathan, Professor Henry Brodaty, and co-researchers: Dr Peter Foltyn, Jayne Braunsteiner, Oral health therapist, Emma Segal Research Assistant and Deepa Singh, Dental Hygienist .

Saliva test results, OHAT assessments and oral care plans of nurses and dental professionals were compared. Care plans were reviewed prior to commencing the study. Dental examinations were completed by author with the aid of a portable dental chair, headlight, compressed air and a disposable probe and mirror.

DMFT scores were recorded according to the WHO standards and definitions as well as trialling a potential new charting system more suited to gerodontics. This new charting system is beyond the scope of this thesis and is not reported in this study but may be suitable for future research. Patients found to have oral disease were referred back to their dental practitioner.

Independent Greene and Vermillion plaque scores were performed 4 times during the study and compared. The first set of plaque scores were performed at the study commencement by an oral health therapist, then by the author and both repeated at the end of the study.

Medical status, medications and social data were collected from residents' records held by the RACF.

The master dental care plan, called the 'Principal Plan' was fixed to the inside cover of a folder visible when opened throughout the 10 week study period. Each day a blank template page was placed opposite the principal plan and all nurses involved

in the care of the patient were required to tick off or initial the opposing blank template form for each preventive intervention performed at the scheduled time as prescribed in the master plan. These filled out forms were placed into the back of the folder and a new blank template was placed opposite the principal plan each day.

Care plans were monitored for compliance over 10 weeks. After 10 weeks OHAT, Short Xerostomia SXD-I Questionnaire, saliva tests and plaque scores were repeated by the oral health therapists, and clinical dental examination and plaque scores were completed by the author to monitor any change.

## Purpose of Feasibility Study

The primary purpose of this feasibility study in using the Xerostomia Questionnaire SXI-D, OHIP14 questionnaire, OHAT assessments and saliva tests was to assess whether these combined assessments and questionnaires were suitable and practical to use:-

1.) As an educational and teaching tool for RACF nurses to better understand the balance between oral health and disease and how interventions can improve oral health.

2.) To enable nurses to formulate individualised comprehensive oral care plans tailored to the participant's needs.

3.) To establish and verify processes and procedures suitable for nurse assessments and dental professional screening of early dementia residents in a RACF setting.

4.) To assess whether an individual assessment has a correlation with caries prevalence and oral disease.

The collection of statistically testable data was not the primary purpose of this study. Both the small participant numbers (n=8), volunteer numbers (n=6), the equipment used for nurse OHAT assessments (bent toothbrushes, torch, headlight, dental mirror) and the saliva test kit had intrinsic limitations that precluded scientific accuracy. These limitations are further discussed in each relevant section following.

Despite these limitations, useful data were collected and was able to demonstrate trends in saliva testing procedures, saliva test results, care plan formulation and care plan compliance to help determine which oral assessments and preventive interventions were appropriate to train nurses and facilitate the formulation of individualised care plans for early RACF dementia residents.

# Aims of the Study

1. To determine whether RACF nurse oral health assessment and saliva testing is a valid, reliable and efficient assessment of oral health risk by comparing RACF nurse test screening results with those of a dental professional.
2. To ascertain if a saliva marker screening tests and oral assessments, conducted by RACF nursing staff, are practically feasible within their scope of current practice and duties.
3. To ascertain whether RACF nurses can formulate individualised comprehensive oral care plans utilising a range of preventive interventions through oral assessments.
4. To determine if oral health preventive management plans and intervention result in measurable changes in oral health markers after 10 weeks.
5. To ascertain whether untrained nurses will comply with following care plans.

# Thesis Format

The design of many clinical trials has been well developed for testing an intervention arm that receives a single therapeutic agent against a control arm useing a standard therapy or a placebo. However, many common and morbid health problems, particularly in older persons, are multi-factorial in aetiology(99) and attempting to test multiple individual interventions one at a time may not be a suitable research strategy.

Clinical trials to test multicomponent interventions for multifactorial health conditions, such as geriatric syndromes in which more than one risk factor is related to outcomes (99), may be more appropriate than testing a single therapeutic agent. A single intervention may be shown to be effective in clinical trials when challenged by only one risk factor. However, the same intervention may prove ineffective if overwhelmed by a combination of multiple risks factors.

This study uses a comparable approach in that poor oral health of early dementia RACF residents has a multifactorial aetiology which may require multiple types of assessments and interventions. Attempting to tease out the most effective intervention may be unnecessary when assessments and interventions combined may prove to be more effective than a single intervention.

This study had many stages and procedures, each are described with separate subject headings.

Table 4 below, summarises the relationship between the main research questions to the methods, interventions and assessment tools used in this study.
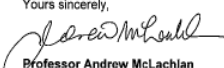
The Discussion chapter explains observations, complications, barriers, unexpected findings and how these findings relate to the literature.  A Conclusion section may be found at the end of the Discussion which outlines critical issues and makes suggestions for changes in oral health RACF procedures and possible improvements in future study designs.

Table 4  Summary of experimental design

| Research Questions | Methods | Interventions | Measures | Outcomes |
|---|---|---|---|---|
| Will additional training of RACF nurses in preventive oral care lead to better oral heath for residents, especially those with dementia and/or SGH | • Convenience sample, <br>• General vs RACF resident <br>• Before/after study <br>• Benchmark against professional standard | • Education & training <br>• OHAT + saliva markers <br>• New care plans <br>• Availability of products | • Tools can be used at professional standard in risk group <br>• Plans for risk group are complied with <br>• Products used appropriately | • High congruency in assessments & procedures <br>• Strong compliance <br>• Indicators of OH improvement <br>• Recommendation for RCTs |
| Can Short Xerostomia Questionnaire, OHIP14 and OHAT predict oral health | • Convenience sample <br><br>• Before/after study | • Education & training | • Questionnaires <br>• OHAT scores | • High congruency in assessments & procedures <br>• Strong compliance <br>• Indicators of OH improvement |
| Can we use salivary markers more effectively to predict oral & systemic health | • Convenience sample from SGH risk group | • Clinical testing of saliva flows <br>• Laboratory tests for saliva constituents | • pH, dryness, buffer <br>• Calcium, phosphates, glycoproteins, carbonates etc. | • Clinical testing feasible & cost-effective <br>• Laboratory analyses show improved protective elements |
| **Can a combination of nurse saliva testing and oral assessments using Short Xerostomia Questionnaire, OHIP14 and OHAT enable nurses to create comprehensive oral care plans that improve oral health for RACF residents, especially those with dementia and/or SGH** | **• Convenience sample, <br>• General vs RACF resident <br>• Before/after study <br>• Benchmark against professional standard** | **• Education & training <br>• New care plans <br>• Use of multiple appropriate preventive products <br>• Assisted brushing where required** | **• Questionnaires <br>• OHAT scores <br>• Plaque scores <br>• Decrease in caries rate and other oral diseases <br>• Improvement in oral hygiene <br>• Improvement in other oral health indices** | **• High congruency in assessments, preventive procedures and longer term health outcomes <br>• Strong compliance <br>• Indicators of OH improvement** |

# Ethics Approval

Fig 2  Ethics Approval Letter: Appendix 5.



Approval for this study was granted by Concord Repatriation Hospital Human Research Ethics Committee approval LNR/14?CRGH/133  (CH62/6/2014-107).

The study was a collaborative study between the Dementia Collaborative Research Centre (DCRC), NSW University, The Centre for Education and Research in Ageing (CERA), Concord Hospital, Sydney University and Montefiore Aged Care Nursing Home, Woollahra NSW.

## Referral for Treatment

Participants found to have decayed teeth and/or other oral pathology were referred back to their private dentist for treatment. The protocol used to inform participants of any dental problem found at clinical examination involved informing the participant verbally and issuing the participant a written 'Findings Form' outlining what was

found during their examination. A second copy of the 'Findings Form' was given to the Executive Care Manager of the nursing home. An additional third copy of the 'Findings Form' was delivered to participants by the nursing home after 1 week as a reminder. Participants were re-examined at the end of the study. All participants had sought treatment and were caries free by the end of the study.

# Participant Recruitment

The study was to be conducted on 20 consenting aged care residents from Montefiore Aged Care Facility, Randwick campus and on 10 healthy volunteers. Volunteers were a test group to train nurses before testing residents. Volunteer test results also acted as a non-dementia control group for nurses and study organisers to compare test results with the early dementia participant group.

### *Original Study Site*
Originally the study site was to be the Montefiore Randwick campus where a greater number of possible participants could be recruited. Randwick Montefiore provides residential accommodation for 30 high care dementia residents, 30 low care dementia residents and107 high care nursing residents, many of whom have cognitive deficits. Unfortunately, the Randwick dementia units were conducting a number of unrelated studies. Montefiore managers felt they could not accommodate another study at Randwick and moved the study location to the smaller Woollahra campus.

### *Montefiore Woollahra Campus Study Site*
The Montefiore Woollahra Campus is designed to provide accommodation for 50 low care residents. Nine high care residents also lived in the facility due to lack of space at other Montefiore campuses. Woollahra Montefiore managers nominated 24 early dementia residents as suitable to participate in this study.

The nursing home selected potential participants on the basis that the resident would be co-operative and would not be distressed or upset by testing procedures. Residents were excluded if unwell, had significant behavioural problems, did not understand sufficient spoken and written English and could not or would not sign consent forms. Residents with advanced dementia or who were likely to be distressed or non-cooperative were not selected.

Researchers and Montefiore managers advertised the study within the nursing home, followed by a one on one discussion with residents who showed an initial interest in participating in the study at resident meetings. 'Participant Information Sheets' and 'Next of Kin Information Sheets' were provided to the participant and their family. About a 5 to 7 days delay was allowed for participants to discuss the study with relatives and/or persons responsible. Subsequently another consultation was held to discuss and explain the study before participants were asked to sign consent forms.  See:-

Appendix  8.            Information for Next of Kin
Appendix  9.            Participation Information for Residents
Appendix 10.            Participant Consent Form


After considerable effort only 8 residents out of the possible 24 residents were recruited.

# Nurse Recruitment, Education and Training

Montefiore managers selected 4 nurses, 2 RNs and 2 AINs, based on their team leadership skills to participate in this study and not on seniority. All four nurses were experienced, enthusiastic and highly motivated to be part of the study. Eight out of the ten tutorials from the Oral Health CRC project (http://www.e-dentalez.com/sitio/oral-health-promotion/)(95) provided the framework for a 4 hour, in house nurse dental education and training course. An additional 4 hours of teaching information material was especially developed by Jayne Braunsteiner, Oral Health Therapist and the author and delivered using Powerpoint presentations. These presentations provided greater detail on the role of saliva, oral disease and health, oral hygiene procedures, preventive interventions, the use of Short Xerostomia and OHIP14Questionnaires, OHAT, modified saliva testing and how to formulate the Nurse Scheduled Comprehensive Oral Care Plans (NSCOCPs). A further 4 hour practical teaching block involved saliva testing of volunteers and care plan development. Nurse education and training involved a total of 12 hours. (See Tables 5 and 6 below)

Table 5  Nurse Education: Topics, training and source material

| Tutorials- Powerpoint http://www.edentalez.com/sitio/oral-health-promotion/ | Sources: http://www.e-dentalez.com/sitio/oral-health-promotion/ | Appendices Study documentation |
|---|---|---|
| Oral Health and Ageing | http://www.edentalez.com/sitio/oral-health-promotion/ | |
| Dental Caries | http://www.youtube/watch?v=XF0b_GgzwUM http://www.youtube/watch?v=nBSQQHYdkE http://www.youtube/watch?v=_ollv59bTL4 | |
| Periodontal Disease | http://www.youtube/watch?v=JryVIJTX9ok http://www.youtube/watch?v=xO_sIPTgYf0 | Appendix 12,13. |
| Oral Hygiene | http://www.youtube/watch?v=zTEA6YxRHXw http://www.colgate.com/app/CP/US/EN/OC/information/Video-Library/How-to-Floss.cvsp http://www.youtube/watch?v=eZcisKcoqSc http://www.youtube/watch?v=_ijCVK_TL14 | Appendix 12,13. |
| Denture Care | http://www.youtube/watch?v=stGCT7qDPOE | Appendix 12,13. |
| Oral Cancer | http://www.youtube/watch?v=WtNosjo8WmY http://www.youtube/watch?v=skKj5d05anU | |
| Dry mouth | http://www.youtube/watch?v=yIGgTpWJdo | Appendix 12,13. |
| Oral Hygiene and Diet | http://www.youtube/watch?v=8wk0wP33KC0 | Appendix 12,13. |

## Table 6  Nurse Education Material Developed For This Study

| Description | Source | Appendices: Study documentation |
|---|---|---|
| Modified Saliva Test Kit GC Saliva Check Buffer ™ | http://www.gcasia.info/ProdDoc/Doc3/ SALIVA_TEST_BROCHURE.pdf | Appendix 12,13. |
| Powerpoint Presentation  Saliva, SGH, pH, NSCOCP | Alan Deutsch | Appendix 12,13. |
| Powerpoint Presentation OHAT, Assisted Brushing, OH | Jayne Braunsteiner | Appendix12,13,16. |
| Xerostomia Questionnaire (SXI-D) | | Appendix 14. |
| OHIP14 | | Appendix 15. |
| OHAT | | Appendix 16. |
| Saliva Test Study Procedures | Alan Deutsch | Appendix 17. |
| Nurse Scheduled Comprehensive Oral Care Plan | Alan Deutsch | Appendix 21. |

See Appendices 12, 13:- Nurse Education Powerpoint Presentations

Practical hands-on nurse training involved examining their co-worker's mouths with the aid of a torch or headlight, dental mirrors and bent toothbrushes. A dental manikin allowed further demonstration of oral hygiene procedures and how to remove partial dentures from the mouth.  Dental terminology was explained and examples of different dental crowns and prosthesis were shown including implant retained over dentures.

The Short Xerostomia Questionnaire SXI-D (Dutch Version), OHIP14, OHAT and saliva testing were used as education and teaching tools and were first performed on the nurses themselves and then on 6 volunteers prior to testing participants. Nurses collated the information from each volunteer, discussed their findings with one of the dental professionals and created volunteer comprehensive oral care plans blind to the dental professional care plans. Care plan variations of volunteers were discussed with the nurses as a teaching tool before commencing participant assessments and saliva testing. Once created the volunteer care plans were checked by a dental professional to ensure the plans were satisfactory and then cross-checked again by the author.

The protocol above was followed for participant assessments and saliva testing and for the formulation of participant oral care plans.

One of the nurses left her employment during the 10 week study period. As a result only 3 out of the 4 nurses who completed the training filled out nurse questionnaires at the end of the study. The nurse questionnaire developed by the author in this pilot study is in a format suitable to be used in larger studies and answers are recorded in percentages despite only 3 trained nurses (n=3) completing the pilot study.

In this study, 3 nurses selecting the same category is recorded as 100%, 67% if 2

nurses select the same category and 33% if only 1 nurse selects a category.

The nurse OHAT questionnaires had the same format as the Chalmers's 2009 OHAT study with categories 'Strongly Disagree, Disagree, Agree and Strongly Agree'.

Researchers received informal feedback from nurses when nurses sought further advice, when chatting with both trained and untrained nursing staff about their progress as well as the nursing home Executive Care Manager during the course of the study.

Formal feedback from nurses consisted of:-
1.) Focus group at 4 weeks
2.) Nurse Scheduled Comprehensive Oral Care Plan (NSCOCP) Questionnaire
3.) Oral Health Assessment Tool Questionnaire

At +4 weeks into the study, three nurses attended a focus group discussion led by Emma Segal (Research Assistant).  The purpose of holding a focus group meeting at 4 weeks was to determine if there were any problems with implementing care plans and if changes to the study protocols were needed.

A decision was made that the dentist and the oral health therapist involved in the training would not attend any focus group meetings in case their attendance influenced nurse answers.

Of the three nurses who attended the focus group only Nurse 1 was involved in the nurse education and training while Nurses 2 and 3 were not trained and were required to follow the Principal Care Plans placed into patient folders. A total of 9 nurses over various shifts were involved in the care of residents and needed to comply with the scheduled comprehensive oral care plans. The views expressed by the 3 nurses at the focus group generally reflect the views of all nurses involved in carrying out care plans.

The Executive Care Manager of Woollahra also expressed a very positive feedback at 4 weeks and at the end of the study.

# ORAL ASSESSMENTS AND SALIVA TEST METHODS

OHAT and saliva tests were performed consecutively on the same morning. Nurse OHAT was carried out with the aid of headlights, dental mirrors and bent toothbrushes on participants seated in a comfortable chair. Nurses also compared their ability to inspect the mouth using available room light, to a hand held torch and finally to a 9,500 lux medical headlight (Headlights/JJ-Medical-B2-LED-Headlight-JJMB2LEDP from www.zonemedical .com.au).

Individual 1 hour appointments were scheduled for each participant between 9:00am to 12:30 pm. During the 1 hour appointment time nurses had to complete OHAT, perform a saliva test, write up their notes and create a preliminary care plan for each participant. Only 3 tests could be performed by 1 nurse per morning at 9:30-10:30, 10:30-11:30. 11:30-12:30.

A total of 29 saliva tests were performed during the 10 week study period with nurses testing 6 volunteers and 8 participants at baseline (total 14) while OHTs tested 9 participants (one re-tested) near baseline and 6 at +10 weeks as two out of the original 8 participants could not complete the study. During the course of this study a total of 15 participant saliva tests were performed.

Both OHTs and the author performed Green and Vermillion plaque scores independently and blind to each other's results. The author carried out clinical examinations using a modified charting system designed specifically for this study.

Two OHTs completed examinations, OHAT and saliva tests on residents within 1 week of nurse testing to verify accuracy of nurse assessments and testing. OHT clinical examinations were performed between 9:00am and 12:30pm with residents seated in a comfortable chair and with the aid headlights, disposable probes and dental mirrors but no compressed air or water spray. OHTs recorded Green and Vermillion plaque scores.

The oral health therapist OHATs and saliva tests were blind to nurse OHAT and saliva test results.

The author carried out a more detailed examination and Greene and Vermillion Plaque scores with residents seated in a fully reclinable portable dental chair, compressed air and water spray, dental headlight, disposable probes mirrors, tweezers, gauze and an assistant to record a new modified DMFT charting system trialled for this study.

No radiographs were taken as part of this study to detect caries or confirm apical pathology. Had radiographs been taken it is likely that caries incidence would be higher. There is poor agreement between visual tactile examinations and radiographic examinations to detect caries in posterior teeth of caries-active adults. (100)

The primary purpose of training RACF nurses in advanced oral assessment and saliva testing is its use as a practical hands on teaching tool to:-

- Help nurses understand  the importance of saliva in maintaining good oral health
- Ascertain whether assessments and saliva tests are practical to be undertaken by a few especially trained nurses in a RACF setting
- Determine if nurses can create individualised preventive comprehensive oral care plans from information collected through their assessments and saliva testing
- To determine if untrained nurses would follow care plans

The correlation between nurse and oral health therapist assessment/testing and the ability of nurses and oral health therapists to create similar care plans was a primary objective and core to this study.

Both the two OHTs and the author involved in the study were experienced in aged care. Prior to commencement of the study, all dental professionals had time to familiarise themselves with Xerostomia and OHIP questionnaires, OHAT, the modified DMFT charting, the Greene and Vermillion plaque score system and saliva tests. It was assumed that examinations and plaque scores by dental professionals would be similar and no attempt was made to standardise plaque scoring prior to commencement of the study. In hindsight, this was an omission which resulted in excessive variation in plaque score results.

The accuracy of the saliva tests, in a strictly scientific sense, was not the primary purpose of the study. The study looked at the feasibility and trialled processes and procedures that could be used in a larger RACF oral health study. Despite the lack of scientific rigour, useful assessment and saliva test results were obtained showing possible trends that may be investigated in future oral health studies.

Future larger studies in this area would require standardisation of all examiners on all procedures.

Both nurses and health oral health therapists did not use compressed air or a reclining chair. The dentist had the benefit of using portable compressed air/water and a reclining chair. It became obvious that variation in results occur when

compressed air/water was not available for OHT plaque scores and OHAT assessments.

The use of compressed air/water allows removal of debris and plaque filling interproximal spaces making detection of caries easier. Ideally future studies should use mobile compressed air and water during clinical examinations even if it cause logistical and time costs problems.

# Oral Assessments: Summary of Methods

The primary outcome here was to create individualised comprehensive nurse care plans for individual residents through RACF nurse assessments and saliva tests. Nurses and OHTs performed the same assessments and tests, created their own care plans blind to each other and results compared. Proposed nurse oral care plans were examined by the author as being appropriate for each individual participant before being implemented. Preventive interventions selected by nurses were monitored for compliance over the 10 week study period.

Table 7 Oral Assessment Methods: Dentist, Nurse, OHT, Research Assistant

| METHOD | PERFORMED BY |
|---|---|
| Clinical Dentist Examination | D |
| Plaque Scores - (Greene and Vermillion) | OHT, D |
| Data Collection - Medical Diagnoses, Medications, Anti-Cholinergic Burden Index, Social History | RA, D |
| Summated Xerostomia Inventory-Dutch Version (SXI-D) | N |
| OHIP14 Questionnaire | N |
| OHAT | N, OHT |
| Saliva Test – (modified GC Saliva Check Buffer $^{TM}$ kit) | N, OHT |
| Cross check for suitability of formulation and verification of nurse care plans RESULTS | N, OHT, D |
| Implementation of nurse care plans | N,RA,D |
| Compliance of nurse care plans RESULTS | N,RA,D |
| Re-examination, assessment and saliva testing of participants at 10weeks by dental professionals | OHT,D |
| Nurse surveys and questionnaires | RA |

Performed by: Nurse assessment/test (N), Oral health therapist assessment (OHT), Research assistant (RA), Dentist assessment (D)

## Clinical Examination

Participants were handed out personalised appointments some days prior their examination appointments and reminded by RACF staff of their appointment with the dentist on the morning of their examination.

Clinical oral examinations of participants were carried out by the author in 2 morning appointment blocks a day or two prior to the nurse and OHT assessments/ tests at baseline and again at 10 weeks. (See Appendix 11.)

Equipment used by the author included disposable mirrors, number 6 probe, tweezers, compressed air and water, gauze, 9500 lux medical headlight, 4.2 times magnification loupes and a reclinable chair. No radiographs were taken. Half hour appointments were scheduled to complete each clinical examination which was held in a dedicated room with hand washing facilities and good lighting. Clinical charting and examination findings were recorded with the assistance of a trained dental assistant who acted as a scribe.

Examination findings included DMFT scores, charting of restored teeth surfaces and decayed surfaces, saliva consistency and Greene and Vermillion plaque scores. Gingival condition was noted but not charted. An oral screen to detect soft tissue pathology was completed at this time.

All participants selected for the study were co-operative, not stressed and did not show any challenging behaviours.

Participants were given a 'Findings Sheet' that listed decayed teeth, pathology found, incidental findings and whether they needed to see their dentist for treatment. A copy of the "Findings Sheet" was given to the executive care manager of the nursing home. A third copy was again given to the participants by the nursing home one week after their examination as a reminder.

# Plaque Scores

Appendix 18.

The Greene and Vermillion OHI scoring system (0, 1, 2, 3 see below) was used as a simple and effective method to score the extent of dental plaque and debris covering buccal and lingual tooth surfaces. (101) (See Appendix 18.)

Table 8  Greene and Vermillion OHI scoring system

| Scores | Criteria |
|--------|----------|
| 0 | No debris or stain present |
| 1 | Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered |
| 2 | Soft debris covering more than one third, but not more than two thirds, of the exposed tooth surface. |
| 3 | Soft debris covering more than two thirds of the exposed tooth surface. |



(101)

The Oral Hygiene Index is composed of the combined Debris Index and Calculus index. Each of these indices is in turn based on 12 numerical determinations representing the amount of debris or calculus found on the buccal and lingual surfaces of each of three segments of each dental arch. The tooth used for the calculation must have the greatest area covered by either debris or calculus in each sextant. This system does not assess interproximal plaque or calculus.

At baseline, 8 participants had plaque scores assessed by the author during participant clinical examinations using a headlight, disposable mirror, probe and compressed air and water with readings recorded by an assistant. Plaque scores were again repeated by the two OHTs within 2-3 days using headlights, disposable mirror and probe but without compressed air or water and prior any change in oral hygiene interventions.

At the end of study at +10 weeks, the 6 remaining participants were re-assessed separately by both the author and the two OHTs using the protocol at baseline to assess if there were any improvement in plaque scores. Dentist and OHT plaque scores were then compared. The 6 participants completing the study underwent 4 plaque scores each while the two participants that could not complete the study underwent 2 plaque scores. A total of 28 plaque scores were performed on participants over the 10 week study period.

There was no standardisation training between the dentist and the two OHTs prior the study which later proved problematic due to variations in scoring.

# Medical Diagnosis, Medications and Anti-cholinergic Burden Scale

Each nursing home resident has his/her medications recorded in an individual folder in a locked medications room. A registered nurse administers each resident's prescribed medications as prescribed by their medical practitioner.

Each resident has their medical conditions and diagnosis recorded within the Montefiore Nursing Home computerised management software.

The research assistant was given access to both medication folders and the nursing home management software to record participant's medical conditions and medications lists. (See Appendix 20.)

The medications taken in the previous 6 months but had been stopped at the time the study had commenced were also recorded.

## Polypharmacy

Only those medicines taken at baseline were scored using an anti-cholinergic activity burden scale.

Participant's medications were scored from an anti-cholinergic activity burden scale formulated by St Vincents Hospital Pharmacy Department, Darlinghurst NSW. Medicines were given a score from 0-3, with 3 having the greatest anti-cholinergic effect. (See Appendix 19.)

St Vincents Hospital allocated an Anticholinergic Burden Score (ABS) to the following categories of medications.
- anti-psychotics (3)
- anti-convalescent (2)
- most heart medications, hypertensives, diuretics (1)
- GORD medication (1)
- opioids (1)

Both total medications taken and a summated anti-cholinergic burden score were recorded as separate total scores.

The study investigated whether there was an association with polypharmacy, anti-cholinergic burden scores, dry mouth, OHAT, SXI-D, OHIP14, saliva quality and decay.

## Xerostomia Assessment: SXI-D Questionnaire

The Montefiore Study used the shorter Summated Xerostomia Inventory-Dutch Version (SXI-D). (See Appendix 14.)

The SXI-D contains only 5 questions and was chosen as a more suitable questionnaire for a dementia oral health study than the longer Xerostomia Inventory (XI) with 11 questions.

The SXI-D has one of three response options "Never" (score 1), "Occasionally", (score 2) and "Often" (score 5) for questions. Scores range from
5 (no xerostomia) to 25 (worst possible Xerostomia) for the questions below.

1. My mouth feels dry when eating a meal
2. My mouth feels dry
3. I have difficulty in eating dry foods
4. I have difficulties swallowing certain foods
5. My lips feel dry

Participant's responses were scored and summed to give a single score.
The shortened Xerostomia questionnaires were completed at the beginning of the study and then again at the end of the study. Two residents were lost to the study due to illness and could not complete follow up questionnaires or saliva tests at 10 weeks.

## Oral Health Impact Profile14 (OHIP14)

OHIP14 was used in this study. (See Appendix 15.)
Each of the 14 questions making up the OHIP14 questionnaire can be scored as:-
'Never (score 1), Hardly Ever (score 2), Occasionally (score 3),
Fairly Often (score 4), Very Often (score 5)' with scores ranging from 14 to 70.

Both participants (n=8) and volunteers (n=6) completed OHIP14 questionnaires.
OHIP14 scores for participants and volunteers were added to give summated total scores and compared.

# Oral Health Assessment Tool (OHAT)

Appendix 16.

The 2009 Chalmers at al. Study used an Oral Health Assessment Tool (OHAT) to assess residents in RACFs. The Chalmers OHAT had a scoring system with minimum of 0 and maximum of 16.  Eight categories *(Lips, Tongue, Gums and Oral Tissues, Saliva, Natural Teeth, Dentures, Oral cleanliness and Dental Pain)* could be scored 'Healthy (score 0), Changes (score 1), Unhealthy (score 3).Thee individual category scores were then added to provide a summated total score. The lower the OHAT score the better.

Montefiore nursing home has been using a modified version of the Chalmers OHAT form for several years. The Montefiore OHAT form differs from the standard OHAT form in that it contains preventive intervention advice for RACF nurses should they discover an adverse finding in any of the 8 OHAT categories. Information on the use of preventive products and procedures suitable for use by nurses in a RACF setting is included on this form. The back page of the Montefiore OHAT form has images of each of the 8 unhealthy categories to assist nursing with scoring.

The nurses involved in this study were not familiar with the Montefiore form until the commencement of the pilot study.

This feasibility study used the same 8 OHAT categories with a different scoring system:
'Healthy (score 1, green column), Changes (score 2, yellow column), Unhealthy (score 3, red column) and Referral for treatment (score 4, black column)'.

Colours were chosen based on a traffic light system to help nurses interpret the forms. Scores range from a minimum of either 7 if the subject was without dentures, or 8 if wearing dentures (the most healthy) to a maximum of 32 (worst possible, requiring referral for all categories) The rational for trialling a change of scoring is that it may be able to differentiate between people with and without dentures. Under this modified OHAT system, a healthy person without dentures would score a 7 and those with dentures would score an 8. Under the Chalmers OHAT scoring system, both would be scored as zero.

The modified OHAT scores used in this study differed from the Chalmers study also with Montefiore scores having a range from 7-32 while the Chalmers OHAT scores ranged only from 0-16.

Nurses completed OHAT assessments and filled out OHAT forms on 6 volunteers prior assessing the 8 Participants.  Nurses worked in pairs with one nurse acting as

a scribe while the other nurse used a bent toothbrush for retraction, a disposable dental mirror and a 9500lumens medical light.

OHTs completed the modified OHAT assessments on 8 Participants at baseline, blind to nurse assessments, and at 10 weeks using a disposable number six probe, mirror, tweezers, gauze and headlights. OHTs did not use compressed air and water or take x-rays.

OHAT assessments proceeded saliva testing at the same appointment.

OHT and nurse OHAT results at baseline were compared. OHT baseline OHAT and at OHAT at +10 weeks were also compared.

The volunteer and participant OHAT scores were recording using the modified (Montefiore) study scoring system (range 7-32).

The Montefiore OHAT scores were then converted into the original Chalmers OHAT scoring system (range 0-16) and the two scoring systems were compared.

# Saliva Tests

Appendix 17.

A standard commercially available saliva test kit 'Saliva Check Buffer $^{TM}$' by GC Australia was used in this study. The saliva test kit procedures were modified to help nurses better understand saliva function and risks.

The rational for choosing this test kit was:-

- The GC company education and material is of a high standard and suitable for educating and training nurses
- Relatively inexpensive as each kit can test 20 subject.
  RACF may be reluctant to adopt new practices if costs are high
- The saliva kit is readily available and can be purchased from dental suppliers

As this study involved early dementia RACF residents, saliva collection was shortened to 3 minute collection of resting and stimulated saliva flow measurements to minimise potential stress to participants. Additional testing protocols were added to the GC Saliva–Check BUFFER test procedures to better suit the circumstances found in RACFs and for the teaching needs of this study to develop nurse comprehensive oral care plans.

## Participant Saliva Tests

Participant saliva tests were carried out between 8:30am and 12:30pm, firstly by nursing staff and then repeated by an OHT within 5-7 days of nurse testing. Saliva tests of participants were again repeated for a third time by an OHTat the end of 10 weeks to ascertain whether there was an improvement in oral and salivary markers.

Saliva was collected into a receptacle by the "spit or drool" method and then weighed using electronic scales (MyWeigh GEMPRO500 100g x 0.002g by Med Shop Aust.) to determine volume which was divided by the collection time to determine flow rate.

## Resting Saliva pH Assessments

Resting saliva pH was assessed in two ways and compared.

1.) By wetting a disposable sponge applicator placed under the tongue for 2-3 seconds to then wet pH paper test strip outside the mouth. The author defines this pH measurement as Sublingual Resting Saliva (SRS pH).

Test subjects were asked to swallow the residual saliva in their mouths and tilt their head slightly forward.

After 30 seconds, a large disposable sponge applicator (c: 3mm round) was placed under the tongue for 2-3 seconds, then used to wet pH paper test strip.

2.) The second method involved collecting Whole Resting Saliva into a receptacle for 3 minutes by the spit/drool method. The saliva pH was measured by pipetting a drop of saliva onto pH paper test strip to record the whole resting saliva (WRSpH)

Both SRSpH and WRSpH methods were compared for accuracy and suitability for use in a RACF setting.

# Saliva Test Procedures Overview and Timings for This Study

Testing procedures and time allocated for each test in sequential order were:-

**1) Sublingual Resting Saliva pH:** Sublingual Resting Saliva pH (SRSpH) was assessed by wetting a small disposable sponge applicator placed under the tongue for 2-3 seconds and then using the wetted applicator to wet pH paper test strip. (Time: 0.5 minute)

**2) Dryness Test:** Dryness was measured by placing tissue paper on the inside aspect of the lower lip for 1 minute and recording the time for beads of saliva to form. (Time 2 minutes)

**3) Consistency:** Saliva was visually assessed and classified as mucous, sticky (if saliva adheres to a dental mirror), frothy, watery or clear, completely dry or muco-purulent. (Time 0.5 minutes)

**4) Resting Whole Saliva Collection and pH:** Participants were asked to spit or drool into a container for 3 minutes and the container weighed to assess unstimulated saliva volume and flow rate. Saliva was pipetted onto pH paper test strip to measure pH. (Time: 5 minutes)

**5) Glucose Challenge:** Participants rinsed with a 20% glucose solution for 1 minute. SRSpH reading was recorded immediately after rinsing followed by a 5 minute wait when a second SRSpH was made at + 5minutes. Where possible, additional pH readings were recorded at 5 minute intervals depending on participant co-operation, if participants seemed unstressed and time allowed. Additional readings were occasionally achieved but were not an essential aspect of this study.
(Time: 7 minutes)

**6) Stimulated Saliva Test:** Participants chewed wax gum for 3 minutes to collect stimulated saliva in a container. The container was weighed to assess volume, flow rate and to measure pH using pH paper test strip. Depending on co-operation, further pH measurements were taken at 5 minute intervals for a further 15 minutes and pH values plotted. Again, additional readings were occasionally achieved but were not an essential aspect of this study. (Time: 4-17 minutes)

**7) Buffering capacity:** Buffering capacity was assessed by pipetting drops of stimulated saliva collected earlier onto the buffer test strips as per the GC Saliva Check Buffer ™ kit. (Time: 5 minutes).

**8) Re-Buffer Test / Neutralise Mouth Acids:** A small pea size increment of commercially available sodium bicarbonate toothpaste (Colgate Acid Neutraliser) was introduced into the mouth by using the participant's finger or on a wooden

applicator. SRSpH was recorded at least once and wherever possible at 5' intervals for a further 10 minutes depending on co-operation and time constraints. (Time 0.5 – 15 minutes).  Additional readings were occasionally achieved but were not an essential aspect of this study


**Time Allocated For Test and Total Number of Tests.**
A 1 hour test time was allocated for nurse saliva testing. Nurses performed saliva tests on 6 volunteers and then on 8 participant at baseline. The OHTs repeated participant saliva tests within 3 days of nurse testing. OHTs re-assessed 6 participants for a third time at the end of the study period at 10 weeks.

The 1 hour participant assessment and saliva test appointment was divided into approximately 10 minutes for setup time and to greet the patient, 45 minutes for OHAT and saliva testing and 5 minutes to write up additional notes. The actual patient contact time, (i.e. when the operator is in physical contact with the participant) was between 12-15 minutes with the bulk of time spent waiting between pH tests and chatting to the participant.


## Alterations to the Saliva Test Kit Procedures
The recommended procedures in the GC Saliva Check Buffer $^{TM}$ kit were modified by the inclusion of following methods:-
1.) SRSpH readings were taken
2.) Both SRSpH and WRSpH results were compared.
3.) Saliva, when collected, was collected for three minutes, not 5 minutes.
4.) Saliva was collected, weighed and divided by 3 to obtain volume and flow rates
4.) Glucose challenge prior to chewing wax
5.) Sodium bicarbonate toothpaste followed by pH measurements


**Initial Impression of Saliva Quality**
Prior to commencing saliva tests, an initial first impression by way of visual examination of the mouth was performed to give an overview of mouth cleanliness and to assess saliva consistency, probable hydration levels and the probable degree of salivary dysfunction. This initial visual impression of saliva quality was recorded for future comparison with test results.

## Saliva Consistency

The GC Saliva Check Buffer $^{TM}$ kit has 3 qualitative descriptors for saliva consistency. This saliva test kit uses the following traffic light colour protocol where green is 'Normal' (Watery, clear: Normal viscosity), yellow is 'Low' (Frothy, bubbly: Increased viscosity) and red is 'Very low' (Sticky, frothy saliva residues).

Table 9 GC-Saliva Check BUFFER: Saliva consistency scores

| SALIVA CONSISTENCY | SCORE |
|---|---|
| Normal | 4 |
| Low | 3 |
| Poor | 2 |

Adapted from GC Saliva Check Buffer $^{TM}$

This study modified this saliva test kit classifications to better reflect saliva consistency more likely to be found in Aged Care. Two additional classifications added were:-

- o **No Saliva  (Totally dry)**
- o **Mucopurulent (mucous thick sludge)**

Numeric scores were allocated to the visual appearance of saliva consistency in order to convert qualitative descriptors into quantitative scores for data collection as per the table below. A score of minus one (-1) was allocated to Mucopurulent saliva to emphasize the severity of this condition as someone with mucopurulent saliva may have a serious respiratory infection.

Table 10  Modified saliva consistency scale used in this study

| SALIVA CONSISTENCY | SCORE |
|---|---|
| Normal          (watery, clear) | 4 |
| Low            (frothy bubbly) | 3 |
| Poor    (Sticky, frothy, viscous) | 2 |
| No saliva        (totally dry) | 1 |
| Mucopurulent    (mucous, thick sludge) | -1 |

Score -1, +1, 2, 3, 4 adapted from GC Saliva Check Buffer $^{TM}$

Both volunteer and participant saliva consistency assessment descriptors and scores were recorded at baseline by nurses and OHTs blind to each other.
Baseline nurse and OHT results were compared. OHTs completed a second saliva consistency assessment at the end of the study at +10 weeks and scores were again compared to both nurse and OHT baseline assessments.

## Hydration

In this study, the instructions found in the commercially available saliva test kit were used to assess hydration. Assessing hydration involved everting the lower lip, gently blotting the labial mucosa with gauze and assessing the time in seconds for labial lip secretions to form. In this study tissue paper was placed onto the inside of the lower lip to aid in visualisation and the time for beads of saliva to penetrate the tissue was recorded. A traffic light system was used where green is 'High' (0-30secs), green is 'Normal' (31-60secs) and red is 'Low' (>61 secs). (Table 11)

For the purposes of creating a graph a midway point from each time period above was placed into a colour band for periods 15, 45 and 75 seconds. Participant's hydration time results were recorded into their respective colour band and no actual time was recorded.

Table 11 shows lip hydration classifications used in the saliva test kit.

Table 11  GC-Saliva Check-BUFFER Kit:
Lip hydration traffic light descriptors

| Greater than 60 seconds | resting flow rate | Low | 🔴 |
|---|---|---|---|
| Between 30-60 seconds | resting flow rate | Normal | 🟢 |
| Less than 30 seconds | resting flow rate | High | 🟢 |

From GC Saliva Testing: Good Practice Good
Sense Manual. – Saliva Check Buffer TM kit

## Unstimulated and Stimulated Whole Saliva Flow Rates

Despite variations in what is considered a normal saliva resting flow rates(67), the following method was used to assess flow rates:

### Unstimulated (Resting) Whole Saliva

A traffic light system was used where green is 'Normal' (> 0.3mg/min), yellow is 'Low' (between 0.1-0.3mg/min) and red is 'Low' (<0.1mg/min). Saliva was collected by the spit method for 3 minutes, weighed and divided by 3 to obtain a flow rate per minute.

### Stimulated Whole Saliva

Participants collected stimulated saliva by chewing paraffin wax supplied in the GC Saliva Check Buffer [TM] test kit and spitting into a receptacle for 3 minute which was then weighed and divided by 3 to obtain a flow rate per minute. A traffic light system in the GC Saliva Check Buffer [TM] test kit was used where green is:-
'Normal' (> 1.0mg/min), Yellow is 'Low' (between 1.0 - 0.7mg/min) and Red is 'Very Low' (<0.7mg/min).

## Colour Coding Assessment and Saliva Test Results

Colour coding was used as much as possible throughout the study.

OHAT assessment forms had colour coded columns with:-
Healthy (green) // Changes (yellow) // Unhealthy (red) // Black (referral).

Saliva test forms also had colour values for:-
Normal (green) // Acidic (yellow) // Very acidic or very low (red)

Traffic light colour coding is easy to understand and ideal for training nurses. Nurses recorded OHAT and saliva test results and placed test subjects results into colour bands. Using this method did not require nurses to look up tables or memorise a wide range of figures for different tests results and simplified assessment/testing procedures. The colour bands also became an easy visual method to help nurses formulate oral care plans

# Saliva pH and PH Paper Test Strip

The pH paper test strip supplied with the GC Saliva Check Buffer $^{TM}$ kit measures acidity in the range pH5.0 to pH7.8. Both the pH paper test strip and the pH scores are also conveniently colour coded using the traffic light system. (Table 12)

Table 12  GC Saliva Check Buffer $^{TM}$: pH paper test strip

| pH | Description | Colour |
|---|---|---|
| 6.8 – 7.8 | Healthy | Green |
| 6.0 - 6.6 | Acidic | Orange |
| 5.0 – 5.8 | Highly Acidic | Red |

The manufacturer does not advise placing pH paper test strip directly into the mouth. Saliva needs to be either collected in a receptacle and pH paper dipped into the container or a disposable sponge applicator can be wetted by placing the applicator under the tongue to wet pH paper test strip.

Table 13  GC Saliva Check Buffer $^{TM}$: pH paper test strip colour descriptors
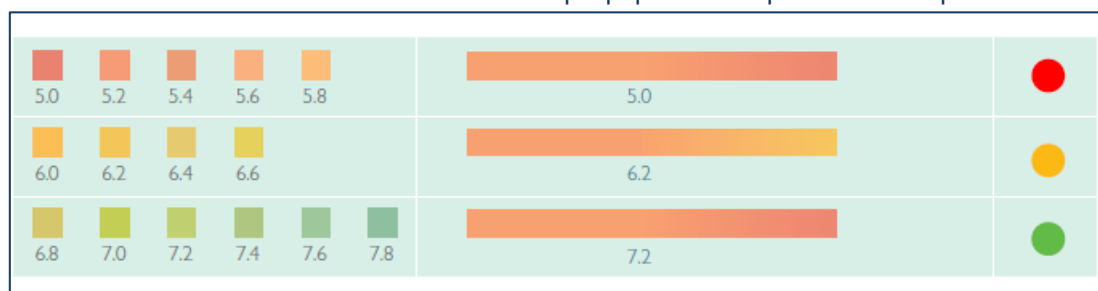


From GC- Saliva Check Buffer $^{TM}$ kit

A strip of pH paper test strip was pre-cut into several squares and placed onto a plastic lined white absorbent paper dental bib. Saliva was applied to the pH paper test strip squares by either a wetted sponge applicator or by a dropper after saliva was drawn from a collection receptacle.

Any excess saliva was knocked off the pH paper test strip by turning the wetted pH paper onto its side with tweezers. pH paper test strip colour change was compared to test kit colour pH measurements and the scores recorded into data sheets.

In situations where the sponge applicator could not adequately wet pH paper or when there was some doubt about the colour band, a third person was asked to arbitrate. If there was still doubt about the colour band, the lowest pH number was recorded. (Table 13)

## Saliva Buffering Capacity
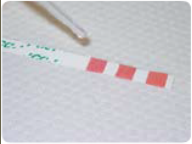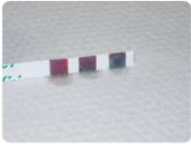
The GC Saliva Check Buffer $^{TM}$ kit includes a buffer test strip that assesses increasing concentrations of only one oral buffer system. The GC test strip assesses the saliva bi-carbonate buffering system.(102)

In this study, stimulated saliva, containing buffers was obtained by chewing and collecting saliva by spitting into a receptacle over a 3 minute period. Saliva was drawn up in a pipette supplied with the GC Saliva Check Buffer $^{TM}$ kit and a drop of saliva was applied to each of the 3 bands on a buffer test strip placed on an absorbent plastic lined bib. Excess saliva was removed by turning the strip at 90 degrees to contact the paper on the absorbent plastic bib. After 5 minutes, the colour change on each of the 3 bands per buffer strip was scored according to the scoring system in the test kit. (Table14). Each band was scored and a final cumulative score was obtained by adding the scores for the 3 bands together. Buffering capacity was assessed as, Very Low (0-5), Low (6-9) and Normal (10-12).

The saliva kit buffer assessment method also uses a traffic light system, has good teaching documentation, is easy to learn and suitable for nurse assessments in a RACF setting.

Table 14 shows the colour system associated with scoring buffering capacity as supplied by the commercially available saliva kit used in this study.

Table 14  GC Saliva Check Buffer $^{TM}$: Buffer colour descriptors



**Results at 2 minutes**

| | | | |
|---|---|---|---|
| Green | 4 points | | |
| Green/Blue | 3 points* | Very Low | |
| Blue | 2 points | | |
| Blue/Red | 1 point* | | |
| Red | 0 points | | |

* Where a colour combination provides an unclear result use intermediate scores as indicated.

**Interpreting the results**

| Combined total | Buffering ability of saliva | |
|---|---|---|
| 0 - 5 | Very Low | ● (red) |
| 6 - 9 | Low | ● (yellow) |
| 10 - 12 | Normal | ● (green) |

Dispense one drop of saliva onto each pad.

#24, #25 already crowned #26 awaiting preparation

From GC Saliva Testing: Good Practice Good Sense Manual. Saliva Check Buffer kit

# DEVELOPMENT OF THE NURSE SCHEDULED COMPREHENSIVE ORAL CARE PLANS (NSCOCP)

## Rationale

This study investigates whether it is feasible to train a few nurses (n=4) in a RACF to make oral health assessments of early dementia residents to formulate, implement and be responsible for monitoring individualised NSCOCPs and whether many untrained nurses involved in the care of a resident can follow these plans during three shifts in a 24 hour period.

Identifying and understanding barriers in RACFs preventing the implementation of oral health initiatives is important in developing protocols and procedures to overcome these barriers.

Nurse training to perform advanced oral assessments and saliva testing to determine an individual's oral risk and to then formulate NSCOCPs tailored to that individual based on their findings requires special education and training as well as commitment and resources from RACF managers. Although the formulation of care plans requires special training, the delivery of preventive interventions and procedures recommended in care plans does not require the same level of training. Untrained staff should be able to deliver these preventive procedures provided the preventive interventions in care plans are easy to deliver and can become part of RACF daily routines. Example: Issuing chewing gum after snacking during the day is a relatively simple non time consuming intervention that can easily be incorporated into daily RACF resident and nursing routines, particularly as this intervention is similar nurses dispensing medications after meals.

Although a dental professional (dentist, oral health therapist or dental hygienist) can undertake risk assessments and create comprehensive oral care plans based on the model proposed in this study. A more efficient and rational use of time and resources would be to provide advanced training to a small number of nurses (1 to 4) within RACFs, whose responsibility would be to assess residents, formulate individualised care plans soon after entry into a nursing home and monitor compliance of care plans. This protocol could be tested in a wide scale trial as a more effective use of resources than attempting to train an entire RACF nurse workforce how to perform oral assessments and decide which preventive product and intervention to use. Additionally this approach may be more effective and immediate than waiting for untimely or unlikely dental professional visits to a RACF to make assessments to prescribe products and procedures before preventive interventions can commence.

Visiting dental professionals are unlikely to be able to monitor daily care plan compliance. Even an OHT working in a dedicated RACF would not be able to monitor care plans in a large facility of on a daily basis while trained nurses would be able to monitor individual resident compliance on a day to day or on a regular basis.

Dental professionals are better utilised in training, supervising, providing ongoing support to the trained nurses, developing a nurse care plan program and monitoring the over-all oral health care program within a RACF.

The author believes the dynamic of trained RACF nurses to formulate their own care plans creates both a responsibility and ownership of the care plan from within the RACF nursing culture. This approach may prove more be successful than oral care plans imposed by a dental professional who is outside the RACF nursing culture. Trained RACF nurses who 'own' and understand why they have selected individualised interventions to formulate oral care plans have a vested interest in the success of their plans, are more likely to ensure their plans are complied with and more likely to motivate, educate and give support to untrained nursing staff and carers.

## Barriers to Nurse Training and Education

Currently RACF nurses are not well trained to recognise oral health problems, nor are they responsible for creating care plans based on individual risk assessments as these assessments are not part of their scope of duties. Unfortunately dental professionals rarely see residents in RACFs on a regular basis and do so usually only for emergency care with little or no time spent formulating and monitoring oral health care plans. Nurses and RACF managers are reluctant to take on these responsibilities as traditionally these duties are the responsibility of a dental professional whose examination of a resident to recommend procedures and products are required before preventive interventions are commenced.

Oral care plans, if they exist, are usually limited to notations in RACF software to perform assisted brushing and are often poorly monitored for compliance. Assisted brushing programs are difficult to maintain long term, due to a range of problems such as staff migration, lack of nurse time, time costs to train and implement programs and resistive behaviours of residents making these tasks difficult.

Assisted brushing requires training and if attempted, is usually performed either in the morning and/or evening during shower times as a bath room is needed for brushing. Adequate cleaning and brushing of posterior teeth is a difficult task and may be problematic and ineffective even with co-operative residents.

Although assisted brushing may be performed routinely, lingual and interproximal

tooth surface cleaning may not be attempted as this is often considered too difficult even for the most dedicated nurse or carer, particularly if there are resistive behaviours.

When assisted brushing is ineffective or not possible, simple preventive procedures throughout the day to neutralise mouth acids, such as chewing gum, using high pH oral lubricants and sodium bicarbonate toothpaste may be the only viable interventions possible. To be effective these preventive interventions need to be scheduled multiple times a day in order to alter an acidic and more pathogenic oral environment to a healthier less acidic oral environment.

Nurses and carers usually do not understand the reason for the use of a particular preventive product and have difficulty delivering multiple products even when written instructions are provided by a dental professional. Most carers and nurses can manage the routine use of one product, such as high fluoride toothpaste, but find multiple products recommended for use at different times of the day problematic. Professional recommendation to use a CCP-ACP paste after the high fluoride toothpaste in the mornings, chewing gum during the day, applying artificial saliva several times a day and a chlorhexidine containing toothpaste or rinse in the evenings are often too complex for carers and nurses to follow.

The scheduled use of multiple preventive products is not part of conventional RACF oral care plans due to lack of understanding by nurses of how these products differ and how they are to be used. As a result most current RACF oral care plans, if they exist, are restricted to assisted brushing with a high fluoride toothpaste once or twice a day.

Traditional oral care plans do not have:-
- An easily visible logged timetable where untrained nurses and carers, including temporary, staff perform specific interventions scheduled at set times.
- A checking and tracking mechanism for nurse responsibility and compliance.
- A checking and tracking mechanism for resident compliance and the recording of resident preference choices for different interventions (chewing gum versus sodium bicarbonate toothpaste).
- The ability to use multiple preventive interventions.

# Implementation of Nurse Scheduled Comprehensive Oral Care Plan (NSCOCP)

Appendix 21.

During the initial planning for this study, it was envisaged that nurses would be able to complete a total of ten SXI-D questionnaires, ten OHIP14 questionnaires and a total of 10 OHAT and 10 saliva tests before assessing and testing participants. Nurses were to assess and test 6 volunteers and 4 nurses themselves participating in the study.

So as not to stress early dementia participants, appointment times were planned to be kept as short as possible and participant questionnaires and assessments were to be spread over two sessions. Xerostomia and OHIP14 questionnaires were to be completed with nurse assistance on a day or two before morning OHAT and saliva tests. Nursing staff had to remind residents not to eat or drink for at least 1 hour before saliva testing.

All volunteer questionnaires, assessments and saliva tests were completed over one session so as not to inconvenience the volunteers. Volunteer SXI-D and OHIP14 questionnaires, OHAT and saliva tests were completed by nurses in a one hour appointment.

Nurses completed participant OHIP14 and SXI-D questionnaires during the nurses' normal working day, one day before participant OHAT assessments and saliva tests.

The four nurses, working in pairs, had difficulty completing their OHAT and saliva tests on the 6 volunteers during the scheduled 4 hour time block. At the beginning of the study, nurses took a little over an hour to complete the OHAT and saliva test on one volunteer. Testing could not be extended due to our budget constraints and nurse RACF schedules. As a result, the planned 10 saliva tests (6 volunteers and 4 nurses) could not be completed. A total of 6 volunteer OHAT and saliva tests were completed before nurses assessed and saliva tested 8 participants.

Nurses worked in pairs with one nurse acting as scribe to record test results and also cross check instructions. Initially nurses were very slow taking the full hour to complete volunteer OHAT and saliva tests. There was a noticeable improvement in nurse confidence and ability to complete saliva tests with each test performed over a relatively short time. By the end of the resident testing sessions, some nurses could complete both OHAT and the saliva tests on participants within 40 minutes with some nurses able to work alone.

Nurses working in a RACF know a resident's general medical/cognitive status, likelihood of resistive behaviours and ability to co-operate better than would a dental professional meeting a resident for the first time. This study found that once trained, nurses were able to collate information from their oral assessments (SXI-D and OHIP14 questionnaires, OHAT, saliva tests) and combined with their knowledge of the participant were able to formulate a scheduled comprehensive oral care plan.

NSCOCP formulation required nurses to determine the type and frequency of preventive interventions appropriate for that participant and select one or more products from a range of products provided by the study organisers. A template NSCOCP form was developed by the author specifically for this project.
(See Figures 3 and 4 below)

The frequency of use of each product and time of day was planned and scheduled by ticking the appropriate time line and column on a pre-printed care plan template. Although the author checked all nurse plans for suitability before implementation, this task in a future study could be performed by an OHT. The care plan created by the nurses after approval by the dentist became the 'Principal Plan' for untrained RACF nurses and staff to follow.

Trained nurses then signed off on the Principal Plan and became responsible for the implementation of their own plans.

The Principal Plan was inserted or taped into the inside cover of a folder under a protective plastic sleeve. This folder was labelled 'Oral Care Plan Folder'. The Principal Plan showed the type and frequency of all interventions to be followed with each intervention recorded in a time log format. (see below)

With each new day, a new blank form called the 'Daily Oral Care Plan' page was placed opposing the Principal Plan. Nursing staff could see both the 'Principle Plan' and the Daily Oral Care Plan' when the folder was opened. Nurses followed the Principal Plan by ticking or initialling the corresponding section on the Daily Oral Care Plan once a scheduled task had been completed.

The Principle Plan together with the Daily Oral Care Plan placed into a folder constitute the NSCOCP.

This folder system allowed interventions to be delivered by untrained nurses and casual staff multiple times over a 24 hour period without nurses and staff understanding the reason for the intervention.

Each intervention planned at a specific time could be easily tracked for compliance by visually comparing the daily plan with the opposing Principal Plan. Interventions not complied with were easily visible.

At the beginning of the following day, the Daily Oral Care Plan form the previous day was placed at the rear of the folder in a separate section and a new blank Daily Oral

Care Plan was again placed opposing the Principal Plan and dated.  As this pilot study was over a 10 week period, 78 pages were printed in advance with the first page being the Principal Plan and 77 blank pages being the Daily Oral care Plans for subsequent days.

Trained nurses responsible for the plan monitored each page for compliance on a daily basis. The research assistant and author monitored plans on a weekly basis. Care plan compliance data were collected by the research assistant every two weeks.


With development of future computer technology, it should be possible for dental professionals to remotely monitor nurse assessment results of residents soon after entry into a RACF, individualised NSCOCPs and compliance of care plans over time.

# The NSCOCP Template Form

The format of the NSCOCP template form is described below. (See Appendix 12.) The front page of the NSCOCP template form contains participant identifiers (Date, Surname, First name, Room Number, Participant Number) and is positioned at the top of the page. Below resident identifiers are check boxes to be filled out by the trained nurse responsible for creating the oral care plan.

The check boxes section gives an overview of the resident and is designed to alert untrained staff, casual staff and carers to the needs of the resident who they may be meeting for the first time. This check box sections allowed information concerning a resident's degree of dependence, likely ability to co-operate, likely resistive behaviours and physical handicaps to be shared with RACF staff before attempting any interventions.

Check box sections were broadly divided into the categories below:-

1.) **Behaviours:**
(Accepts interventions, Will NOT accept interventions, Will not open mouth, Aggressive/kicks/hits, Bites toothbrush/staff)

2.) **Dependency:**
(Is independent, Needs reminding, Needs supervision, Needs assistance)

3.) **Physical Handicap:**
(Can't swallow, Can't rinse/spit, Constant grinding, Head down/moves)

4.) **Dry Mouth:**
(Normal, Dry, Very dry, Extremely dry)

5.) **Dentures:**
(Will not remove dentures, Soak dentures (in denture cleanser)

## Fig 3: Front page of NSCOCP form

**Appendix F**     **RN INTERVENTION CARE PLAN**      ( Print 1 page per day for 77 days) * 20 Residents in 20 Folders)

Date     Surname     First Name     Room No.     Participant No.

| | | | |
|---|---|---|---|
| Accepts Intervention [ Y ] | Is independent [ ] | Can't swallow [ ] | **DRY MOUTH** |
| Will NOT accept Intervention [ X ] | Needs Reminding [ ] | Can't rinse/spit [ ] | Normal [ ] |
| Will not open mouth [ ] | Needs Supervision [ ] | Constant grinding [ ] | Dry [ ] |
| Aggressive/kicks/hits [ ] | Needs Full Assistance [ ] | Head down/moves [ ] | Very dry [ ] |
| Bites toothbrush/staff [ ] | | | Extremely dry [ ] |

Wont remove dentures [ ]
Soak dentures [ ]

INTERVENTIONS (Intervention NOT Required = /)

| Place Tick on Eating | Food Management Meal or or Snack | Remineralisation Neutrafluor 5000 | GC Mousse | Hydration Water mls | Artificial Saliva Oral7 | Saliva Gland Stimulation Xylitol Gum | Rebuffer After meals Colgate Acid Neutraliser | Anti-Microbials Curascept | Brushing Unassisted Teeth | Brushing Unassisted Dentures | Brushing Assisted Teeth | Brushing Assisted Dentures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6:00am -9:00am | | | | | | | | | | | | |
| 9:00am - 12:00pm | | | | | | | | | | | | |
| 12:00pm - 3:00pm | | | | | | | | | | | | |
| 3:00pm-6:00pm | | | | | | | | | | | | |
| 6:00pm -9:00pm | | | | | | | | | | | | |
| 9:00pm- 12:00am | | | | | | | | | | | | |
| 12:00am- 6:00am | | | | | | | | | | | | |
| TOTALS | | | | | | | | | | | | |

## Fig 4: Back page of NSCOCP form

**ADDITIONAL NOTES**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6:00am -9:00am | | | | | | | | | | | |
| 9:00am - 12:00pm | | | | | | | | | | | |
| 12:00pm - 3:00pm | | | | | | | | | | | |
| 3:00pm-6:00pm | | | | | | | | | | | |
| 6:00pm -9:00pm | | | | | | | | | | | |
| 9:00pm- 12:00am | | | | | | | | | | | |
| 12:00am- 6:00am | | | | | | | | | | | |

**Daily Time Lines**
The 24 hour daily cycle was divided into 6 three hour periods starting at 6:00am (6:00-9:00am, 9:00-12:00am, 12:00-3:00pm, 3:00-6:00pm, 6:00-9:00pm, 9:00-12:00am) and 1 six hour period (12:00 - 6:00am). Scheduling and recording a daily time line is critical to the design of the plan as it provides a structured framework for delivering different interventions at different times of day and allows an easy rapid visual method of tracking compliance and nurse responsibility.


**Food Management (Meal or Snack)**
A food management column was included in the care plan as a reminder to nurses even though food and snacking was not monitored during the study. The time lines and food management concept allowed nurses to plan chewing gum and/or sodium bicarbonate toothpaste interventions after meals and snacks to neutralise mouth acids.




## How to Use the NSCOCP and Scheduled Combination Preventive Intervention Therapies


In this study, the only compulsory oral care plan preventive intervention in all NSCOCPs was the use of high fluoride toothpaste in the mornings. Other products were optional depending on nurse assessments.

Column headings explained the function or purpose of an intervention in association with the preventive products available for selection by nurses were listed below by their trade names directly under each column heading:-

- Remineralisation (Products: Neutrafluor5000 toothpaste, GC Tooth Mousse Plus)
- Hydration (Product: Water)
- Artificial Saliva (Product: Oral7 Gel)
- Salivary Gland Stimulation (Product: Xylitol gum)
- Re-buffer After Meals (Product: Colgate Acid Neutraliser toothpaste)
- Anti-microbials (Product: 0.12% Curascept toothpaste)


The rational for including both the commercially recognisable trade name of a product (as would be found in any bathroom), together with the reason for the use of

that product was aimed at helping nurses to select the appropriate preventive product for the intended intervention.

A time log template form included a brushing section with sub headings:-

- Unassisted Brushing Teeth
- Unassisted Brushing Dentures
- Assisted Brushing Teeth
- Assisted Brushing Dentures

**Back Page**

The back page of the Daily Oral Care Plan form included a 'Notes' section for nurses to record any problems concerning a participant's management. This section also allowed nurses to record residents' likes and dislikes of products and interventions, likely resistive behaviours and the best way to approach an individual dementia participant to deliver interventions.

A notes section was used to record handover information between shifts for the nurses involved in the 24 hour care of a RACF dementia resident. Up to 9 different nurses were involved in the care of participants over a weekly period due to shift work. This figure did not include casual staff.

**Time Log**

A time log on the back page was included to record any additional intervention that may be needed but was not in the Principle Plan, such as a Curascept gel after an extraction.

Notes can be recorded relevant to the time of day, such as when a dementia resident is more likely to exhibit challenging behaviours or is more likely to accept or reject interventions (Sundowner Syndrome).

**Totals Row**

The NSCOCP form allows recording a "TOTALS' box to help track and monitor total interventions completed per day. These intervention totals were collected by the research assistant on a periodic basis for later analysis.

## PREVENTIVE PRODUCTS

There are many preventive products in the market place suitable for use in a RACF setting. Products chosen in this study were on the basis that:-

- There was evidence in the literature to support their use to improve oral health.
- Readily available in the market place and could be easily purchased by a RACF from chemists, supermarkets or dental suppliers.

Table 15  Preventive Products: Available for selection by nurses

| PRODUCT | FUNCTION | TIME | FREQUENCY |
|---|---|---|---|
| Neutrafluor5000 toothpaste (Colgate – Palmolive Co.) | Remineralisation | Morning | 1 / day |
| GC Tooth Mousse Plus (GC Co.) | Remineralisation | Morning | 1 / day |
| Water | Hydration | Any time | Frequently |
| Oral7 Mouth Moisturising Gel (Auspharm) | Lubrication Moisturisation Protection | Any time | Frequently |
| Xylitol Chewing Gum (Miradent Gum Hager and Werken GMBH and Co.) | Chewing for Stimulate saliva flow Clearance Neutralise mouth acids | After meals or snacks or Anytime | 4 – 6  / day |
| Colgate Acid Neutraliser (Colgate – Palmolive Co.) | Neutralise mouth acids Re-buffer saliva | After meals or snacks | 4 – 6  / day |
| 0.12% Curascept Toothpaste (Curaden Swiss, Australia) | Anti-microbial | Evening | 1 / day |

This study did not to try to determine whether any particular product was more effective than another product or whether a combination of products were more effective than an alternate combination of products or a single product. The primary purpose of the study was to determine whether trained nurses could recommend a range of suitable products and whether untrained nurses and early dementia RACF residents would comply with these recommendations through care plans.

The only product deemed compulsory in all care plans was the use of high fluoride (5000 ppm Fluoride) toothpaste, otherwise nurses were able to choose from a list of preventive products supplied by the study organisers. Although a recommended time of day and frequency of use for each product was discussed during nurse training, nurses where free to choose a product, its purpose and rate of use based on their own risk assessments of participants. Table 15 summarises the preventive products made available by the study organisers.

The products made available to nurses are discussed below.

## Remineralisation

Products: Colgate Neutrafluor5000 (5000 pmm Fluoride) Colgate-Palmolive Co. GC Tooth Mousse Plus (Amorphous calcium phosphate stabilized by casein phosphor-peptides: CPP-ACP with 900 ppm F) GC Co.

The protocol used in this study for 'Remineralisation' was to apply a pea size increment of Neutrafluor5000 in the mornings on a toothbrush, spit out, do not swallow and do not to rinse.

Where the participant was assessed as having a higher caries risk, topical CPP-ACP paste was applied to teeth after the fluoride toothpaste and the CPP-ACP paste was left to dissolve away. Where the mouth was completely dry a small quantity of water was swished about to help activate the CPP-ACP paste.

Where co-operation was limited or resistive behaviours evident, nurses could place Neutraflour5000 and GC Mousse Plus onto the brush at the same time.

## Hydration
Product: Water

Water is often overlooked as an intervention. Nurses were advised participants should ingest a minimum of 1600 mls of water a day unless they were medical reasons for fluid restrictions.

In this study, the participants were too mobile and independent to monitor their water intake. Although monitoring hydration was beyond the scope of this study, hydration was included in the care plan as a reminder to nurses of the importance of maintaining an adequate fluid intake.

## Oral Lubricant - Artificial Saliva
Product: OralSeven™ Moisturising Mouth Gel (Auspharm)

Oral7 gel was chosen for this study due to its higher pH (pH 6.1) compared to other oral lubricants. The manufacturer claims Oral 7 also contains calcium, xylitol and fluoride as well as anti-microbial agents lactoperoxidase, lactoferrin and lysozyme.

Participants were encouraged to apply Oral7 Moisturising Gel frequently or as needed. When a participant's mouth was found to be dry or the participant complained of a dry mouth nurses could schedule Oral7 gel more frequently. Nurses had to remind some participants to use the gel.  Oral7 was also recommended for use before inserting dentures and before eating to allow for lubrication of oral soft tissues.

Where resident co-operation was likely to be poor, nurses were advised to place a small amount of gel into the lips and wait a few seconds. In the authors experience, even unco-operative dry mouths dementia residents who exhibit challenging behaviours will usually lick off the gel and then voluntarily open there mouths for more gel.  However, where there is complete lack of co-operation, oral lubricant gel can be placed into the mouth with aid of a bent toothbrush and disposable wooden applicators or spoons.

## Salivary Gland Stimulation
Product: Miradent Xylitol Chewing Gum (Hager and Werken GMBH and Co.
1 gm tablet contains 0.72 Xylitol

Participants had a choice of 4 flavoured tablets and were recommended to chew 1-2 tablets, 3-5 times a day, preferably after meals or snacks for a minimum of 10 minutes.

Nurses promoted the use of gum after meals as a form of desert to some of the participants. Nurses were able to successfully plan the periodic use of sugarless gum containing Xylitol throughout the day or after meals.

Nurses found issuing gum to participants an easy intervention able to be easily integrated into the nursing home routines and similar to issuing medications.

## Acid Neutralising Toothpaste To Neutralise Mouth Acids After Meals

Product: Colgate Acid Neutraliser Toothpaste: Colgate-Palmolive Co.

Colgate Acid Neutraliser toothpaste was chosen as it contained sodium bicarbonate and calcium and sodium carbonate to help neutralise mouth and plaque acid. This toothpaste has a higher concentration fluoride (1450ppm Fluoride) than most standard fluoride toothpastes currently available in the Australian market place (1000ppm F).  It is noted that changes at the Therapeutic Goods Administration level now allow for 1500ppm F toothpastes to be considered within the "standard".

The introduction of small pea size increments of sodium bicarbonate toothpaste into the mouth and left to dissolve to neutralise mouth acids can be self-administered by either using the participant's own finger or by a carer using a spoon or applicator. Nurses can administer this intervention using the same aids and a toothbrush handle where patient co-operation is lacking. This intervention is a relatively easy preventive procedure even when resistant behaviour is encountered.

## Anti-Microbials

Product: Curascept Toothpaste 0.12% Chlorhexidene (Curaden Swiss, Australia) Contains xylitol and is sodium lauryl sulphate free.

Selection criteria and procedure: Nurses could elect to use a chlorhexidene (CHX) containing dentifrice in the evenings only where the nurse considered the oral hygiene of a participant to be very poor, where co-operation was lacking for assisted brushing due to resistive behaviours and where nurse assessment indicated a higher risk of oral and respiratory disease.

Chlorhexidine is de-activated by fluoride and sodium lauryl sulphates in toothpastes. To optimize the anti-plaque effect of CHX, it seems best that the interval between

tooth brushing and rinsing with CHX be more than 30 minutes, cautiously close to 2 hours after brushing.

Oral risk assessment plays a factor in selecting the concentration of CHX to be used and the delivery system.

For this study, Curascept toothpaste containing 0.12% CHX was selected and the toothpaste was used once only in the evenings in participants assessed as having a high risk oral disease due to very poor plaque control.

## Assisted Brushing Teeth and Dentures

Mechanical disruption and removal of dental plaque is of primary importance to reduce the oral bio-burden of the mouth and maintain good oral health.

The comprehensive oral care plan has separate columns for assisted and unassisted brushing of teeth and dentures allowing the planning and tracking these tasks individually.

Brushing was performed usually at the same time as showering in the mornings and/or evenings as a bathroom is required. Some residents needed reminding and supervision. In general, residents assessed as higher risk needed assistance with these tasks.

## Infection Control

Nurses followed infection control procedures as per the Montefiore Nursing Home training and protocols which included gloves, aprons, disposable wooden applicators and either disposable tooth brushes or the participant's own toothbrush.

Each participant was issued with one preventive product from each class of product as chosen for use in care plans formulated by the trained nurse at baseline. There was no sharing of any products. Products were kept in the resident's bathroom and only replaced when needed as each product was used up.

Assisted bushing, re-mineralising and anti-microbial products where performed or applied in the mornings or evenings in each participant's bathrooms during shower times.

Artificial saliva, chewing gum and sodium bicarbonate toothpaste were self-administered throughout the day by the participants using their washed fingers, wooden applicator or spoon. Some dementia participants needed reminding to do

these tasks and no participant needed nurses to place these products into their mouth. Where co-operation was lacking, nurses were trained to wear gloves, use a bent tooth brush to retract the cheek and apply pastes or gels using a disposable wooden applicator or the participant's toothbrush from their bathroom.

**Purchase of Preventive Products and Reserve Stock**

An assessment of the likely amount of preventive products to be used over the 10 week study period was made prior the commencement of the study. As products were issued without charge to participants, a budget was prepared and funds reserved for their purchase. A reserve stock of all products was kept in a secure cupboard and only issued when needed by the author to the trained nurses responsible for care plans. This method allowed stock levels of individual products to be monitored and checked for adequate usage over time.

# CHAPTER 3 –FINDINGS

This chapter will review findings and results related to:-

- Nurse performance, capacities and nurse assessment procedures
- Case reports
- Clinical findings
- Medical diagnosis, medications and anti-cholinergic index
- Shortened Xerostomia Index SXI-D (Dutch version)
- Oral Health Impact Profile (OHIP14)
- Oral Health Assessment Tool (OHAT)
- Saliva assessments and test results
- Preventive products
- Plaque scores
- Compliance

## Nurses Performance and Capacities

There were a total of eight early dementia RACF residents and six volunteers (n = 14) involved in the clinical aspects of this study. Four trained nurses and up to 10 untrained staff were involved in the feasibility study to implement NSCOCPs.

This section of the Thesis is structured around the central aims of the study:

- Is an RACF nurse oral health assessment valid as compared with professional dental screening?
- Is it feasible and practical for RACF nurses to undertake oral health assessments?
- Can nurses provide appropriate advanced oral care plans?

In order to estimate outcomes, a series of focused evaluations of SXI-D questionnaires and OHIP14 questionnaires, OHAT and saliva tests were undertaken.

Nurses completed participant SXI-D and OHIP14 questionnaires a day or two prior OHAT and saliva tests. Nurses were able to complete OHAT, saliva tests, write up notes, create care plans and set up for their next saliva test within 1 hour.

Initially nurses took considerably more time than expected to complete volunteer assessments, saliva tests and create care plans but became progressively more

proficient with the more assessments and saliva tests completed. Originally nurses were to test 10 volunteers but only managed to test 6 volunteers (n=6) due to time constraints.

However, by the end of nurse participant testing (n=8), nurses working in pairs completed their last two test subject assessments and saliva tests in about 40 minutes and did not require guidance by a dental professional.

Much of the time was spent during the 1 hour participant OHAT and saliva test appointment was spent simply waiting for pH readings at 5 minute intervals. The spare time was spent mostly chatting to the participants (or volunteers). The actual contact time with the participants (i.e. when someone is touching or doing something to the participant) was restricted to only about 15 minutes throughout a 40-45 minute test period to minimise stress. The additional 15 minutes of the allocated 1 hour appointment was used to set up the saliva test kit and equipment, write up notes and formulate care plans.

The trained nurses knew the early dementia participants from working in the home and the participants were comfortable with the nurses. No participant found assessments stressful and all seemed to enjoy the experience.

This study found that nurses could complete OHAT assessments and saliva tests on early dementia residents in a reasonable time frame within a RACF setting and could formulate nurse oral care plans. This time needed to complete assessments and saliva testing shortened with experience.

This study confirmed the first two study aims.

1. That - RACF nurse assessment of oral health risk, including saliva testing is be a valid, reliable and efficient assessment of oral health risk of residents

2. That - It is feasible and practical for RACF nurses to undertake oral health assessments

# Performance of Nurses in Recording Information and Devising Oral Care Plans.

## Case Reports

Evaluation of nurse saliva results and oral assessments (SXI-D, OHIP14 questionnaires, OHAT) were summarised into tables using a colour coded system and care plans compared with OHT care plans for suitability. Three case studies are presented below involving participants with relatively healthy, unhealthy and very unhealthy saliva test results and oral assessments with their respective NSCOCPs.

Clinical findings by the author were placed into the table using the same colour coding traffic light system.

Total medications and an anti-cholinergic burden score were similarly placed into the table and colour coded

The first two case studies demonstrate nurse care plans found to be satisfactory and suitable for the risk profile of the individual participant. The third case study shows a care plan, that although workable and of benefit to the participant, was not considered satisfactory by the author. This care plan was one of the early plans formulated by this nurse during her training and probably shows a lack of experience. With more experience the same nurse was able to formulate more suitable care plans for other participants.

## Case Study 1: Low risk profile and example of a satisfactory nurse 'Principal Plan'

Participant 4 was assessed as having a low oral health risk profile and the nurse Principle Plan reflects the minimal need for scheduling preventive interventions.

**Figs 5: NSCOCP Case Study 1**



| Assessment | Score | Healthy / Unhealthy |
|---|---|---|
| Medications -total | 11 | |
| Anti-cholinergic Index | 7 | Unhealthy? |
| Functioning tooth pairs | 9 pairs from 23 teeth | 10 pairs considered acceptable |
| Xerostomia questionnaire | 5    (range 5-25)    lower the better | Healthy |
| OHIP14 | 14 (range 14-79)    lower the better | Healthy |
| OHAT | 10  (range 7-32)    lower the better | Mainly healthy |
| **Saliva Assessments** | | |
| Hydration<br>Healthy 0 -30 sec<br>Low    30-60 sec<br> Poor    > 60 sec | <30 secs | Healthy |
| Consistency | Frothy | Hydration low |
| Sublingual Resting pH<br>Healthy>6.8<br>   Acidic 6.0 -6.6<br>   Very acidic <5.8 | pH 6.6 | Slightly acidic |
| Unstimulated saliva flow rate<br>   Normal    0.3-0.4mg/min<br>   Very Low <0.1 mg/min | 0.49mg/min | Normal |
| pH after Glucose Challenge at +5min | pH 6.8 | Healthy |
| Stimulated saliva flow rate<br>   Normal   1.0 – 2.0 mg/min<br>Low    <0.5 mg/min | 1.17mg/min | Healthy |
| Buffering capacity<br>   Healthy   10 -12<br>Low       6 – 9<br>Very Low  0 - 5 | 6 | Low |
| pH stimulated saliva after +5 min | pH 7.8 | Healthy |
| pH after Na Bicarb. toothpaste | pH 7.8 | Healthy |
| **Clinical Findings** | | |
| Decayed Teeth | 0 | |
| Plaque Score (6 sextants) | 9                  lower the better | Healthy -Low score |
| Dental Bio-burden<br>   Plaque score average times<br>   number of teeth | 38                  lower the better<br>(Plaque score / No sextants * number of teeth) | Healthy –Low score |

**Case Study 1. above: Low risk profile and an example of a satisfactory nurse 'Principal Plan' (Participant 4)**

Participant 4 was taking 11 medications with and Anti-cholinergic Burden Score (ABS) of 7, placing her probably into a red (unhealthy) band.

Medical history: Arrhythmia, Ischemic heart disease, Transient ischemic attack (TIA) Depression, GORD, Osteoporosis and Spinal fracture.

Hydration, sublingual resting pH and buffering capacity assessments were in the yellow bands. All other assessments were in the green (healthy) bands. Participant 4 had no carious lesions and had a healthy plaque score.

**Nurse Principal Plan**
Nurse recommendations for preventive procedures and products were minimal, consisting of morning brushing with a high fluoride tooth paste, a single use of acid neutralising toothpaste after dinner and to check that unassisted brushing was complied with in the mornings and evenings.

Although the "dentist –gold standard" (the author) would have preferred to include other preventive product interventions in Participant 4's care plan, the author found this plan to be a suitable oral care plan as this resident had a low oral health risk profile.

## Case Study 2: High risk profile and example of a satisfactory nurse 'Principal Plan'

**Figs 6: NSCOCP Case Study 2**



| Assessment | Score | Healthy / Unhealthy |
|---|---|---|
| Medications -total | 9 | |
| Anti-cholinergic Index | 7 at time of study<br>10 six months earlier | Unhealthy? |
| Functioning tooth pairs | 12 pairs from 25 teeth | 10 pairs considered acceptable |
| Xerostomia questionnaire | 9  (range 5-25)   lower the better | Healthy |
| OHIP14 | 14  (range 14-79)   lower the better | Healthy |
| OHAT | 8  (range 7-32)  lower the better | Mainly healthy |
| **Saliva Assessments** | | |
| Hydration<br>  Healthy 0 -30 sec<br>  Low    30-60 sec<br>  Poor    > 60 sec | 30 -60 sec | Low |
| Consistency | Frothy | Hydration low |
| Sublingual Resting pH<br>Healthy>6.8<br>  Acidic 6.0 -6.6<br>  Very acidic <5.8 | pH 5.0<br><br>NOTE: Limit of pH paper test strip is pH 5.0<br>It is possible actual pH was lower | Unhealthy -Very acidic |
| Unstimulated saliva flow rate<br>  Normal   0.3-0.4mg/min<br>Low    <0.1 mg/min | 0.33mg/min | Healthy |
| pH after Glucose Challenge at +5min | pH 5.0 | Unhealthy -Very acidic |
| Stimulated saliva flow rate<br>  Normal    1.0 – 2.0 mg/min<br>  Low        0.6 - 0.9 mg/min<br>  Very Low  <0.5 mg/min | 0.76 mg/min | Unhealthy –Low |
| Buffering capacity<br>  Healthy   10 -12<br>Low        6 – 9<br>Very Low  0 - 5 | 4 | Unhealthy -Very low |
| pH stimulated saliva after +5 min | pH 5.8 | Unhealthy – Low |
| pH after Na Bicarb. toothpaste+5 min | pH 6.8 | Healthy |
| **Clinical Findings** | | |
| Decayed Teeth | 3 | |
| Plaque Score (6 sextants) | 20                      lower the better | Unhealthy – High score |
| Dental Bio-burden<br>  Plaque score average times<br>  number of teeth | 87                      lower the better<br>(Plaque score / No sextants * number of teeth) | Unhealthy – High score |

## Case Study 2. High risk profile and satisfactory nurse 'Principal Plan' (Participant 1)

Participant 1 was assessed as having a high oral health risk profile and the nurse care plan reflects a more intensive need for preventive interventions.

Participant 1 was taking 9 different medications with an ABS of 7. Six months earlier, this Participant was taking 12 medications with an ABS of 10 placing her in a high risk category.

Medical history: Short term memory loss (STML +++), Lower back pain, Pain Gastro-oesophageal reflux disease, Worries, Restlessness and Agitation.

Participant 1 had 3 carious lesions, poor salivary function with low pH values, high plaque scores due to poor oral hygiene and needed assistance to brush teeth. Functioning pairs of teeth, Xerostomia questionnaires, OHIP14 and OHAT were in the green (healthy) bands.

Nurse saliva assessments found hydration, saliva consistency and stimulated saliva flow rates to be in the yellow (low) bands and surprisingly found unstimulated saliva flow rate to be in the green (normal) band. The saliva test results suggests that this Participant had unhealthy low stimulated salivary reserve, probably did not suffer from complete SGH as stimulated saliva flow was normal and would benefit from stimulating her salivary function.

Sublingual resting pH, pH after glucose challenge, pH after 5 minutes of chewing and plaque scores were in the red (unhealthy) bands. The saliva pH results suggest poor plaque control and polypharmacy induced partial SGH may be a major cause of her low saliva pH and this patient would benefit from better brushing, better hydration, oro-muscular exercises and chewing gum.

Saliva buffering capacity was also in the red (unhealthy) band suggesting the quality of the participant's buffering capacity is reduced probably due to polypharmacy, despite having normal stimulated saliva flow rate. Even if saliva flow rates are stimulated by chewing, the buffering capacity may not improve sufficiently to neutralise mouth acids and the use of a sodium bicarbonate toothpaste as an intervention should be expected to benefit this Participant.

The nurse has attempted to improve salivary function by stimulating saliva flow by recommending the use of chewing gum 3 times a day after breakfast, lunch and

dinner.to neutralising mouth acids after eating main meals. The nurse elected to alternate gum chewing with 3 interventions of sodium bicarbonate toothpaste scheduled after the participant's likely mid-morning and afternoon snack times to neutralise mouth acids. This nurse scheduled 7 preventive interventions at approximately 2 hour intervals throughout the day.

The nurse has attempted to improve oral hygiene by increasing assisted brushing to 4 times a day after meals. Managing to perform assisted brushing four times a day is unlikely to be achievable; however it shows that the nurse has recognised the importance of brushing the mouth to improve oral hygiene in this Participant.

The author found this plan to be a suitable oral care plan.

**Note:** In this case study, the saliva test results and plaque scores provided a better indicator of risk of oral disease and better matched the clinical findings of 3 decayed teeth than the SXI-D, OHIP14 and OHAT indicated.

## Case Study 3: Very high risk profile and an example of an unsuitable nurse 'Principal Plan' (Participant 3)

**Figs 7: NSCOCP Case Study 3: Very high risk profile.**



| Assessment | Score | Healthy / Unhealthy |
|---|---|---|
| Medications -total | 4 | |
| Anti-cholinergic Index | 2-4+   Likely error in med history! | Healthy? |
| Functioning tooth pairs | 6 pairs from 19 teeth | Unhealthy  10 pairs acceptable |
| Xerostomia questionnaire | 13   (range 5-25)   lower the better | Healthy |
| OHIP14 | 15 (range 14-79)   lower the better | Healthy |
| OHAT | 13* (range 7-32)   lower the better | Changes |
| **Saliva Assessments** | | |
| Hydration<br>   Healthy 0 -30 sec<br>   Low     30-60 sec<br>   Poor     > 60 sec | 30 -60 sec | Low |
| Consistency | No Saliva – Completely dry | Unhealthy - Very  low |
| Sublingual Resting pH<br>Healthy>6.8<br>   Acidic 6.0 -6.6<br>   Very acidic <5.8 | pH 6.2 | Low |
| Unstimulated saliva flow rate<br>   Normal   0.3-0.4mg/min<br>Low     <0.1 mg/min | 0.01mg/min | Unhealthy – Very Low |
| pH after Glucose Challenge at +5min | pH 5.0 | Unhealthy -Very acidic |
| Stimulated saliva flow rate<br>   Normal     1.0 – 2.0 mg/min<br>   Low       0.6 - 0.9 mg/min<br>   Very Low  <0.5 mg/min | 0.01 mg/min<br><br>NOTE: Limit of pH paper test strip is pH 5.0<br>It is possible actual pH was lower | Unhealthy - Very low |
| Buffering capacity<br>   Healthy   10 -12<br>Low       6 – 9<br>Very Low  0 - 5 | 0 | Unhealthy -Very low |
| pH stimulated saliva after +5 min | pH 6.2 | Low |
| pH after Na Bicarb. toothpaste | pH 6.0 | Low |
| **Clinical Findings** | | |
| Decayed Teeth | 6 | |
| Plaque Score (6 sextants) | 25                  lower the better | Unhealthy – High score |
| Dental Bio-burden<br>   Plaque score average times<br>   number of teeth | 84                  lower the better<br>(Plaque score / No sextants * number of teeth) | Unhealthy – High score |
| Denture Cleanliness Scale<br>   Plaque score average all surfaces | 42                  Lower the better<br>5 teeth denture | Unhealthy – High score |

**Case Study 3: Very High Risk Profile and an Unsuitable Nurse Care Plan (Participant 3)**

Participant 3 was assessed by nurses, OHT and the author as having a very high risk profile. The nurse oral care plan does not reflect adequately the more intensive need for preventive interventions.

The nursing home medications chart shows Participant 3 taking only 4 medications with a relatively low anti-cholinergic burden index of 2-4. In this case, the Participant's medical history and her anti-cholinergic medication do not adequately reflect the Participant's poor oral assessments, saliva test results or poor clinical examination results.

Medical History: Poor short term memory, Cholesterol, Depression, Hypertension, and Non-insulin dependent Diabetes Mellitus.

Participant 3 had 6 carious teeth, including one root stump and a fistula draining from a symptom free chronic peri-apical infection (not confirmed with X-rays) with 6 functioning pairs from 19 remaining teeth.

Xerostomia and OHIP14 questionnaires were in the green (healthy) band but this result may be due to bias from nurses assisting the participant to complete the questionnaires.

OHAT, hydration, saliva consistency, sublingual resting saliva pH, stimulated saliva pH, and buffering capacity were in the yellow (low or unhealthy) band.

All other saliva assessment results were in the red (very low and unhealthy) zones. This Participant was assessed by nurse and OHT testing and assessments as having severe SGH with the production of resting and stimulated saliva barely readable and buffering capacity so poor it could not be determined.

Poor oral hygiene with high plaque scores for both her natural teeth and dentures together with SGH exacerbated her oral health risk profile.

**Nurse Principal Plan**
This Principal Plan was one of the first care plans formulated by this nurse and showed lack of experience. The care plan was considered by the dentist ('gold standard) to be poor.
The nurse recognised the importance of decreasing the oral bio-burden and recommended 0.12% Curascept (chlorhexidene) toothpaste in the evenings and assisted denture and tooth brushing 3 times a day after morning, lunch and evenings meals. There was only one attempt at neutralising mouth acids using sodium bicarbonate toothpaste which was scheduled after lunch.

Despite the author considering this oral care plan to be unsatisfactory, following this plan would have still benefitted the participant as compared to no plan or preventive interventions at all.

A more appropriate care plan would take into consideration whether there were adequate functioning pairs of teeth to chew gum, whether regular use of chewing gum after meals could help improve on the limited saliva function. The alternate use of chewing gum and sodium bicarbonate toothpaste to neutralise mouth acids as per Case Study 2 would have been advisable. Although this Participant did not complain of a dry mouth, periodic use of an oral lubricant would also have improved the Participant's oral health and comfort.

# Clinical Findings

**The Complexity of Residential Aged Care Participants**

Seven out of 8 participants had complex dental restorations and bridgework with an obvious need to maintain complex dentistry in this study group. (See Table 16.) Our study participant cohort may not be representative of early dementia residents in other RACFs coming from different socio- economic backgrounds.

Maintaining a heavily restored dentition and past sophisticated dental treatment will become a greater burden on the aged care industry as the future baby boomer generations enter nursing homes with a greater number of retained teeth and complex dentistry.

**Fixed Dental Unit (FDU)**

A Fixed Dental Unit (FDU) is defined by the author in this study as any natural tooth or prosthetic units, such as fixed bridgework or in implant retained over-dentures that cannot be removed from the mouth to be cleaned. FDUs provide additional surface areas for pathogenic biofilms to grow.

Conventional DMFT scores do not adequately reflect the oral pathogenic bio-burden living in the mouth as it does not provide an indication of the total surface area where pathogenic biofilms grow. The greater the overall surface area available for pathogenic biofilm to colonise, the greater is the likelihood of this biofilm contributing to an increased incidence of oral and systemic disease, particularly respiratory infections. FDUs such as implant retained over dentures are unlikely to be adequately cleaned even when RACF nursing staff and carers have completed assisted brushing programs.

This study attempted to score the total oral dental biofilm of the mouth by allocating plaque scores based on the Greene and Vermillion Plaque Scores to FDUs and dentures. (See section on Plaque Scores)

**Functioning Pairs**

Four out of 8 Participants had less than 10 functioning pairs of teeth while two Participants had 20 or more teeth but less than 10 functioning pairs. One Participant had only 5 lower teeth opposing a full upper denture. Two other Participants wore 5 and 7 teeth part metal dentures.

Functional pairs of teeth give an indication of masticatory efficiency, which in turn may relate to quality of life and nutritional deficits if there are inadequate apposing

masticatory tooth contacts. In this study, a premolar to premolar occlusion with 20 functioning teeth in 10 pairs was considered adequate for mastication and aesthetics.

## Clinical Findings Summary

Table 16  Clinical Findings

| Participant | Decayed Teeth | Missing | Filled Teeth | Unfilled Teeth | Fixed Dental Units* | Function Pairs | Notes |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 7 | 12 | 13 | 25 $^{+1P}$ | 12 | #16 Fistula |
| 2 | 3 | 6 | 22 | 4 | 26 | 12 | |
| 3 | 6 | 13 | 16 | 3 $^{+1\,R}$ | 19 | 6 | #24 Fistula P/CoCr 5 teeth/- |
| 4 | 0 | 11 | 11 | 10 | 23 $^{+2P}$ | 9 | |
| 5 | 0 | 6 | 22 | 4 | 26 | 12 | #26 Implant fixture only |
| 6 | 0 | 27 | - | 5 | 5 | 0 | F/ CoCr 8 teeth |
| 7 | 0 | 8 | 18 | 6 | 26 $^{+2P}$ | 11 | |
| 8 | 8 | 12 | 19 | 1 $^{+1R}$ | 20 $^{+1P}$ | 7 | #42 Fistula |

* 'Fixed Dental Units' signifies number of natural or prosthetic teeth that cannot be removed from the mouth.
$^{+P}$ signifies number of pontics included in total occlusal surface count
$^{+R}$ signifies number of retained roots in total of unfilled tooth count

Four out eight participants had decayed teeth.
Participants 1, 2, 3 and 8 had 3, 3, 6 and 8 decayed teeth respectively.
Asymptomatic fistulas were evident for 3 participants suggesting apical infections.

Two residents had retained unfilled roots $^{(+R)}$ and one resident had an unrestored implant fixture.

Seven out of eight participants had complex dental restorations and bridgework.

# Medical Diagnoses, Medications and Anti-Cholinergic Index

All participants were taking anti-depressants as per their RACF medications charts. Participant 6, despite not having a diagnosis of depression recorded in her medical history was also taking anti-depressants. (Figure 8)

Participants 1,2,3,5 were taking anti-psychotics in addition to anti-depressants.

Fig 8  Participants: Medications, Anti-cholinergic Burden Scale Compared to Decayed Teeth



|  | Participants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| No. Medications | 9 | 10 | 11 | 10 | 10 | 10 | 8 | 4 | 9 |
| Anti-cholinergic Scale | 7 | 11 | 5 | 7 | 8 | 5 | 6 | 2 | 6 |
| Decayed Teeth | 3 | 3 | 6 |  |  |  |  | 8 |  |
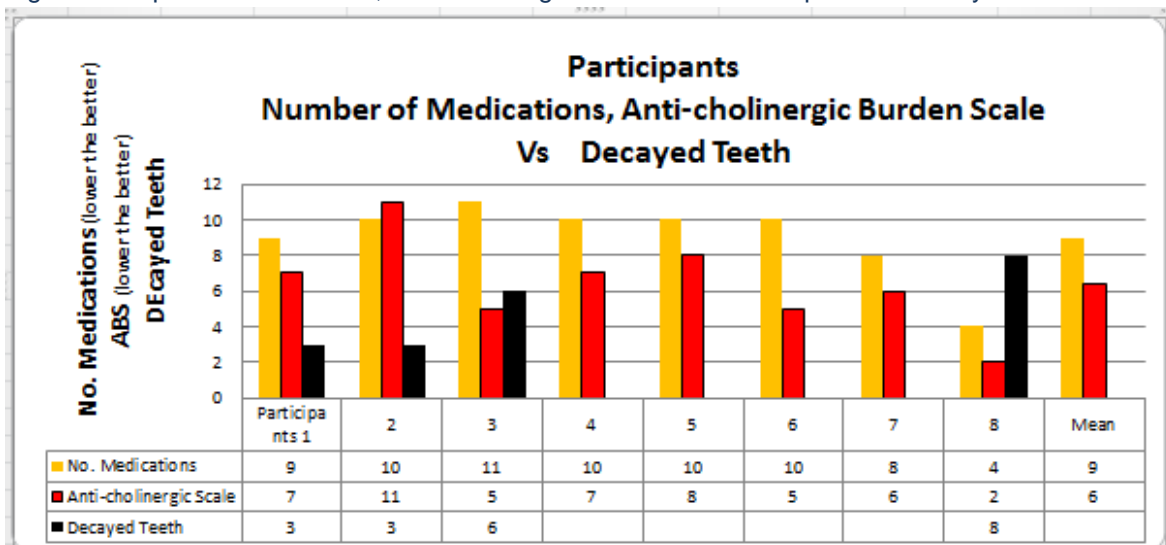
Participants 1-8 with 9,10,11,10,10,10,8,4 total medications
Participants 1-8 with 7,11,5,7,8,5,6,2 ABS
Participants 1,2,3,8 with 3,3,6,8 decayed teeth respectively

Early dementia participants in this study were taking the following most frequently prescribed and complementary medicines (Table 17.):-

Table 17  ABS associated with medication category and participants

| Medication Category | Participants | ACB score |
|---|---|---|
| Anti-depressants | 1-8 | 3 |
| Anti-psychotics | 1,2,3,5 | 3 |
| Hypertensives / diuretics | 1,3,6 | 1 |
| GORD | 1,2.4.6,7 | 1 |
| Opioids | 1,2,4,6,7 | 1 |
| Laxatives | 1,3,4,5,6 | 0 |
| Parkinson's Disease | 7,8 | 1 |
| Alzheimer's Disease | 7,8 | 1 |

Not all complementary or prescription medications were recorded in the above list

In summary, participants (n=8) were taking between 4 and 11 prescription and / or complementary medications with a mean of 9 medications.

## Anti-cholinergic Burden Scale

Participant's medications were scored from an anti-cholinergic activity scale formulated by St Vincents Hospital Pharmacy Department, Darlinghurst. Medicines were given a score from 0-3, with 3 having the greatest anti-cholinergic effect. St Vincents Hospital allocated ABS scores to the following categorises of medications: Anti-psychotics (3), Anti-convalescents (2), Hypertensives (1), Diuretics (1), Opioids (1), Most medications for heart disease (1), Parkinson's (1), Alzheimer's (1) and GORD (1)

Participants 1-8 were taking 9,10,11,10,10,10,8 and 4 total medications respectively. Participant's medications when converted to the St Vincents Hospital Anti-cholinergic Burden Scale resulted in participants 1-8 having ABS scores of 7,11,5,7,8,5, 6 and 2 respectively.

# Shortened Xerostomia Inventory Questionnaire (SXI-D)
Appendix 14

The scores for the SXI-D range from a minimum score of 5 to a maximum of 25. In this study resident participant scores varied between 5 and 13 (average 7.75). (Figure 9)

Volunteer 10 suffers from Sjogren's Syndrome and Volunteer 11 was taking anti-cholinergic medication. These volunteers were specifically asked to participate in the saliva testing to show nurses examples of people in the general community with poorer salivary function. Total volunteer scores varied between 5 and 18, (average 8.83). Removing Volunteer 10's score, on the basis that someone with Sjogren's disease would be an outlier, resulted in an average score of 7.0.  While removing volunteers 10 and 11 moved the average score for the remaining four volunteers to 6.5.

Fig 9: Summated Xerostomia Inventory-(SXI-D) Scores Participants compared to Volunteers
Range 5-25, the lower the better
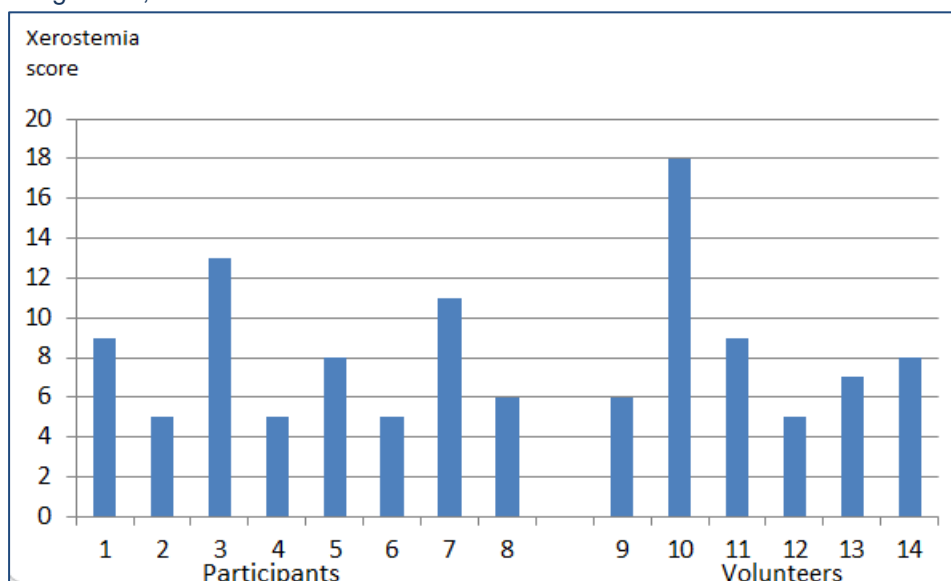


Participants 1-8: and Volunteers 9-14.
Participants 1,2,3,8 with 3,3,6,8 decayed teeth respectively
Volunteer 10 has Sjogren's Syndrome
Volunteer 11 was taking anti-cholinergic medication

Nurses had to help early dementia participants answer questions and this assistance may have biased participant answers.

## Participant SXI-D Scores at Baseline and +10 Weeks

| | Participants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Baseline | 9 | 2 | 13 | 5 | 8 | 5 | 7 | 6 | 6.9 |
| 10 weeks | 6 | 2 | | 7 | 14 | 5 | | 6 | 6.7 |

Participants 1,2,3,8 with 3,3,6,8 decayed teeth respectively
Participants 3 and 7 lost to the study due to illness

For participants with decayed teeth, SXI-D scores at baseline ranged from 5 to13 (See Figure 10: range 5-25, the lower the better).

Participant 3 (6 decayed teeth) was found to have very severe salivary gland hypofunction and recorded the highest SXI-D score of 13.

Participant 7 scored the next highest score of 11 but was found to have reasonably good salivary function and had no decayed teeth.

Two participants (2, 6) had very low SXI-D scores of 5 (3, 0 decayed teeth respectively) while Participant 8 had a SXI-D score of 6 (8 decayed teeth). In these participants the Xerostomia scores did not reflect the severity of their prevalence of decay. (Table 18.)

Table 18  Baseline xerostomia scores compared to decayed teeth

| Participant No. | Xerostomia Score | Decayed Teeth |
|:---:|:---:|:---:|
| 1 | 9 | 3 |
| 2 | 5 | 3 |
| 3 | 13 | 6 |
| 4 | 5 | 0 |
| 5 | 8 | 0 |
| 6 | 5 | 0 |
| 7 | 11 | 0 |
| 8 | 6 | 8 |

SXI-D Scores (Range 5-25) the lower the better

**Baseline Short Xerostomia Scores (Range 5-25) compared to Decayed teeth (Table 18)**

Participant 1 recorded a SXI-D score of 9 with 3 carious lesions while:-

Participant 2 scored   5 with 3 carious lesions

Participant 3 scored 13 with 6 carious lesions

Participant 8 scored   6 with 8 carious lesions

Participant 8 had the greatest number of decayed teeth with a low SXI-D score of only 6. Participants 4, 5, 6, 7 had no decayed teeth and scored 5, 8, 5, 11 respectively.

At 10 weeks, only one participant reported a lower SXI-D score, three participants reported no change while two reported their mouths felt drier and recorded higher scores. (Figure 10)  Participants 3 and 7 were the most frail of the all the participants. Both Participants 3 and 7 reported the highest Xerostomia scores (13 and 11) at baseline and were lost to the study by the 10-week follow up stage due to illness.

Participant 5, without any decayed teeth, reported the greatest individual variation over the 10 week period scoring 5 at the start and rising to 14 at the end of the study.

# Oral Health Impact Profile14 (OHIP14)

Appendix 15.

Some residents needed assistance answering questionnaires and it was difficult to determine if participant answers were influenced by nurses or whether the nurses knew the resident sufficiently well enough to prompt the resident to answer correctly. In both circumstances nurses may bias participant answers.

Fig 11: OHIP14 Scores: Participants compared to Volunteers
Range 14-70: the lower the score the better



**OHIP14: Quality of Life 14 Questionnaire**
**14 questions**
**Lower the better: Range 14 -70**

| | Baseline | Particip ants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean | | Volunte ers 1 | 2 | 3 | 4 | 5 | 6 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ■ Series1 | | 14 | 14 | 15 | 14 | 24 | 18 | 28 | 13 | 18 | | 14 | 26 | 20 | 14 | 17 | 17 | 18 |
| ■ Series2 | | | | | | | 15 | | | 15 | | | | | | | | |
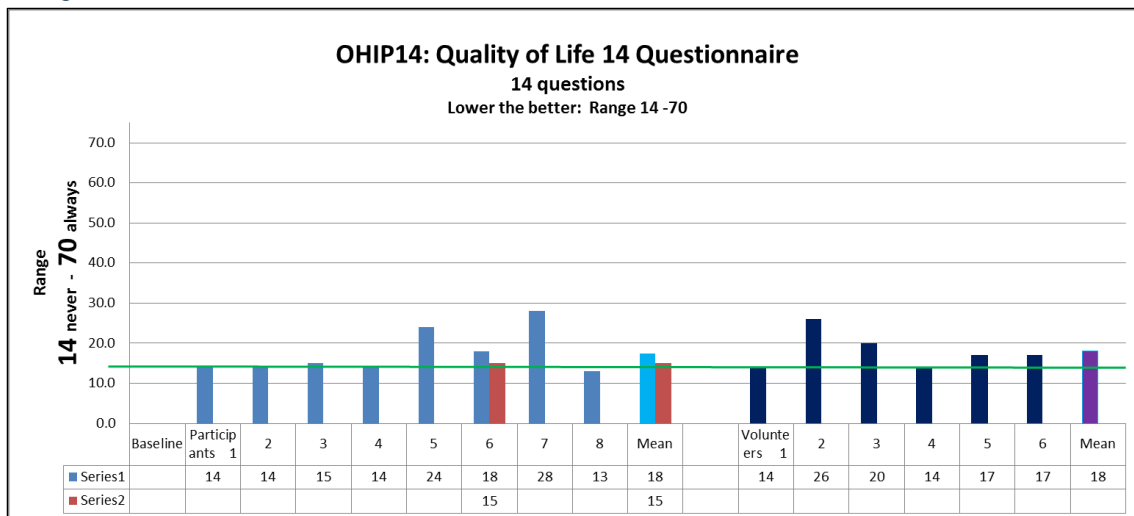
Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Participant 8 answered only 13 questions
Volunteer 2 Sjogren's syndrome
Volunteer 3 taking anti-cholinergic medication

Figure 11 shows that Volunteer 2 (Sjogren's Disease) and Volunteer 3 (anti-cholinergic medications) scored the highest scores among the volunteers with 26 and 20 respectively. The remaining four volunteers scored between 14 and 17.

Only two participants had scores greater than the highest volunteer scores. Participants 5 and 7 (who were caries free) had relatively high OHIP14 scores of 24 and 28 respectively.

Participants and volunteers, (including Volunteers 2 and 3) scored similar OHIP14 scores with participants averaging 17.4 and volunteers averaging a slightly higher score of 18.0.

Participants 1,2,3,8 all recorded the lowest OHIP14 scores possible despite having 3,3,6,8 carious lesions respectively and poorer salivary function test results.

Participant 3 had an extremely dry mouth with the worst salivary function of all participants, had the lowest resting and stimulated saliva pH yet reported no adverse impact on her quality of life through the OHIP14 questionnaire.

In contrast, Participants 5, 6 and 7 had the best salivary function test results yet reported poorer quality of life scores. Participant 6 accidently completed the OHIP14 twice with the assistance of 2 different nurses on the same morning and reported scores of 18 and 15.  Other studies have reported lower elderly oral health quality of life scores possibly due to older people coming to terms with a reduced quality of life as they age.

# Oral Health Assessment Tool (OHAT)

Appendix 16.

The modified (Montefiore) OHAT scores range: 7-32 (without dentures) or 8-32 (with dentures).

Figures 12 summarises the findings of Nurse OHAT assessments of both participants and volunteers at baseline. Figure 13 compares OHT and nurse OHAT assessments of participants at baseline.

**Nurse OHAT baseline scores: Participants versus Volunteers (Figure 12).**

Fig 12: Nurse OHAT:  Participants compared to Volunteers
Range 7 (healthy) – 32 (unhealthy), the lower the better
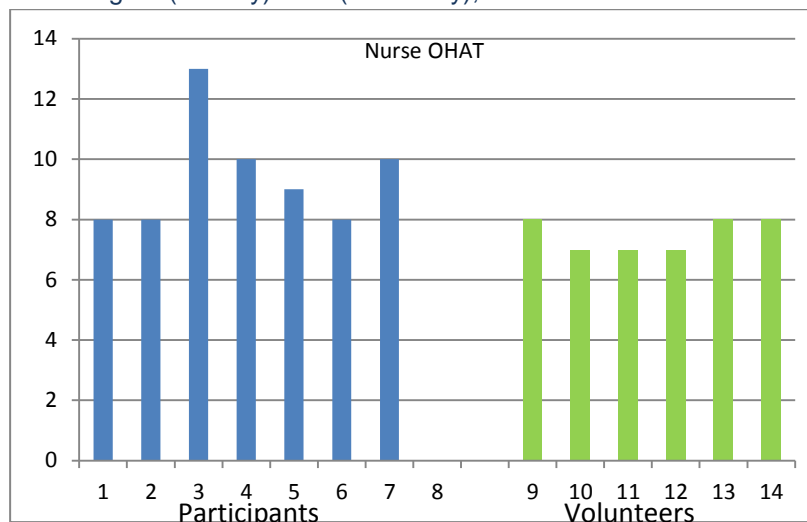


Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Resident 8 was unable to be assessed by nurses

Mean baseline nurse participant OHAT score (n=7) was 9.4.
Mean nurse volunteer OHAT scores (n=6) was 8.5

## Nurse OHAT scores compared to Oral Health Therapist OHAT scores at Baseline.   (Figure 13)

**Nurse and OHT Baseline Participant OHAT Scores Compared**

| | Partici pants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| ■ Nurse | 8 | 8 | 13 | 10 | 9 | 8 | 13 | | 9.9 |
| ■ OHT | 10 | 8 | 16 | 8 | 8 | 9 | 10 | 9 | 9.8 |
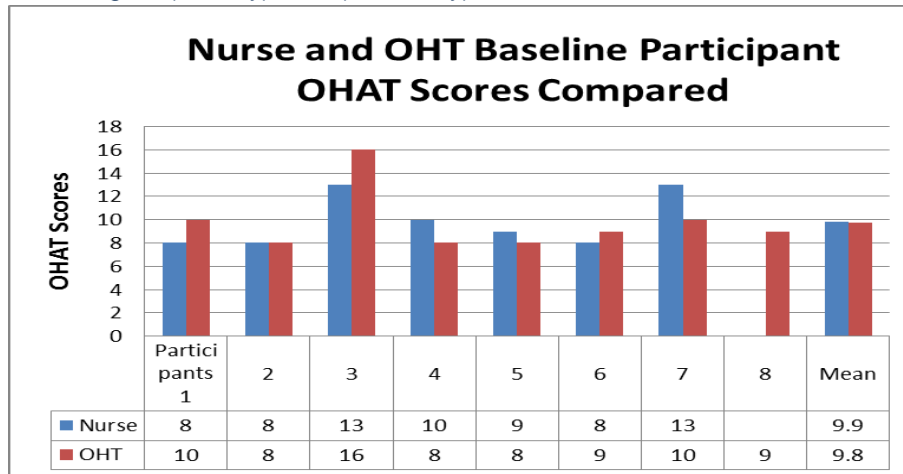
Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Participant 8 was not assessed by nurses at baseline

Participant 8 joined the study late and did not have an OHAT assessment performed by the nurses at baseline, but had OHAT OHAT assessments at baseline and at +10 weeks. OHAT results compared nurses and OHTs assessments of the same participants (i.e. Participant 8 excluded), mean scores correlated closely with scores of 9.9 and 9.8 respectively.

## Mean OHT OHAT scores at baseline and at end of study (+10 weeks) (Figure 14)

Fig14: OHT OHAT Scores at Baseline and +10 Weeks
Range 7 (or 8 dentures) - 32, Lower the better
For each category score of 1=healthy, 2=changes, 3=Unhealthy
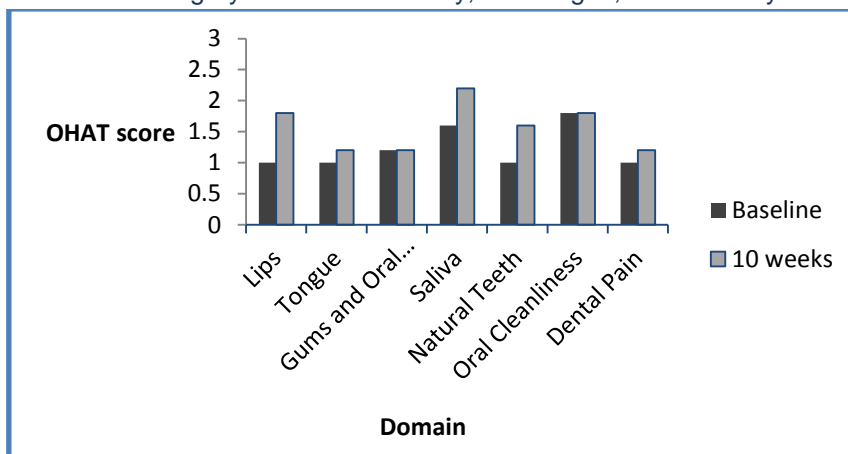


Figure 3: Mean OHAT scores for each domain at baseline and at 10-week follow-up (n=5). Lower scores indicate better health in each domain.

**OHT OHAT scores of participants at baseline and at +10 weeks (Figure 15)**

Fig 15: OHT OHAT Total Scores at Baseline and at +10 Weeks
Range 7 (or 8 dentures) - 32, Lower the better
For each category score of 1=healthy, 2=changes, 3=Unhealthy



**OHT OHAT Scores at Baseline and +10 weeks**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| OT OHAT Baseline | 10 | 8 | 16 | 8 | 8 | 9 | 10 | 9 |
| OT OHAT 10 weeks | 14 | 8 | 0 | 9 | 12 | 12 | 0 | 12 |

Individual Participant Cumulative OHAT Scores
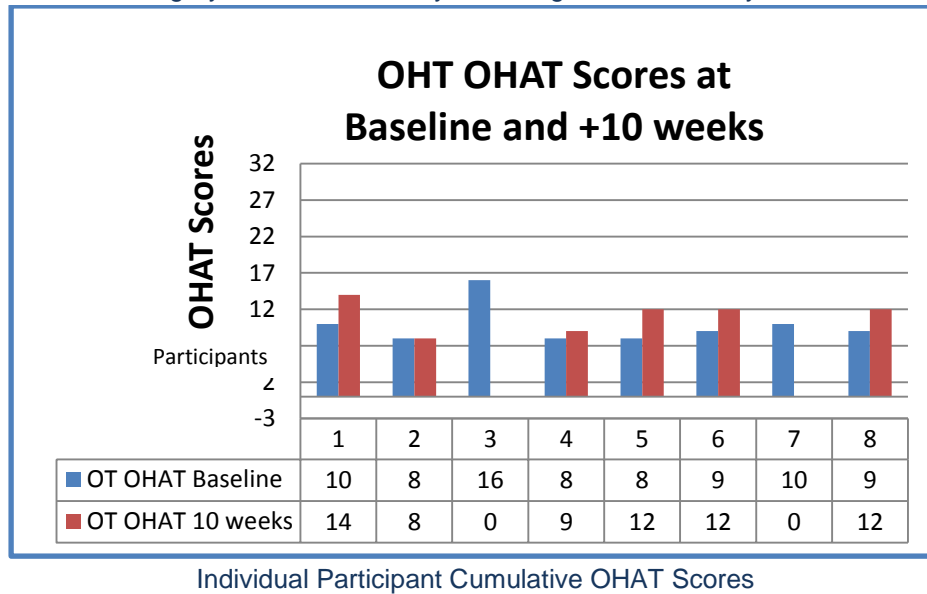
A score of 1 signified 'Healthy', 2 'changes', 3 'Unhealthy' and 4 "Referral required". Oral health therapist mean OHAT scores tended to become worse over all categories at the end of the 10 week study period. (Figure 15) Participant numbers were too low for statistical analysis but trends were evident with lips, saliva, and natural teeth having greater adverse findings, then tongue followed by slightly worse findings for dental pain and little change for oral tissues and oral cleanliness.

Mean scores for categories for lips, tongue, natural teeth and dental pain were 'Healthy' at baseline for all 8 participants. Lips, saliva and natural teeth had the greatest change at the end of study at +10 weeks.

No resident was assessed by nurses as having the need for a referral to a dentist for any category.

**Participants with Decay: OHT and Nurse OHAT scores at baseline and at +10 Weeks Compared   (Figure 16)**

Fig16:  Participant OHAT compared to Decayed Teeth (range 7-32). The lower the better
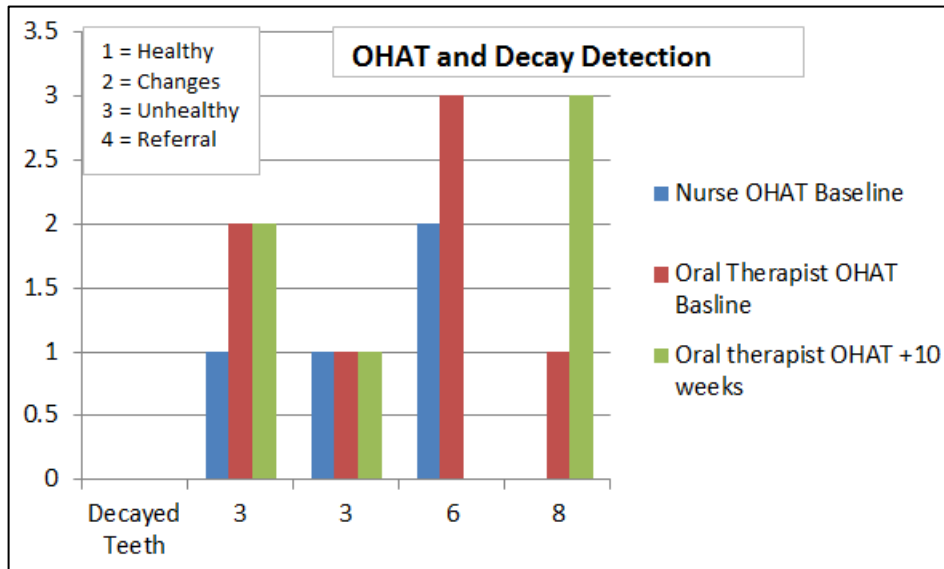


Participants 1, 2, 3 and 8 with 3, 3, 6 and 8 decayed teeth respectively compared to OHAT scores

Figure 16 shows only Participant 3 (with 3 decayed teeth), having the same OHT and nurse OHAT scores at baseline as well as oral health therapist OHAT score at baseline and again at +10 weeks.  OHTs scored Participants 1, 3 and 8 (with 3, 6 and 8 decayed teeth) higher than nurses scores.

Although OHT were experienced in aged care and familiar with OHAT assessments, no standardisation of OHAT assessments were made prior to commencement of this study which might account for inter-examiner variation.

Nurses in general felt they could perform OHAT assessments, felt well supported in their efforts to perform OHAT and that they understood the various OHAT categories.

Table 19 below, shows nurse responses to the OHAT Questionnaire. This questionnaire was the same questionnaire used in the Chalmers 2009 study. (See OHAT Discussion section Page 144)

## Table 19 Nurse answers to OHAT questionnaires

| | Oral Health Assessment Tool (OHAT) | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 1 | I feel knowledgeable and prepared to use the Oral Health Assessment Tool | 0 | 0 | 100 | 0 |
| 2 | Using the Oral Health Assessment Tool improves my ability to detect dental pain and problems in residents' mouths | 0 | 0 | 100 | 0 |
| 3 | I had enough time to learn about the Oral Health Assessment Tool before it was implemented | 0 | 33 | 67 | 0 |
| 4 | I feel supported in my efforts to implement the Oral Health Assessment Tool for residents | 0 | 0 | 100 | 0 |
| 5 | I am able to complete the 'lips' category of the Oral Health Assessment tool | 0 | 0 | 100 | 0 |
| 6 | I am able to complete the 'tongue' category of the Oral Health Assessment tool | 0 | 0 | 100 | 0 |
| 7 | I am able to complete the 'gums and tissues' category of the Oral Health Assessment tool | 0 | 0 | 100 | 0 |
| 8 | I am able to complete the 'saliva' category of the Oral Health Assessment tool | 0 | 0 | 100 | 0 |
| 9 | I am able to complete the 'natural teeth' category of the Oral Health Assessment tool | 0 | 0 | 100 | 0 |
| 10 | I am able to complete the 'dentures' category of the Oral Health Assessment tool | 0 | 33 | 67 | 0 |
| 11 | I am able to complete the 'oral cleanliness' category of the Oral Health Assessment tool | 0 | 0 | 100 | 0 |
| 12 | I am able to complete the 'dental pain' category of the Oral Health Assessment tool | 0 | 33 | 67 | 0 |
| 13 | I feel knowledgeable and prepared to use the Oral Hygiene Care Plan | 0 | 0 | 100 | 0 |
| 14 | Using the Oral Hygiene Care Plan enhances the quality of oral hygiene care I provide for residents | 0 | 0 | 100 | 0 |
| 15 | I had enough time to learn about the Oral Hygiene care plan before it was implemented | 0 | 0 | 100 | 0 |
| 16 | I feel supported in my efforts to implement the Oral Hygiene care plan for residents | 0 | 0 | 100 | 0 |
| 17 | I am able to complete the 'dentist details' section of the Oral Hygiene Care Plan | 0 | 0 | 100 | 0 |
| 18 | I am able to complete the 'dentures' section of the Oral Hygiene Care Plan | 0 | 0 | 100 | 0 |
| 19 | I am able to complete the 'natural teeth' section of the Oral Hygiene Care Plan | 0 | 0 | 100 | 0 |
| 20 | I am able to complete the 'assistance with oral hygiene care' section of the Oral Hygiene Care Plan. | 0 | 0 | 100 | 0 |
| 21 | I am able to complete the 'regular problems with oral hygiene care' section of the Oral Hygiene Care Plan | 0 | 0 | 100 | 0 |

100% signifies 3 out 3 nurses, 67% signifies 2 out of 3 nurses agree

# Saliva Assessments and Test Findings

## Saliva Consistency

This study used a modified version of descriptors for saliva consistency as described in the GC Saliva Check Buffer $^{TM}$ kit.

Two additional classifications, 'Completely dry' and 'Mucopurulent', were added to the saliva consistency descriptors and given scores. (See Methods page 57)

Fig 17: Proposed: New Saliva Consistency Scores:
Baseline Participants compared to Volunteers
The higher the better (Range: 1 to 4)

**SALIVA CONSISTENCY: Modified GC Saliva Check Buffer kit**
**Nurse Baseline, OHT Baseline, OHT at +10 weeks**

-1 = Completely dry
1 = Mucoussy - Pussy
2 = Sticky - Frothy
3 = Fothy - Bubby
4 = Watery - Clear

| | Partici pants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean | Volun teers 1 | *2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nurse Baseline | 2 | 4 | -1 | 2 | 4 | 4 | 2 | 2 | 2 | 4 | 2 | 2 | 4 | 4 | 4 |
| OT baseline | 3 | 2 | -1 | 3 | 4 | 1 | 3 | 1 | 2 | | | | | | |
| OT +10wks | 1 | 4 | | 2 | | 2 | | 2 | 2 | | | | | | |
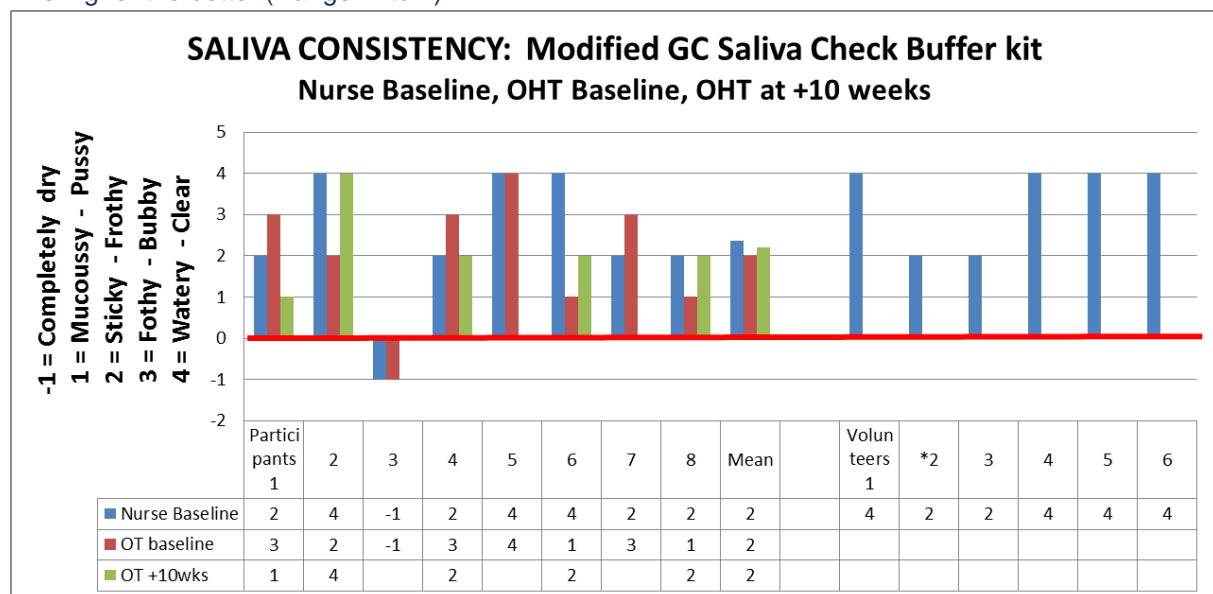
Comparison of baseline nurse saliva consistency scores of participants (n=8) and volunteers (n=6) and OHT scores of participants at baseline (n=8) and +10weeks (n=5).
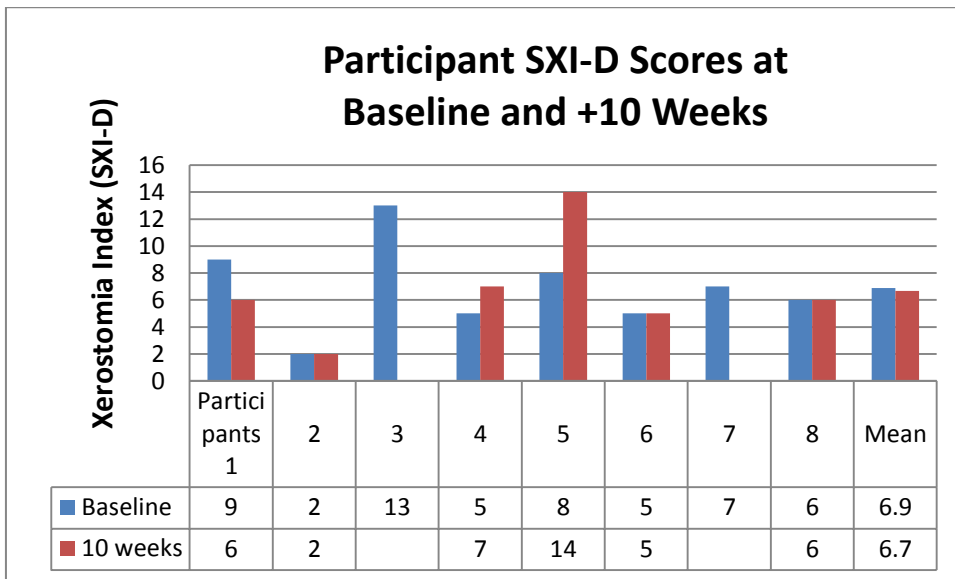Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Volunteer 2 has Sjogren's syndrome,
Volunteer 3 is taking anti-cholinergic medication.

Both baseline participant (n=8) nurse and OHT assessments of saliva consistency resulted in the same mean score of 2.

Mean OHT participant saliva consistency scores at baseline (mean = 2) and end of the study period (mean=2) were again the same. In other words no improvement was found.

Participants (n=8) in general had poorer saliva consistency scores compared to volunteers (n =6), with mean saliva consistency scores of 2 and 3 respectively.

Both the Sjogren's and the anti-cholinergic medication volunteers, with poorer

salivary function compared to the other volunteers, were included in saliva consistency data set. As the Sjogren's volunteer might be considered an outlier, removing this volunteer's score from the data set would result in a more noticeable difference between Participants and Volunteers (with scores 2 and 4 respectively).

## Hydration Results

Nurse assessments of volunteer hydration levels fell into the normal range, except for Volunteers 2 with Sjogren's, and Volunteer 3 taking anti-cholinergic medication. (Figure 18)

Fig 18: Hydration: Baseline Nurse Participant compared to Volunteer Hydration Scores. Range 0->60secs: The lower the better



**Hydration Lip:** time for beads of saliva to wet tssue on lip
High 0-30secs: Midway point 15 sec chosen
Normal 31-60secs: Midway point 45 sec
Low >61 secs: Midway point 75 sec

| | Partic ipants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean | | Volun teers 1 | 2 | 3 | 4 | 5 | 6 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nurse Baseline | 45.0 | 15.0 | 45.0 | 15.0 | 15.0 | 45.0 | 45.0 | 15.0 | 30.0 | | 45.0 | 75.0 | 75.0 | 15.0 | 45.0 | 45.0 | 60.0 |
| OT baseline | 45.0 | 45.0 | 75.0 | 75.0 | 75.0 | 75.0 | 75.0 | 75.0 | 67.5 | | | | | | | | |
| OT +10wks | 75.0 | 15.0 | | 75.0 | | 75.0 | | 75.0 | 63.0 | | | | | | | | |
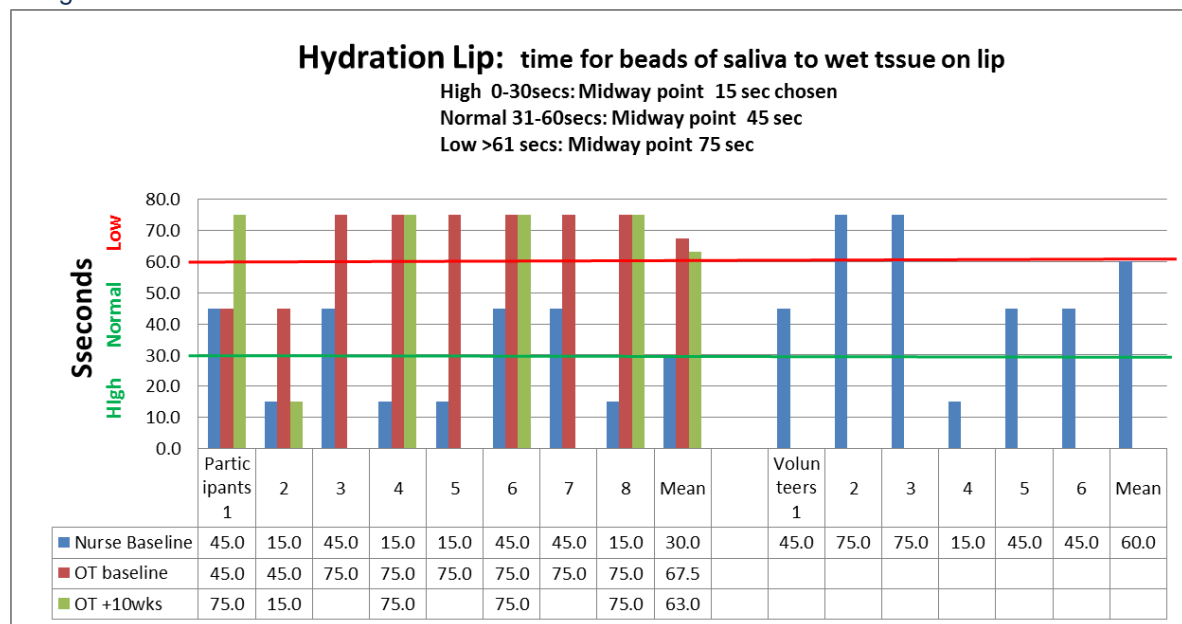
Comparison of baseline nurse hydration scores of participants (n=8) and volunteers (n=6) and OHT scores of participants at baseline (n=8) and +10weeks (n=5).
Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Volunteer 2 Sjogren's syndrome
Volunteer 3 anti-cholinergic medication

Although variations on a day to day basis occur, there was an unexpected and obvious difference between hydration baseline scores given by the nurses (mean=30) and those given by the OHTs (mean = 67.5). In this test, nurse results better reflected expected findings that early dementia participants on polypharmacy would have worse results than volunteers.

Despite the difference between baseline nurse and OHT assessments, OHT assessments at baseline and at +10 weeks were similar with mean scores of 67 and 63.0 respectively.

## Resting Saliva Flow Rate

Participants 1, 2, 3 and 7 had poorer resting saliva flow rates compared to their peers. Participant 3 had by far the worst saliva function of the participants and had a barely detectable unstimulated saliva flow rate. Participants 3 and 7 could not complete the study due to ill health.

Participants 4, 5, 6 and 8 had resting flow rates at or above the normal resting saliva flow rate.

Fig 19: Three Minute Unstimulated Whole Resting Saliva Flow Rate
Nurse Assessment: Baseline Participants compared to Volunteers
Normal (> 0.3mg/min); Low (between 0.1-0.3mg/min); Very Low' (<0.1mg/min)
Higher the better



Unstimulated (Resting) Whole Saliva Flow Rate (Spit method)

| | Partici pants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean | Volun teers 1 | 2 | 3 | 4 | 5 | 6 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nurse Baseline | 0.33 | 0.12 | 0.00 | 0.49 | 0.76 | 1.20 | 0.12 | 0.40 | 0.43 | 0.71 | 0.00 | 0.03 | 2.17 | 0.71 | 0.95 | 0.91 |
| OT baseline | 0.20 | 0.15 | 0.01 | 0.40 | 1.47 | 0.41 | 0.25 | 0.71 | 0.45 | | | | | | | |
| OT +10wks | 0.21 | 0.19 | | 0.21 | 0.49 | 0.35 | | 0.47 | 0.32 | | | | | | | |
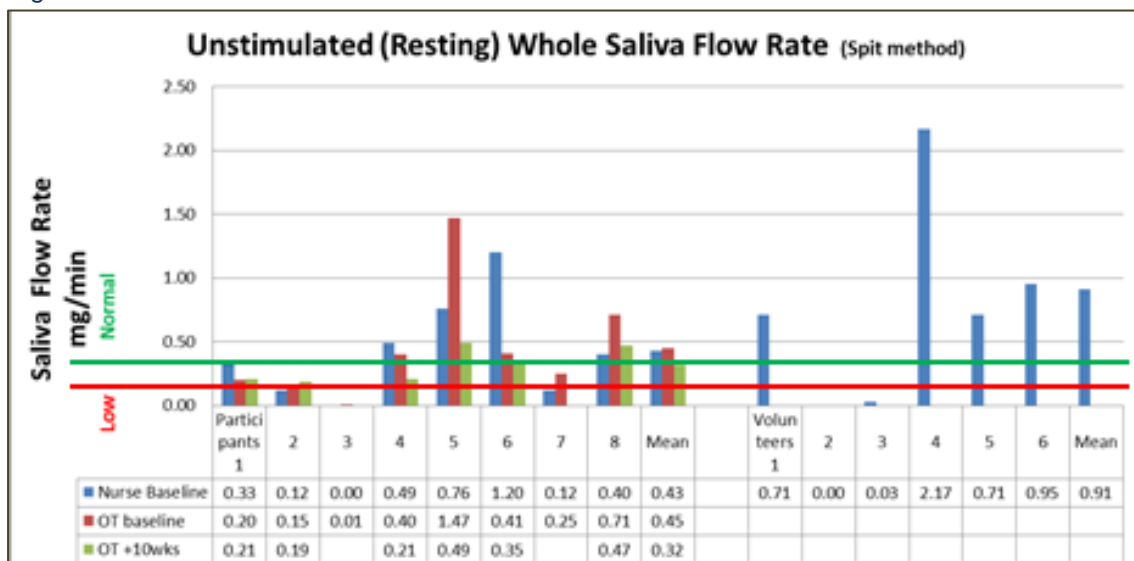
Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Participant 3 had insufficient resting saliva function to measure
Volunteer 2 suffers from Sjogren 's syndrome: insufficient resting saliva function to measure
Volunteer 3 is taking anti-cholinergic medication

When Volunteers 2 (Sjogren's) and 3 (anti-cholinergics) were included in the data set of baseline nurse testing of participants (n=8) and volunteers (n=6), mean unstimulated (resting) whole saliva flow rates were 0.43ml/min and 0.76l/min

respectively.

However, volunteer 2 could not record a resting flow rate and was considered to be an outlier. Volunteer 3, taking anticholinergics had noticeably worse resting saliva flow rates compared to other volunteers.

In figure 19 above, when outlier volunteer 2 was removed from the data set (n=5), mean unstimulated flow rate was 0.91ml/min.

Nurse and OHT participant baseline mean unstimulated (resting) whole saliva flow rate measurement were similar with nurse results 0.43ml/min and OHT rates at 0.45ml/min.

OHT testing of participants (n=8) at baseline and at +10 weeks (n=6) found mean unstimulated saliva flow rates were 0.45ml/min and 0.32ml/min respectively. Participant saliva results generally became worse over the course of the study.

## Stimulated Saliva

Figure 20 shows Participants 5, 6, 7 and 8 with stimulated flow rates near healthy volunteer stimulated saliva flow rates. Participant 8, despite having a healthy stimulated saliva flow rate had eight carious lesions.

Participant 3, with six decayed teeth, had insufficient salivary reserve to record salivary flow. Participant 3 consistently had the poorest saliva function with the lowest unhealthy scores for consistency, resting and stimulated salivary flow rates and was considered at very high risk of oral disease.

Participants 1 and 2 also had both very poor stimulated and resting saliva flow rates placing them in a high risk category.

Participant 4 recorded better resting flow rate but poorer stimulated flow rate and may also be considered at high risk of oral disease.

Participant 7 had low resting flow rates but sufficient stimulated salivary reserve to record high normal values.

Figure 20 demonstrates how stimulated whole saliva flow rates show the largest variance and the most obvious difference between participants with poor salivary function compared to participants and volunteers with normal stimulated saliva flows.

Baseline OHT assessments of Participants 1, 2, 3 and 4 found these participants to have poor to very poor saliva function with a mean stimulated saliva flow rate of 0.71 (n=4).

When all 8 participants are included into a data set the participant mean saliva flow rate rises to 4.27 but is still well below the volunteer mean of 7.37 (n= 6) even when Volunteers 2 (Sjogren's) and 3 (anti-cholinergic medication) are included.

Fig 20: Three Minute Stimulated Whole Resting Saliva Flow Rate
Nurse Assessment: Baseline Participants compared to Volunteers
Normal (>3.0mg/min); Low (between 2.1-3.0mg/min); Very Low' (<2.1mg/min)
Higher the better



**3 Minute Whole Stimlated Saliva Flow Rate (wax)**
**Baseline Participants V's Volunteers**

| | Particip ants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean | | Volun teers 1 | 2 | 3 | 4 | 5 | 6 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nurse Baseline | 0.76 | 1.10 | 0.00 | | 7.40 | 6.60 | 6.20 | 7.80 | 4.27 | | 7.80 | 6.00 | 7.20 | 7.80 | 7.80 | 7.60 | 7.37 |
| OTbaseline | 0.80 | 0.84 | 0.01 | 1.17 | 6.60 | 6.80 | 7.00 | 7.60 | 3.85 | | | | | | | | |
| OT+10wks | 0.94 | 0.96 | | 0.76 | 6.10 | 6.60 | | 7.40 | 3.79 | | | | | | | | |
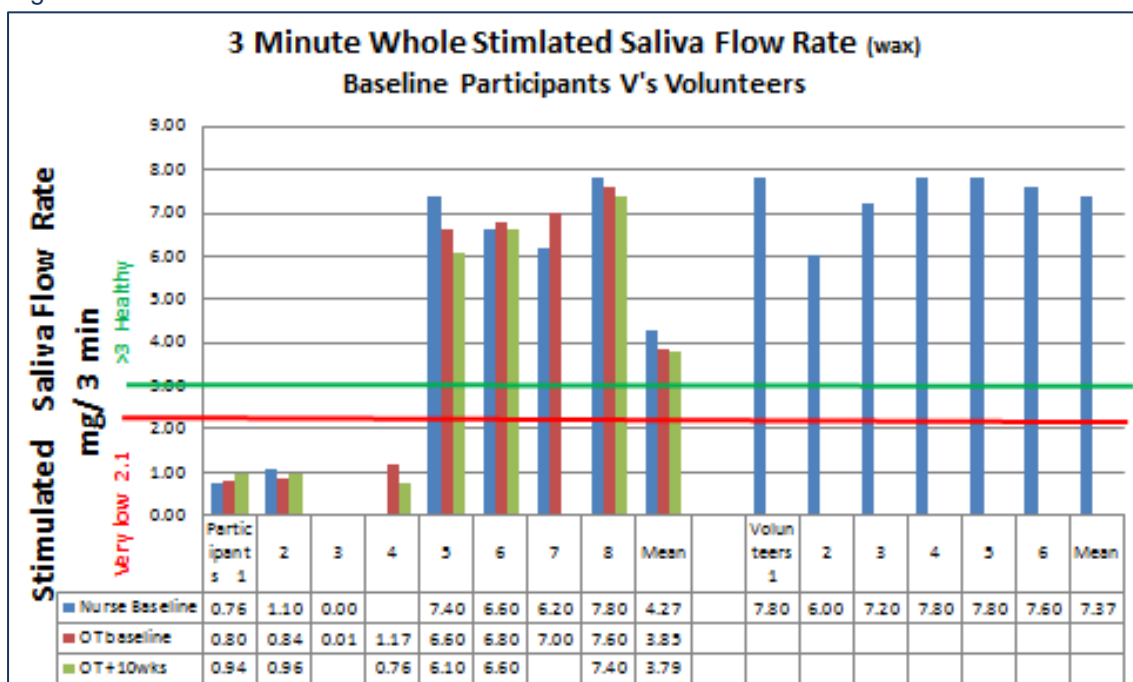
Participant 3 had insufficient resting saliva to be measurable.
Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Volunteer 2 suffers from Sjogren's syndrome
Volunteer 3 is taking anti-cholinergic medication

Volunteers 2 (Sjogren's), although having very poor salivary assessments for hydration, saliva consistency and resting saliva flow, had adequate salivary reserve to place her stimulated flow rate well into the healthy zone. Volunteer 3 (anticholinergics), also with poor resting flow rate and hydration results had stimulated saliva flow rates near that of the other four volunteers.

Comparison between baseline participant (n=8) mean stimulated flow rates between nurses and OHT were 4.27 and 3.85 respectively. Participant 4 was unable to produce sufficient stimulated saliva flow to measure during the nurse baseline testing session but was able to do so 3 days later for OHTs and at 10 weeks. OHT mean

stimulated flow rates at baseline (n=8) and at 10 weeks (n=6) were 3.85 and 3.79 respectively.

In general stimulated saliva flow rate testing between nurses and OHTs were consistent and produced similar results.

In this study, stimulated flow rates may be a good indicator of risk of oral disease as there were clear differences in participants with healthy flow rates and non healthy flow rates and with volunteers.

## Saliva pH

### Resting pH

Nurses recorded baseline resting pH readings of both volunteers and participants using both the SRSpH and the +3 minute spit/drool collection methods and results were compared. Oral health therapists recorded resting pH of participants using both methods at baseline and at +10 weeks. The 10 week results are not represented in Figure 21 below.

Fig 21: Nurse and OHT Assessments SRSpH and +3minute collection pH compared: Participant compared to Volunteer SRSpH
Healthy >6.8pH; Acidic 6.0-6.6; Highly Acidic <5.8          The higher the better



**Baseline: Sublingual Resting pH (SRpH) v's 3 min Resting Saliva** (spit method)

| | Particip ants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | MEAN | | Volunt eers 1 | | 3 | 4 | 5 | 6 | MEAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nurse Sublingual Resting pH | 5.6 | 6.2 | 6.8 | 6.6 | 7.8 | 5.2 | 5.2 | 6.0 | 6.2 | | 6.8 | | 6.6 | 7.5 | 6.8 | 6.8 | 6.9 |
| Nurse +3 min collection resting pH | 5.0 | 6.2 | | 6.6 | 6.8 | 5.2 | 5.0 | 6.6 | 5.2 | | 7.4 | | 7.0 | 7.8 | 7.4 | 7.4 | 7.4 |
| OT Sublingual Resting pH | 6.0 | 6.2 | 6.2 | 6.4 | 7.2 | 5.4 | 6.0 | 5.6 | 6.1 | | | | | | | | |
| OT +3min collection resting pH | 6.2 | 6.2 | 6.2 | 6.6 | 6.8 | 6.6 | 5.4 | 6.0 | 6.3 | | | | | | | | |
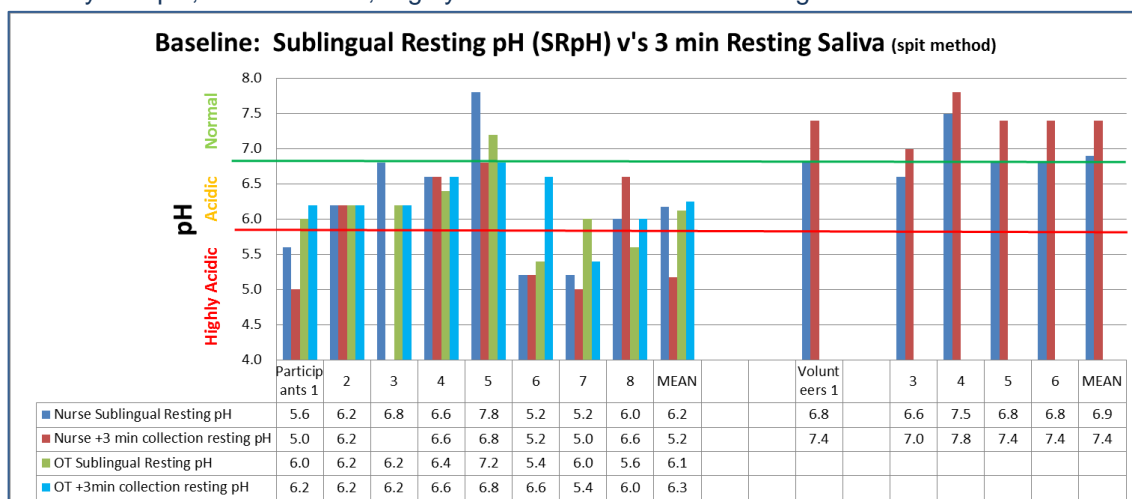
Comparison of nurse and OHT baseline resting pH readings SRSpH and 3 minute spit method
Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively
Participant 3, nurse error recording +3minute saliva collection omitted
Volunteer 2, Sjogren's syndrome and could not record resting saliva pH values, considered an outlier and was not included on this data set.
Volunteer 3, taking anti-cholinergic medication

Volunteer 2 (Sjogren's) produced such little resting saliva that she could not wet pH paper test strip to record pH and was removed from the graph data set in Figure 21 as being an outlier.

In the five remaining volunteers, comparisons between the two methods consistently found SRSpH to be lower than the +3 minute saliva spit/drool collection method (n=5, mean pH6.9 and pH7.4 respectively). This may be a normal finding in healthy adults and may be an expected future finding if the act of spitting stimulates salivary function to produce saliva with more buffering capacity.

Interestingly this same effect was not consistently found among the participants. Although individual nurse participant readings were often close, a greater variation with nurse assessments was found than with OHT assessments. Nurse mean participant SRSpH compared to +3 minute collection was found to be the reverse with means of pH 6.2 and pH5.2 respectively.

Participant 5 was the only test subject to have consistent pH readings in the 'Healthy' zone with nurse SRSpH as high as pH7.8 and +3 minute pH of 6.8. Participant 5 may be an exception and her readings may have affected the mean pH results. A larger study needs to determine if SRSpH is consistently lower than + 3minute resting whole saliva collection pH.

Comparing baseline SRSpH nurse assessments of volunteers (n=6) versus participant's (n=8) found a mean of pH6.9 and pH6.2 respectively; while a +3 minute resting saliva pH had a more obvious differences with volunteer mean of pH7.4 compared to participant mean of pH5.2.

Comparison of baseline OHT assessments of participant SRSpH and +3minute saliva pH found closer results with means pH6.1 and pH6.3 respectively.

Volunteers in general, except for volunteer 2 (Sjogren's), had SRSpH at or near the healthy pH zone (>pH6.8) and had +3 minute saliva pH well above the healthy zone with a mean pH of 7.4.

The pattern of having a lower SRSpH compared to the +3 minute saliva collection method in participants was not a consistent finding. In participants, the lack of a consistent small rise in pH on spitting may suggest that the property in saliva to cause this finding in volunteers may be different or lacking in participants.

OHT assessments found five participants with lower SRSpH than +3 minute collection pH, one participant had the same pH score and two participants had slightly higher SRSpH scores than +3 minute saliva collection scores.

All participants, except Participants 5 and possibly 3, had resting pH in the 'Acidic' or 'Highly Acidic' colour bands using both SRSpH and +3 minute collection methods when assessed by both nurses and OHTs.

Again, numbers in this study were too small to draw any statistical conclusions and a larger study would be needed to verify whether SRSpH is a valid assessment tool for early dementia RACF residents.

## Saliva pH Changes During Saliva Test Procedures

The graph below compares nurse and OHT pH assessments at each stage of the saliva test procedures used in this study. (Figure 22)

Fig 22: Comparison between Nurse and OHT pH readings at baseline measuring:-
Resting pH: Glucose challenge after +5mins, Stimulated saliva and Sodium Bicarbonate
Highly Acidic (<pH5.8), Acidic (pH6.0-6.6), Healthy (>pH6.8): The higher the healthier

**Baseline Partcipant pH Saliva Test Results**
**Nurses and Oral Therapist Tests**
Resting saliva, Glucose challenge, Simulated saliva, Na Bicarb paste

|  | Nurse start | OT start | Nurse | OT | Nurse | OT | Nurse | OT |
|---|---|---|---|---|---|---|---|---|
|  | Resting pH |  | Glucose +5 min pH |  | Stimulated pH 0min |  | Na Bicarb + 5 min pH |  |
| 1 Participant | 5.6 | 6.0 | 5.0 | 5.5 | 5.8 | 7.0 | 6.8 | 6.4 |
| 2 | 6.2 | 6.1 | 6.0 | 6.0 | 7.8 | 7.2 | 6.8 | 6.8 |
| 3 | 6.8 | 6.2 | 6.6 | 5.0 | 6.4 | 6.4 | 6.2 | 6.2 |
| 4 | 6.6 | 6.6 | 6.8 | 6.8 | 7.8 | 7.6 | 7.8 | 7.6 |
| 5 | 6.8 | 6.8 | 7.4 | 6.8 | 7.4 | 6.6 | 7.8 | 6.6 |
| 6 | 5.2 | 6.6 | 6.2 | 5.2 | 6.6 | 6.8 | 7.0 | 7.0 |
| 7 | 6.0 | 6.0 | 5.0 | 5.2 | 6.2 | 7.0 | 6.6 | 7.0 |
| 8 | 6.0 | 6.0 | 6.6 | 5.6 | 7.8 | 7.6 | 7.4 | 6.8 |

Participants 1, 2, 3, 4, 5, 6, 7, and 8 respectively (n=8)
Participants 1, 2, 3, 8 with 3, 3, 6, 8 carious lesions respectively
Resting saliva pH: 3 minute collection of whole saliva (spit method)
Glucose challenge pH: Sublingual pH measured 5 minutes after a 1 minute 20% glucose rinse
Stimulated saliva pH: 3 minute collection of whole saliva (spit method) while chewing wax
Sodium bicarbonate toothpaste: Saliva pH measured 1 minute after paste applied in mouth

Table 20  Nurse compared to OHT mean pH readings at different saliva test stages

| Saliva Test Stage | Mean Nurse pH | Mean OHT pH |
|---|---|---|
| +3 minute resting saliva | 6.2 | 6.3 |
| Glucose challenge: wait + 5 minutes | 6.2 | 5.8 |
| Chewing wax: after chewing for 5 minutes | 7.0 | 7.0 |
| Sodium Bicarbonate toothpaste | 7.1 | 7.0 |

Except for the glucose challenge assessment test stage (Table 20), Nurse and OHT pH readings showed comparable trends with nurses and OHTs placing participant mean pH readings into the same colour bands (Red: Highly Acidic (pH<5.8), Yellow: Acidic (pH6.0-pH6.6) and Green: Normal >pH6.8). Nurses recorded participant glucose challenge mean pH scores in the acidic zone (pH6.2) while OHTs recorded a greater participant pH drop placing the glucose challenge mean score (pH5.8) into the highly acidic zone.

The various participant saliva test stages showed the following general trends:-
- Participant mean resting saliva pH was in the acidic zone
- pH dropped further into the acidic zone after a glucose challenge
- pH rose after chewing wax into the healthy zone
- pH remained in the healthy zone after a small increment of sodium bicarbonate toothpaste was placed into the mouth.
- Nurse and OHT pH testing are comparable and provide similar results

Eight participants started this study and were assessed at baseline. Two participants became ill during the 10 week study period could not be assessed at+10 weeks.

The two graphs below represent saliva pH test results of participants (n=8) by nurses at baseline, OHT at baseline and the remaining participants (n=6) re-assessed by OHTs at +10 weeks. (Figures 22 and 23)

**pH Saliva Test Results of Particpants 1, 2, 3**
at Rest, after Glucose challenge, Stimulated saliva, Na Bicarb toothpaste

| | Resting pH | | | Glucose +5 min pH | | | Stimulated pH 0min | | | Na Bicarb + 5 min pH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nurse | OT start | OT +10wks | Nurse | OT start | OT +10wks | Nurse | OT start | OT +10wks | Nurse | OT start | OT +10wks |
| Series1 | 5.6 | 6.0 | 5.8 | 5.0 | 5.5 | 5.0 | 5.8 | 7.0 | 6.2 | 6.8 | 6.4 | 6.6 |
| Series2 | 6.2 | 6.1 | 6.6 | 6.0 | 6.0 | 6.0 | 7.8 | 7.2 | 7.2 | 6.8 | 6.8 | 6.8 |
| Series3 | 6.6 | 6.6 | 6.0 | 6.8 | 6.8 | 6.8 | 7.8 | 7.6 | 7.5 | 7.8 | 7.6 | 6.9 |
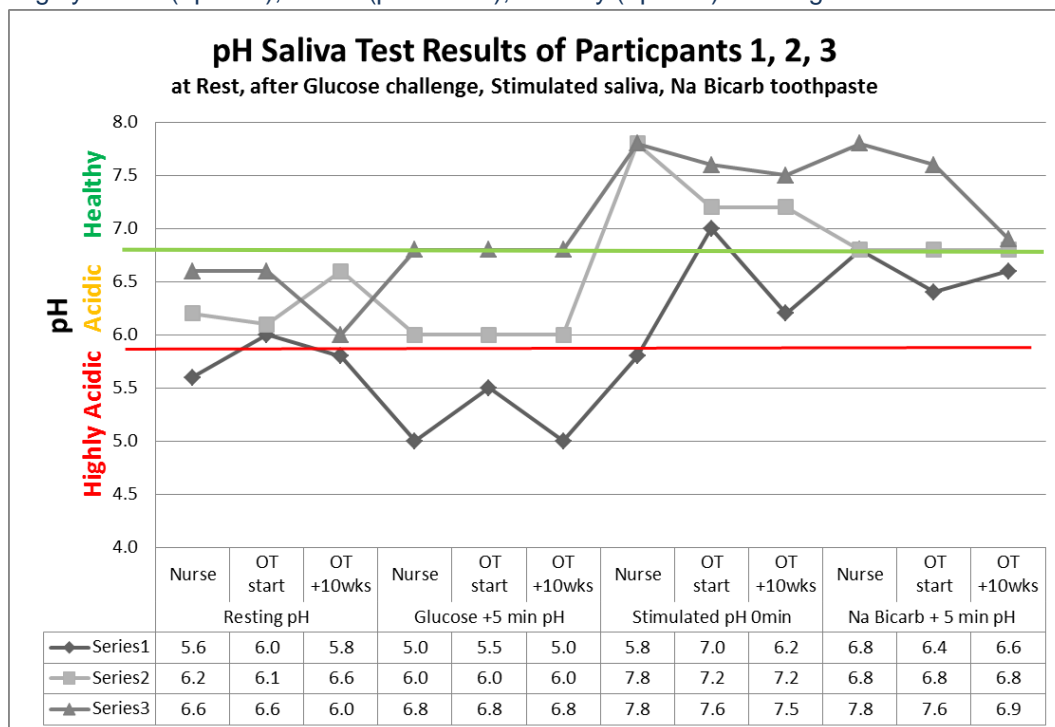
Horizontal axis series 1,2,3 relate to Participants 1, 2, 3 respectively
Participants 1, 2, 3 with 3, 3, 6 carious lesions respectively

Similar trends are shown in both Figure 23 and 24 of nurse and OHT baseline
assessments and OHT +10 week assessment. Participants 4 and 7 withdrew from
the study due to illness and were not re-assessed at the end of the study at +10
weeks.

The pH readings, taken at various saliva test stages of the three Participants (1, 2
and 3) assessed as having the worst salivary flow rates are demonstrated in Figure
23. The remaining three Participants (5, 6 and 8) who completed the study have their
various saliva test stage pH readings demonstrated in Figure 24.

Resting and stimulated salivary flow rates of Participants 1, 2, 3 were poor and were
reflected in their respective poor pH assessments. The resting saliva pH of
Participant 1 moved from pH 5.6 further into the 'Highly Acidic' zone after the
glucose challenge to record pH 5.0 on two occasions.

It is probable that the real pH drop in this Participant may have been greater than
pH5.0 as the lower limit of the GC Saliva Check Buffer pH paper test strip is pH5.0.
Future saliva pH testing should use pH paper test strip with a much lower pH limit
than available in the commercially available pH paper test strip used in this study.

Surprisingly Participant 3, despite having had the worst saliva flow rates, had a resting pH of 6.6 just in the 'Acidic' zone and close to the healthy zone (pH>6.8)

The pH of all participants rose after chewing gum and stayed in or approached the healthy zone after sodium bicarbonate toothpaste. The greatest relative benefit gained from these interventions was to Participant 1 who had the lowest resting pH and was able to move from 'Highly Acidic' to near 'Healthy' pH values.

Participants 5, 6 and 8 show similar trends with resting saliva pH tending to fall after glucose challenge, then rising after chewing gum and after sodium bicarbonate toothpaste to healthy or near healthy levels. (Figure 24)

Fig 24: Participants 5, 6 and 8 saliva pH measurements compared at: Nurse Baseline, OHT Baseline and OHT at 10 weeks, after Glucose challenge, Stimulated saliva and Sodium Bicarbonate measurements
Highly Acidic (<pH5.8), Acidic (pH6.0-6.6), Healthy (>pH6.8).    The higher the healthier



**pH Saliva Test Results of Participants 5 (Series 1), 6 (2), 8 (3)**
at Rest, after Glucose challenge, Stimulated saliva, Na Bicarb toothpaste

| | Nurse | OT start | OT +10wks | Nurse | OT start | OT +10wks | Nurse | OT start | OT +10wks | Nurse | OT start | OT +10wks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Resting pH | | | Glucose +5 min pH | | | Stimulated pH 0min | | | Na Bicarb + 5 min pH | | |
| Series1 | 6.8 | 6.8 | 6.4 | 7.4 | 6.8 | 5.8 | 7.4 | 6.6 | 6.1 | 7.8 | 6.6 | 7.0 |
| Series2 | 5.2 | 6.6 | 5.8 | 6.2 | 5.2 | 6.2 | 6.6 | 6.8 | 6.6 | 7.2 | 7.0 | 6.4 |
| Series3 | 6.0 | 6.0 | 6.0 | 6.6 | 5.6 | 5.2 | 7.8 | 7.6 | 7.4 | 7.4 | 6.8 | 6.8 |
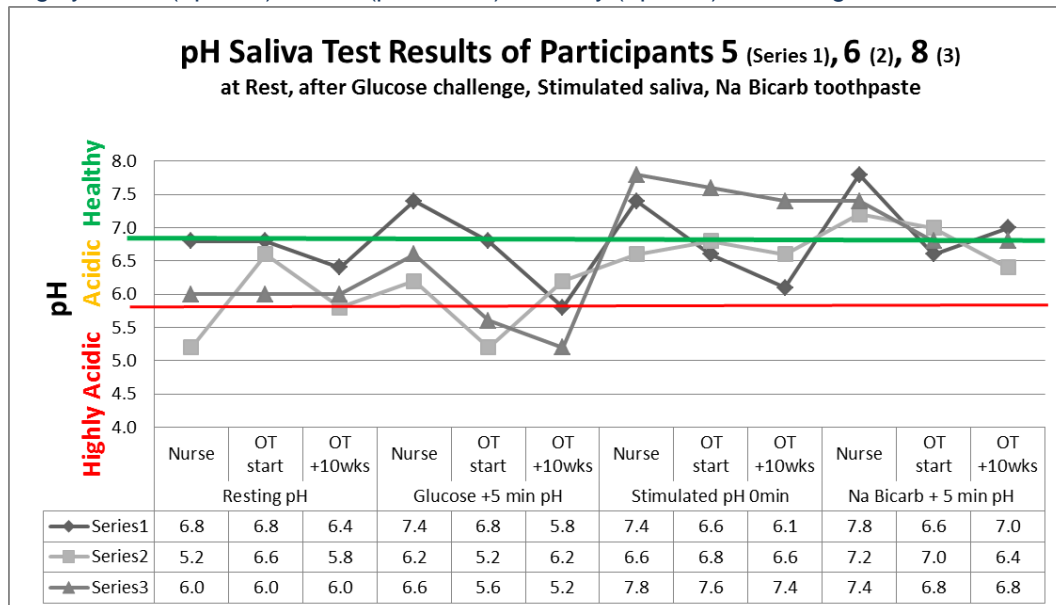
Horizontal axis series 1,2,3 relate to Participants 5, 6, 8 respectively
pH measurements: nurse baseline, OHT baseline and +10 weeks
using pH paper test strip
Participants 4 and 7 did not complete the study due to illness
Only 6 out of 8 participants completed the 10 week study
Participant 8 (series 3) with 8 carious lesions

It is probable that if this study had been able to perform multiple pH readings at 5 minute intervals after glucose challenge, that participant pH readings would have continued to fall and stay depressed for extended periods of time. This hypothesis was beyond the scope of this early dementia study and could not be tested.

Fig 25: Nurse Volunteers 1,2,3,4,5 and 6 saliva pH measurements at
Rest and after Glucose challenge, Stimulated saliva, Sodium bicarbonate toothpaste
Highly Acidic (<pH5.8), Acidic (pH6.0-6.6), Healthy (>pH6.8). The higher the healthier

**Nurse pH Saliva Test Results of Volunteers** 1,2,3,4,5,6
**at Rest, after Glucose challenge, Stimulated saliva, Na Bicarb Toohpaste**

| | Resting pH | Glucose +5 min pH | Stimulated pH 0min | Na Bicarb + 5 min pH |
|---|---|---|---|---|
| Volunteers 1 | 7.4 | 6.8 | 7.8 | 7.4 |
| *2 | 0.0 | 6.0 | 6.0 | 7.2 |
| 3 | 7.0 | 6.6 | 7.2 | 7.6 |
| 4 | 7.8 | 7.8 | 7.8 | 7.8 |
| 5 | 7.4 | 6.8 | 7.8 | 7.8 |
| 6 | 7.4 | 7.0 | 7.8 | 7.4 |
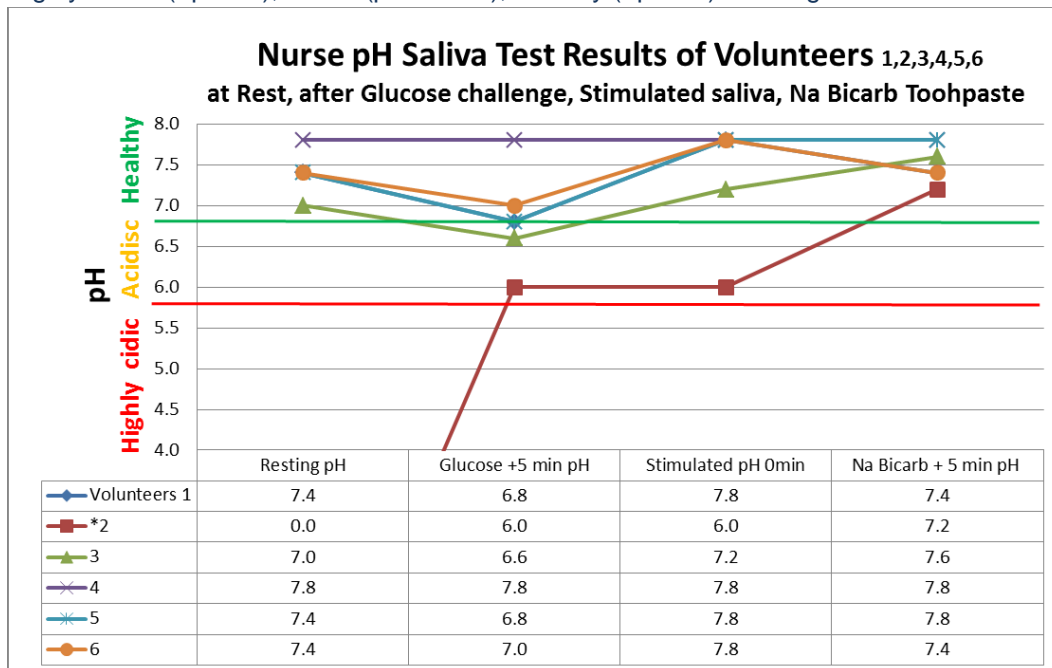
Volunteer *2 (Sjogren's Syndrome), SRSpH not assessable as mouth was too dry to wet an applicator
to wet pH paper test strip
Volunteer 3 (anti-cholinergic)

Figure 25 shows nurse saliva pH assessments of six volunteers at rest, after glucose
challenge, when stimulated, and after sodium bicarbonate toothpaste.

Except for Volunteer 2 (Sjogren's), all volunteers had resting saliva pH in the healthy
zone, had a smaller drop or no drop in pH after glucose challenge compared to
participants , pH rose with chewing gum and rose again after sodium bicarbonate
toothpaste applied.

Volunteer 2 (Sjogren's) had too little saliva at rest to wet the applicator and too little
saliva when attempting to collect her 3 minute saliva flow to read resting saliva pH.
Volunteer 2 recorded pH6.0 after her glucose challenge. Despite Volunteer 2 having
adequate stimulated saliva flow in the healthy band, her stimulated saliva pH
remained the same pH as her glucose challenge pH. Volunteer 2 was not able to
raise her saliva pH by chewing and could only manage to reach a healthy pH after a
small increment of sodium bicarbonate toothpaste was applied.

## Mean pH Scores: Participants and Volunteers
### with and without Sogrens Volunteer
### at Rest, after Glucose challenge, Stimulated saliva, Na Bicarb paste

|  | Resting pH | Glucose +5 min pH | Stimulated pH | Na Bicarb + 5 min pH |
|---|---|---|---|---|
| Mean Participants | 6.2 | 6.2 | 7.1 | 7.2 |
| Mean Volunteers less Sogrens Volunteer | 7.4 | 7.0 | 7.7 | 7.6 |
| Mean Volunteers plus Sogrens volunteer | 6.2 | 6.8 | 7.4 | 7.5 |
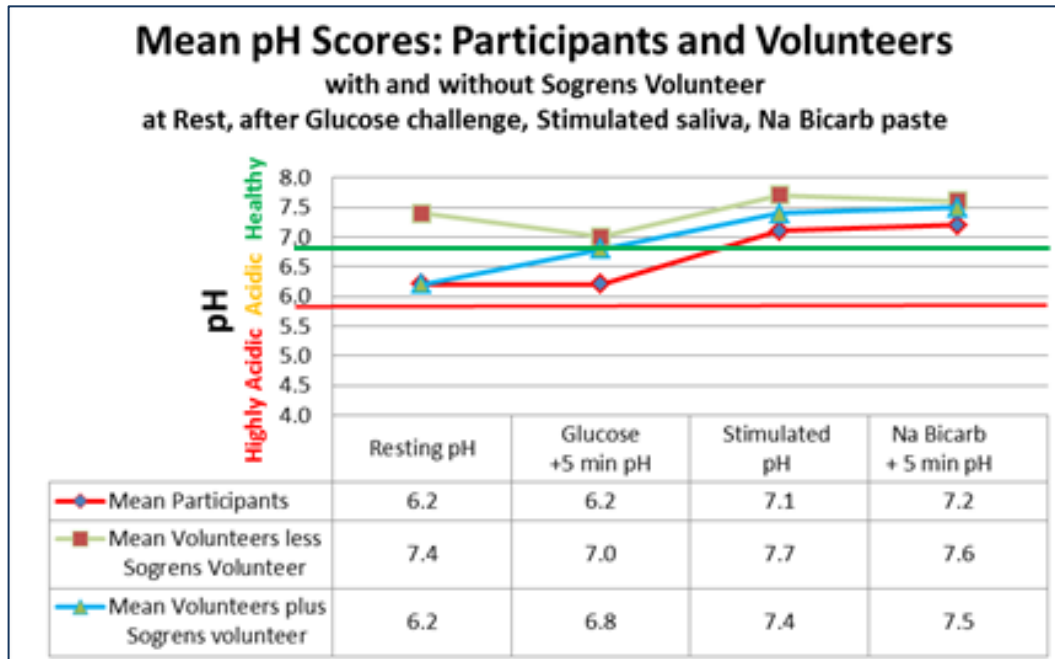
Participants (n=8), mean resting pH 6.2
Volunteers (n=5) without Sjogren's volunteer had a mean resting pH 7.4
All volunteers (n=6) with Sjogren's volunteer included had a mean resting pH 6.2

Figure 26 compares mean participant pH to mean volunteers pH values at various saliva test stages at baseline: at rest (after 3 minute collection), glucose challenge, chewing and sodium bicarbonate toothpaste:-

- Green line: When Volunteer 2 (Sjogren's) was excluded as an outlier and with Volunteer 3 (anti-cholinergic medication) included (n=5), all pH assessments of volunteers are within the healthy pH zones.
- Blue line: When all volunteers (n=6, including Volunteers 2 and 3) are included, pH values for various saliva test stages show healthy pH zones except for resting pH.
- Red line: All participants (n=8) resting saliva is in the acidic zone and only rises into the healthy pH zone after chewing and sodium bicarbonate toothpaste.

Table 21 shows baseline mean pH scores at various stages of saliva testing. This table compares participant nurse and OHT assessments and nurse assessments of participants and volunteers.

Table 21  Baseline Nurse compared to OHT mean pH: various saliva test stages: Participants compared to Volunteers

| Saliva Test Stages at Baseline | Mean Nurse pH Participants | Mean OHT pH Participants | Mean Volunteer pH |
|---|---|---|---|
| +3 minute resting saliva | 6.2 | 6.3 | 7.4 |
| Glucose challenge: wait + 5 minutes | 6.2 | 5.8 | 7.0 |
| Chewing wax: after chewing for 5 minutes | 7.0 | 7.0 | 7.7 |
| Sodium Bicarbonate toothpaste | 7.1 | 7.0 | 7.6 |

Volunteers 2 (Sjogren's) has been removed from the data set as an outlier
Baseline nurse participant pH assessments compared to OHT participant pH assessments
Baseline nurse participant pH assessments compared to Nurse volunteer pH assessments

Where possible, a second and third pH reading was taken at various saliva test stages on some participants when co-operation and time allowed. These occasional additional pH readings at 5 minute intervals showed:-

  A further drop in pH after glucose challenge at further 5 minute intervals

  A rise and maintenance of higher pH values after chewing

  A maintenance of higher pH values after sodium bicarbonate toothpaste.

These occasional readings were not included into data sets in Figures 22 and 23.

# Buffering Capacity

Figure 27 compares nurse baseline scores for participant buffering capacity (mean = 6.5) and volunteers (mean = 9.7) including Volunteers 2 (Sjogren's) and 3 (anti-cholinergics). Had Volunteer 2 been excluded as an outlier, volunteers would have a mean buffer score of 10.8.

Fig 27: Nurse Baseline Participant and Volunteer Buffer Scores
Range 0-12, Very Low (0-5), Low (6-9) Normal (10-12): The higher the better
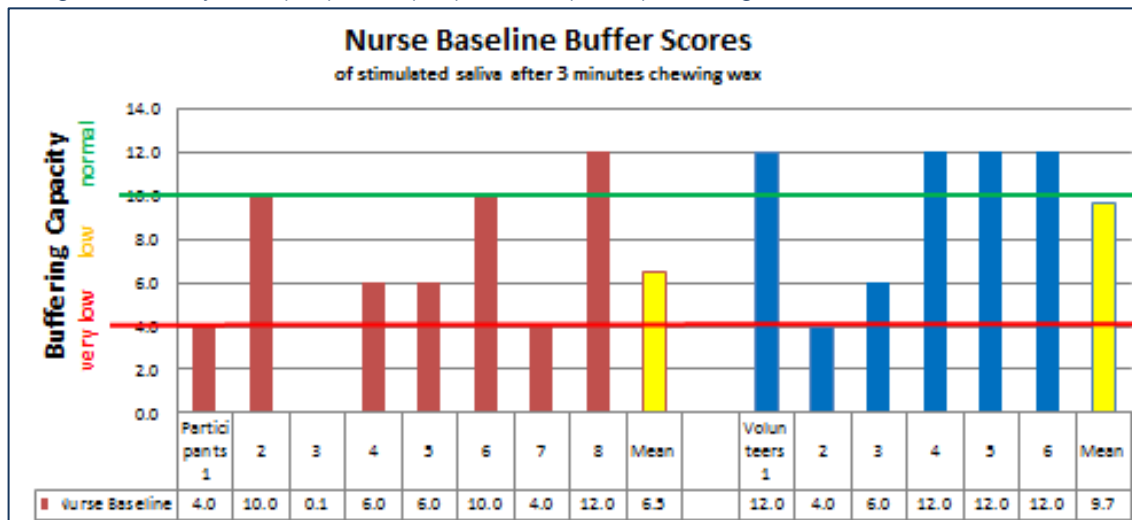


Participants (n=8)
Volunteers (n=6)  Volunteers 2 (Sjogren's), Volunteer 3 (anti-cholinergic medication)
Participants 1, 2, 3, 8 with 3, 3, 6, 8 carious lesions respectively

All volunteers except Volunteers 2 (Sjogren's) and 3 (anti-cholinergic medication) had buffering scores at the maximum score of 12 in the normal range.

Out of eight participants, three had nurse buffer scores in the normal range, two in the low range and three participants in the very low range. Participant 3 with consistently the worst saliva test results in all other saliva assessments also had the worst buffering capacity score.

Interestingly, Participant 2 who had an unhealthy stimulated flow rate and 3 carious lesions reached a normal buffer score of 10. Participant 8 despite having 8 carious lesions had a healthy stimulated saliva flow rate and reached the maximum healthy buffering capacity score (12) placing her in the normal saliva buffering band.

When mean baseline nurse and OHT buffer assessments results are compared (Low) and (Very Low) respectively, mean buffer baseline OHT testing was consistently lower than nurses. A possible explanation for this variation may be due to the difficulty in reading the colour of the buffer test strip, which at times were found

to be difficult to assess requiring opinions from others as to the likely colours on the test strip. Improvement in scoring the buffer strip may occur through experience and standardisation prior to future studies.

Fig 28: Buffering capacity: Nurse compared to OHT baseline Participant assessments
Range 0-12, Very Low (0-5), Low (6-9) Normal (10-12): The higher the better
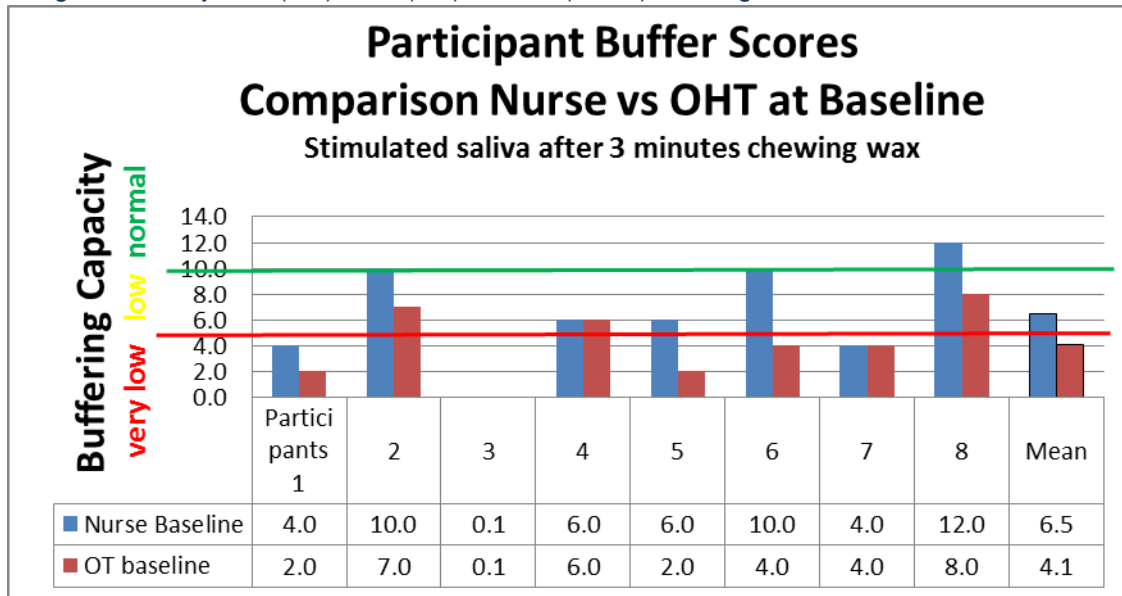


**Participant Buffer Scores**
**Comparison Nurse vs OHT at Baseline**
Stimulated saliva after 3 minutes chewing wax

| | Participants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Nurse Baseline | 4.0 | 10.0 | 0.1 | 6.0 | 6.0 | 10.0 | 4.0 | 12.0 | 6.5 |
| OT baseline | 2.0 | 7.0 | 0.1 | 6.0 | 2.0 | 4.0 | 4.0 | 8.0 | 4.1 |

Participants 1, 2, 3, 8 with 3, 3, 6, 8 carious lesions respectively

Participants 1, 2, 3 and 8 had 3, 3, 6 and 8 carious lesions respectively. In general, all participant OHT saliva buffering test results were in the low range. Participants 1 and 3 had nurse buffering assessments in the very low range, while OHTs assessed Participants 1, 5, 6 and 7 in the very low range.

Poor buffering capacity of participants as compared to volunteers was evident and may help explain the decay rates of participants.

## Stimulated Saliva pH Compared to Buffering Capacity

Figure 29 shows:- Baseline Participant SRSpH versus Volunteer SRSpH, pH of +3 minute collection of whole stimulated saliva measured 5 minutes after a glucose challenge with buffering capacity scores overlaid. The vertical axis shows pH values. Although buffering capacity scores do not correspond to the vertical axis pH values their comparative relationship is shown by overlaying the buffer scores in a line graph. The overlay of buffering scores graphically demonstrates the difference between poorer participant saliva buffer quality and healthy volunteer saliva buffer quality relative to saliva pH.

Fig 29:  Nurse Participant and Volunteer assessments compared for
SRSpH, Stimulated pH (after glucose challenge) and Buffering capacity scores overlayed (line graph)



| | Participant s1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean | | Volunteers 1 | *2 | 3 | 4 | 5 | 6 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nurse Resting Saliva pH | 5.6 | 6.2 | 6.8 | 6.6 | 6.8 | 5.2 | 6.0 | 6.0 | 6 | | 6.8 | 0.0 | 6.6 | 7.5 | 6.8 | 6.8 | 5.8 |
| Nurse Stimulated Saliva pH | 5.0 | 6.0 | 6.6 | 6.8 | 7.4 | 6.2 | 5.0 | 6.6 | 6 | | 6.8 | 6.0 | 6.6 | 7.8 | 6.8 | 7.0 | 6.8 |
| Average Buffering Capacity (3 tests) | 3.0 | 5.0 | 0.0 | 5.0 | 3.0 | 7.0 | 4.0 | 9.0 | 5 | | 12.0 | 4.0 | 6.0 | 12.0 | 12.0 | 12.0 | 9.7 |
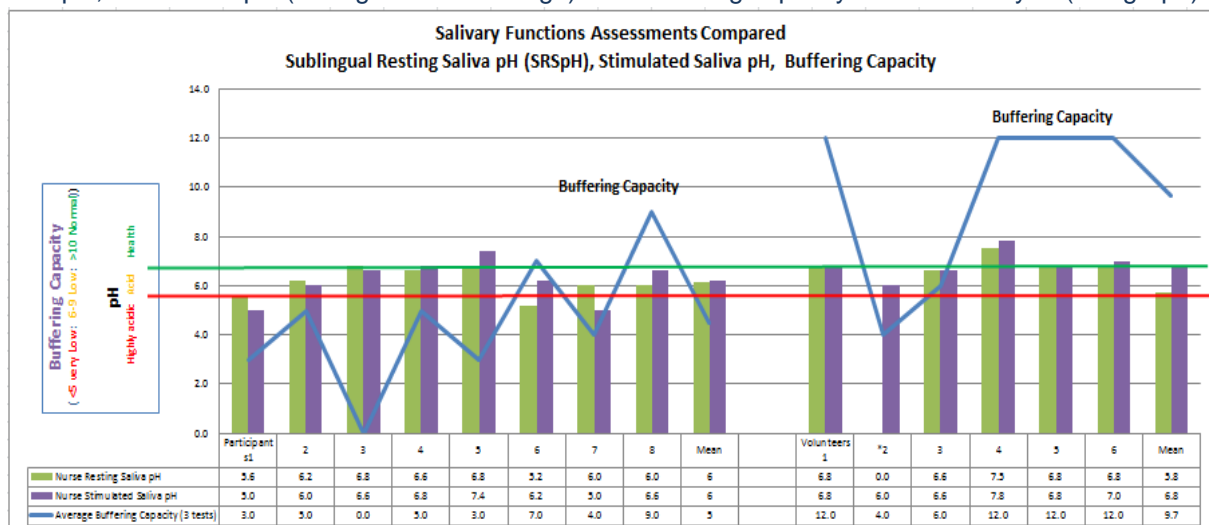
Nurse Baseline Assessments of Participants and Volunteers

| | |
|---|---|
| Participant SRSpH (n=8) | Mean pH6    (acidic) |
| Volunteer SRSpH (n=6) | Mean pH5.8  (acidic) |
| Volunteer SRSpH Volunteer 2* outlier removed (n=5) | Mean pH6.9  (healthy) |

After glucose challenge and +5 minutes chewing gum
| | |
|---|---|
| Participant nurse baseline stimulated saliva pH(n=8) | Mean pH6.0  (acidic) |
| Volunteer nurse baseline stimulated saliva pH (n=6) | Mean pH6.8  (healthy) |

| | |
|---|---|
| Participant baseline buffering capacity | Mean 5      (very low) |
| Volunteer baseline buffering capacity | Mean 9.7    (normal) |

Participants 1, 2, 3, 8 with 3, 3, 6, 8 carious lesions respectively
*Volunteers:  (n=6)  Volunteer 2 (Sjogren's outlier), Volunteer 3 (anti-cholinergic medication)

## Stimulated Saliva pH: Buffering Capacity, Anti-cholinergic Burden Scale, Medications

Figure 30 is the same graph as Figure 29 above, but with participant total medications and anti-cholinergic burden scale super-imposed. No medication history was taken of volunteers.

Fig 30: Comparison of Participant vs Volunteers Total Medications, Anti-cholinergic Scale and nurse Participant and Volunteer assessments comparing SRSpH, Stimulated pH (after glucose challenge) and Buffering capacity scores (line graph) overlayed

Number of Medications and Anti-cholinergic Burden Scale vs Effect on Salivary Functions - Sublingual Resting Saliva pH (SRSpH), Stimulated Saliva pH, Buffering Capacity

| | Participant s1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean | | Volunteers 1 | *2 | 3 | 4 | 5 | 6 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. Medications | 9 | 10 | 11 | 10 | 10 | 10 | 8 | 4 | 9 | | | | | | | | |
| Anti-cholinergic Score | 7 | 11 | 5 | 7 | 8 | 5 | 6 | 4 | 7 | | | | | | | | |
| Nurse Resting Saliva pH | 5.6 | 6.2 | 6.8 | 6.6 | 6.8 | 5.2 | 6.0 | 6.0 | 6 | | 6.8 | 0.0 | 6.6 | 7.5 | 6.8 | 6.8 | 5.8 |
| Nurse Stimulated Saliva pH | 5.0 | 6.0 | 6.6 | 6.8 | 7.4 | 6.2 | 5.0 | 6.6 | 6 | | 6.8 | 6.0 | 6.6 | 7.8 | 6.8 | 7.0 | 6.8 |
| Average Buffering Capacity (3 tests) | 3.0 | 5.0 | 0.0 | 5.0 | 3.0 | 7.0 | 4.0 | 9.0 | 5 | | 12.0 | 4.0 | 6.0 | 12.0 | 12.0 | 12.0 | 9.7 |

Nurse Assessments at Baseline
 *Volunteers: (n=6)
 Volunteers 2 (Sjogren's outlier), Volunteer 3 (anti-cholinergic medication)
 Participant baseline number of medications (n=8)    Mean 9

Figure 30 shows that all participants were on polypharmacy, except for Participant 8. In general, participants with higher anti-cholinergic burden scores had lower SRSpH, placing participants, except Participants 4 and 5, in the acidic or highly acidic pH unhealthy zones.

The overlay of buffering scores graphically demonstrates the different buffering capacities between participants on polypharmacy carrying an anti-cholinergic burden and volunteers.

# Plaque Scores

The highest baseline plaque scores were from Participant 1 with a plaque score of 20 (3 decayed teeth) and Participant 3 with a plaque score of 25 (6 decayed teeth). Noticeably lower plaque scores were found for Participants 2 with plaque score 9 (3 decayed teeth) and 8 with a plaque score of 8 (8 decayed teeth). Participants 5 and 7, although having higher plaque scores (20, 25 respectively) did not have any decayed teeth. (Figure 31)

Fig 31: Participant decayed teeth and plaque scores at baseline and at +10 weeks:
From dentist clinical examination



**Decayed Teeth vs Plaque Scores**
Dentist Plaques Scores at Baseline and +10 weeks

| | Participants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| No. Decayed Teeth | 3 | 3 | 6 | 0 | 0 | 0 | 0 | 8 | 3 |
| Baseline Dentist Plaque scores | 20 | 9 | 25 | 9 | 11 | 2 | 21 | 7 | 13 |
| +10wks Dentist Plaque Scores | 25 | 4 | | 3 | 19 | 5 | | 10 | 11 |
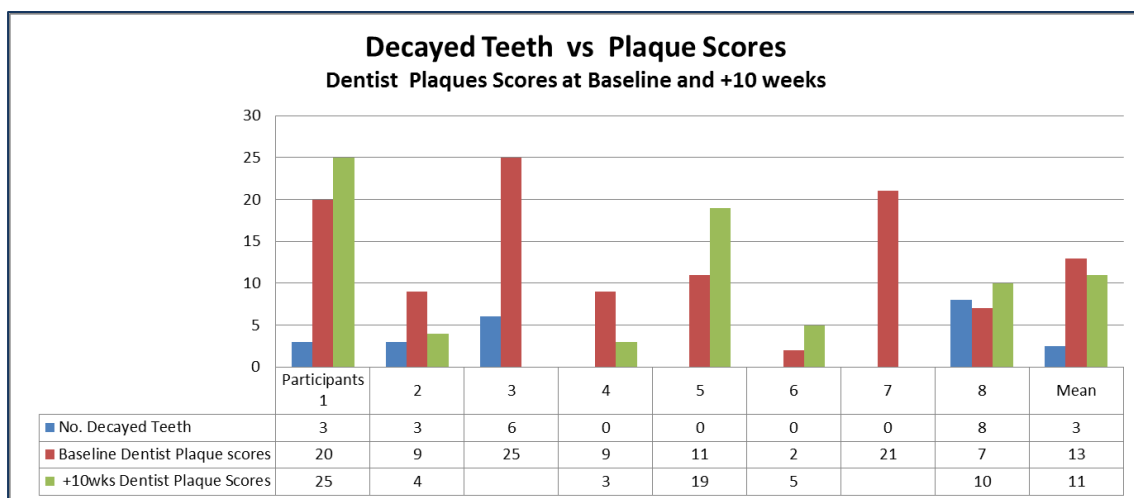
Participants 1, 2, 3, 8 with 3, 3, 6, 8 carious lesions respectively

Participants 3 and 6 did not complete the study due to illness, were the most frail at the commencement of the study and had the highest plaque scores at baseline.

In general, plaques scores did not improve from baseline when compared to the end of the study period at +10 week despite the implementation of care plans.

Of the six participants that completed the study, only Participants 2 and 4 had a decrease in plaque scores. Participants 1, 6, and 8 had relatively small increases in plaque scores while Participant 5 had a large increase in their plaque score.

# Preventive Products

A range of products were made available for nurses to use as they felt appropriate in care plans.

In summary, the results of whether these preventive products could be incorporated and utilised into NSCOCPs are:-

**Remineralisation:**.

Products:  Colgate Neutrafluor5000 (5000pmm Fluoride) and GC Tooth Mousse Plus (Amorphous calcium phosphate stabilized by casein phosphor-peptides: CPP-ACP with 900ppm Fluoride)

High Fluoride toothpaste was routinely incorporated into all NSCOCPs and used usually during morning and/ or evening shower routines. CPP-ACP was less often scheduled and was similarly able to be incorporated into shower routines.

**Hydration:**

Product: Water

Participants were too independent to monitor water consumption in care plans

**Artificial Saliva - Artificial Oral Lubricant:**

Product:  OralSeven™ Moisturising Mouth Gel (Auspharm)

In this study, all participants were able to self- administer the product on a regular basis even though some needed reminding.

**Salivary Gland Stimulation:**

Product:  Miradent Xylitol Chewing Gum

Nurses were able to successfully plan the periodic use of sugarless gum containing Xylitol throughout the day or after meals. Nurses found issuing gum to participants an easy intervention able to be easily integrated into the nursing home routines similar to issuing medications. Nurses were able to schedule the alternating use of chewing gum and sodium bicarbonate toothpaste after meals and snacks to in order to help neutralise mouth acids.

Some participants did not like chewing gum while other participants began to use chewing gum enthusiastically at the beginning of the study but then used less over

time. Part of the design of the study was such that participants who did not like chewing gum had alternative preventive products (either another flavour of gum or sodium bicarbonate toothpaste) available that nurses could recommend.

About half the participants found chewing gum a great benefit and continued to ask for gum after the study had finished.

**Acid Neutralising Toothpaste To Neutralise Mouth Acids After Meals**
Product: Colgate Acid Neutraliser Toothpaste: Colgate-Palmolive Co.
Anecdotally nurses commented on some participants having a noticeable improvement in their oral malodour. This toothpaste was able to be incorporated into NSCOCPs and used on a regular basis soon after meals or snacks.

**Anti-Microbials:**
Product: Curascept Toothpaste 0.12% Chlorhexidene (Curaden Swiss, Australia)
Contains xylitol and is sodium lauryl sulphate free
This anti-microbial toothpaste was able to be incorporated into NSCOCPs during evening shower routines and at least 1 hour after the use of any other toothpaste.

# COMPARISON BETWEEN NURSE AND ORAL HEALTH THERAPISTS NSCOCP

## Baseline Comparison Between Nurse and OHT Scheduled Oral Care Plans

There was a high level of agreement between trained nurse and OHT interventions and care plans made blind to each other at the beginning of the study.

Table 22 summarises the findings of analysis completed by the project's research assistant to test whether RACF nurses can formulate individualised early preventive interventions into scheduled comprehensive oral care plans through oral assessments.

Table 22 shows the number of nurse-developed care plans that were concordant (agreement) and disconcordant (omissions/errors) with care plans developed by OHTs for the same resident, by intervention.

Table 22  Nurse versus OHT care plans: Percentage concordant versus discordant

| Intervention | Omissions[b] | Errors[a] | Agreement[c] | Total | Agree % |
|---|---|---|---|---|---|
| Remineralisation[d] | 0 | 1 | 7 | 8 | 88 |
| Oral7 | 1 | 0 | 7 | 8 | 88 |
| Rebuffer[e] | 2 | 0 | 6 | 8 | 75 |
| Curascept | 0 | 2 | 6 | 8 | 75 |
| UB teeth | 0 | 2 | 6 | 8 | 75 |
| UB dentures | 1 | 0 | 7 | 8 | 88 |
| AB teeth | 0 | 2 | 6 | 8 | 75 |
| AB dentures | 0 | 1 | 7 | 8 | 88 |
| **Total** | **4** | **8** | **52** | **64** | **81** |

a. Errors: The nurse recommended the use of an intervention not recommended by the OHT.
b. Omissions: The nurse failed to recommend the use of an intervention that was recommended by the OHT.
c. Agreement: The nurse and OHT recommendations agreed on whether or not an intervention was necessary at least once a day.
d. Remineralising agents: gum and/or Neutraflour5000 toothpaste.
e. Rebuffering agents: gum and/or Colgate Acid Neutraliser toothpaste.

The four nurses included in the study were found to be highly capable of formulating individualised early preventative interventions into comprehensive oral health care

plans. Comparison of nurse developed and OHT developed oral health care plans showed a high level of agreement, ranging from 75-88% for individual interventions (Table 22).

The most common disagreements were 8 cases in which nurses recommended interventions for participants that had not been recommended by OHT. The majority of these were related to the unassisted brushing of teeth, assisted brushing of teeth and the use of Curascept toothpaste. In four cases, nurse care plans also omitted interventions that had been recommended by OHT. The use of re-buffer was omitted from 2 care plans and Oral7 and unassisted brushing of dentures omitted from 1 care plan each.

Figure 32: relates to the number of participants for whom trained nurses selected interventions that were in agreement, in error or were omitted compared to OHT care plans.

Fig 32: All preventive interventions and brushing
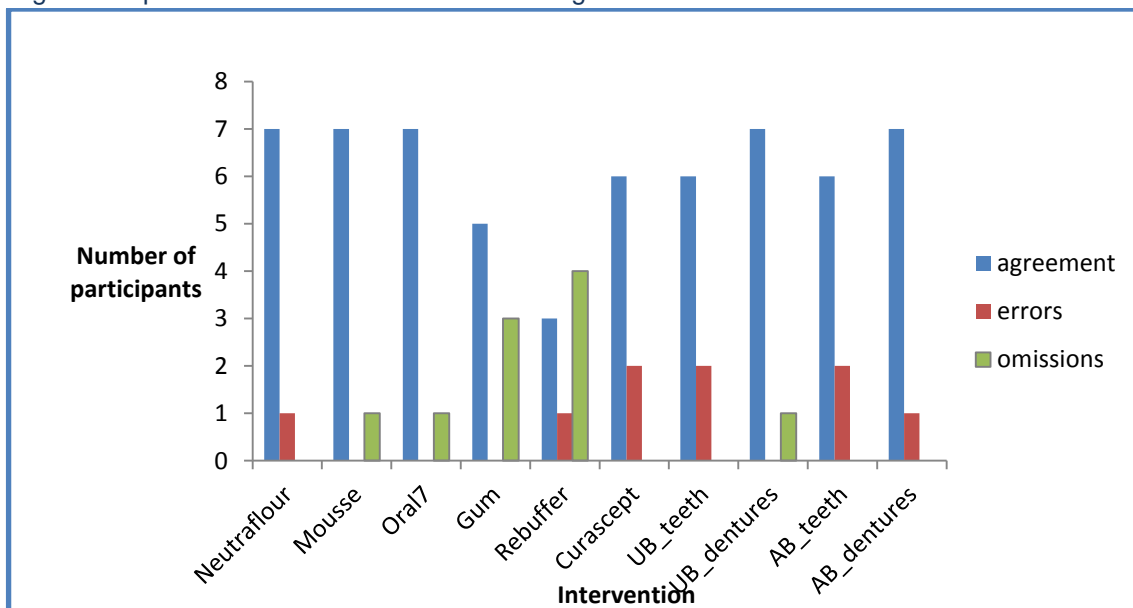


Figure 52: The number of participants for whom nurse care plans agreed / disagreed with OHT care plans on whether or not an intervention was necessary at least once a day using all interventions.
Re-buffer: Colgate Acid Neutraliser toothpaste, UB: (Unassisted brushing), AB: (Assisted brushing)
a. Agreement: the nurse and OHT recommendations agreed on whether or not an intervention was necessary
b. Errors: the nurse recommended the use of an intervention not recommended by the OHT.
c. Omissions: the nurse failed to recommend the use of an intervention recommended by the OHT.

Combination of interventions that serve the same function.
   i.  Re-mineralisation: Neutraflour5000 and GC Tooth Mousse Plus are used together for re-mineralisation.
   ii  Re-buffer:      Chewing gum and sodium bicarbonate toothpaste are used alternatively to neutralise mouth acidity.

In this study, Neutrafluor5000 toothpaste and/or GC Tooth Mousse Plus were both used to re-mineralise teeth and may be considered as functioning in the same intervention classification column in care plans.

Similarly, both chewing gum and sodium bicarbonate toothpaste (Colgate Acid Neutraliser toothpaste) serve to neutralise mouth acids and may be considered in the same intervention classification.

When these four products above are combined and re-classified as two interventions, described as a 'Remineralisation' (Neutraflour5000 and GC Tooth Mousse Plus ) and 'Re-buffer' (chewing gum and sodium bicarbonate toothpaste), the graph below (Figure 33) shows a greater level of agreement between trained nurses and OHT scheduled oral care plans.

Fig 33: Combining preventive product interventions so that:-
Re-mineralisation: (Neutraflour5000 and GC Tooth Mousse Plus are combined).
Acid Neutralising: (Chewing gum and sodium bicarbonate toothpaste are combined)
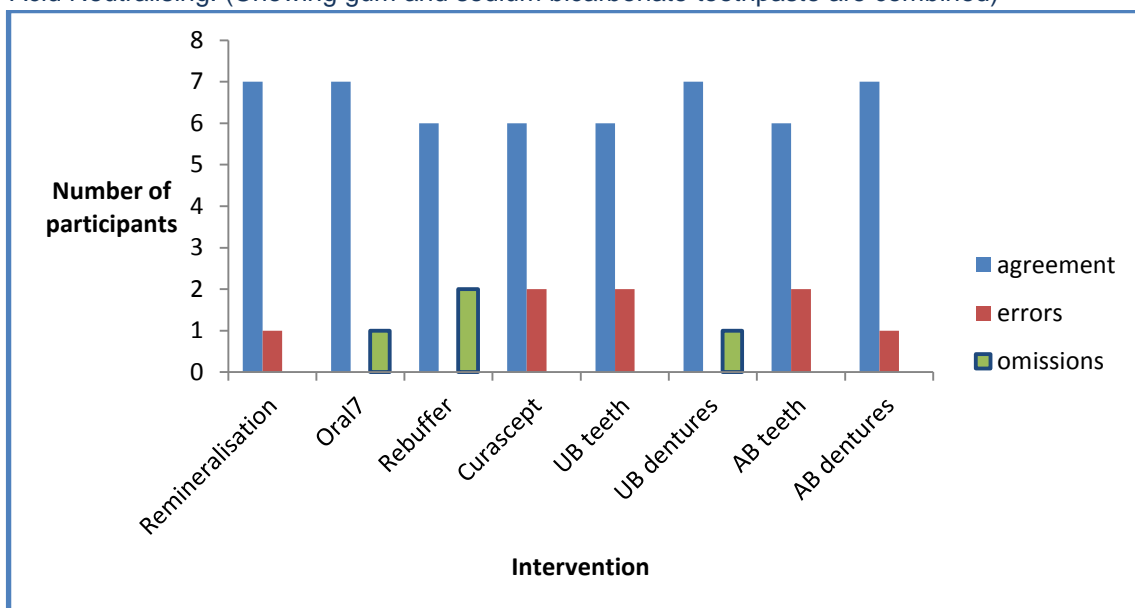


Figure 2: The number of participants for whom nurse care plans agreed / disagreed with OHT care plans on whether or not an intervention was necessary at least once a day using all interventions.
Remineralisation: Combined Neutraflour5000 and GC Tooth Mousse Plus.
Re-buffer: Combined chewing gum and Colgate Acid Neutraliser toothpaste
UB: Unassisted brushing,  AB: Assisted brushing
a.  Agreement:  the nurse and OHT recommendations agreed on whether or not an intervention was necessary
b.  Errors:        the nurse recommended the use of an intervention not recommended by the OHT.
c.  Omissions:  the nurse failed to recommend the use of an intervention that was recommended by the OHT.

Figures 34: relates to the level of agreement between nurse and OHT care plans on whether or not all 10 preventive interventions were necessary (as per the vertical columns found in NSCOCPs).

Fig 34: Percentage agreement between Nurse and OHT care plans for all interventions and brushing
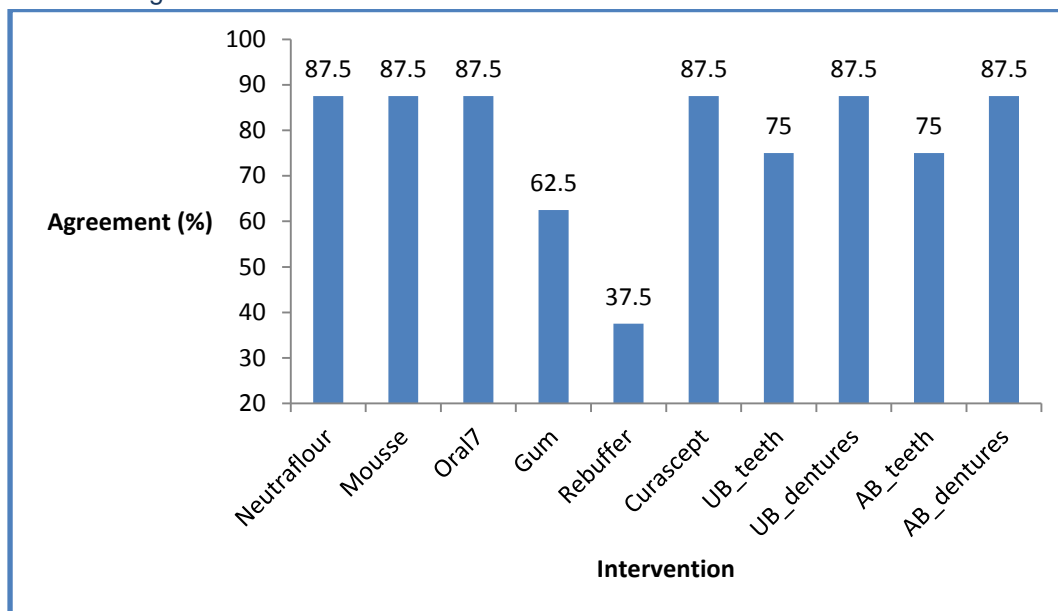


The level of agreement between nurse and OHT developed oral care plans on whether or not an intervention was necessary at least once a day.

In this study, the preventive combinations of Neutraflour5000 and GC Tooth Mousse Plus is called a 'Re-mineralisation' intervention and similarly, 'Re-buffer' refers to the combination of using either gum chewing and/or sodium bicarbonate toothpaste to neutralise mouth acids. Figure 34, shows that a greater level of agreement between nurse and OHT care plans becomes evident when the 4 individual combinations are combined into the 2 categories of Re-mineralisation and Re-buffer.

Combining 'Re-mineralising' interventions and 'Re-buffer' interventions effectively reduces the total interventions to 8 different preventive methods as shown in Figure 35.

Figure 35 shows the level of agreement between nurse developed care plans and OHT developed care plans on whether or not an intervention was necessary at least once a day for 8 preventive interventions when Re-mineralising' and 'Re-buffer' interventions are combined. .

Fig 35: Percentage agreement combining interventions and brushing
Re-mineralisation interventions combined: Neutraflour5000 toothpaste and GC Tooth Mousse Plus
Acid Neutralising  interventions combined: Chewing gum and sodium bicarbonate toothpaste
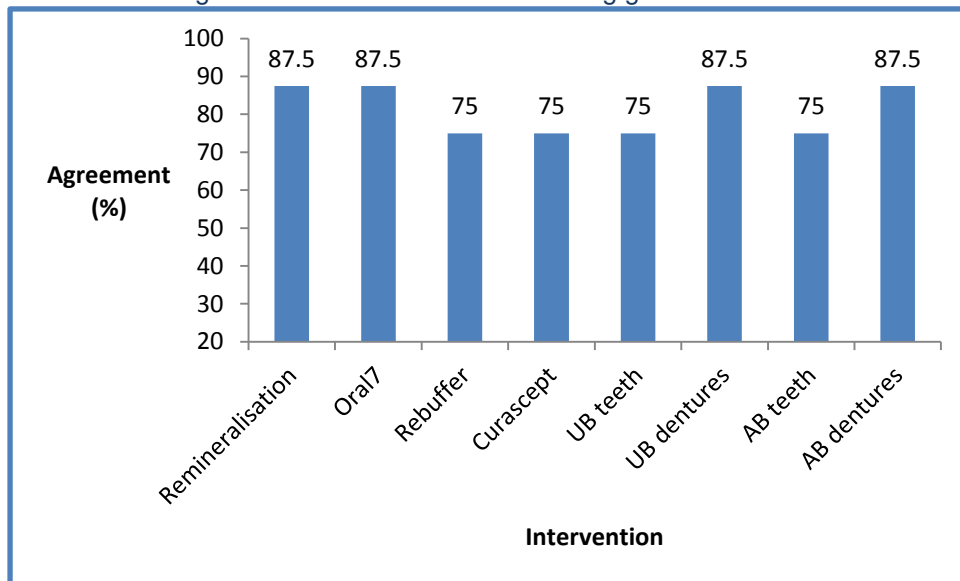


Figure 35: The level of agreement between nurse developed care plans and oral therapist developed care plans on whether or not an intervention was necessary at least once a day.

Overall the level of agreement between Nurse and OHT selection of combined intervention methods was very high, varying from 75% for Re-buffer, Curascept, Unassisted brushing teeth and assisted brushing teeth to 87.5% for Remineralisation, Oral7 gel, Unassisted brushing denture and assisted brushing of dentures.

# Nurse Comprehensive Oral Care Plan Compliance After 10 Weeks

There was a high level of agreement between nurse and OHT oral care plans made blind to each other at the beginning of the study. (Table 23)

Table 23 summarises the findings of the analysis, completed by the project's research assistant, to test whether RACF nurses will be able to implement appropriate preventive interventions.

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Table 23  Percentage nurse oral care plan agreement with OHT oral care plans
The number of instances in which daily recorded notes indicated compliance (agreement) or non-compliance (omission or error) with master care plans

| Intervention | Omissions[a] | Errors[b] | Agreement[c] | Total | Agree % |
|---|---|---|---|---|---|
| Neutraflour | 9 | 0 | 484 | 493 | 98.2 |
| Mousse | 4 | 0 | 489 | 493 | 99.2 |
| Oral7 | 0 | 7 | 486 | 493 | 98.6 |
| Gum | 14 | 2 | 477 | 493 | 96.8 |
| Rebuffer | 32 | 1 | 460 | 493 | 93.3 |
| Curascept | 3 | 6 | 484 | 493 | 98.2 |
| UB Teeth | 4 | 5 | 484 | 493 | 98.2 |
| UB Dentures | 3 | 26d | 464 | 493 | 94.1 |
| AB Teeth | 6 | 1 | 486 | 493 | 93.7 |
| AB Dentures | 31 | 0 | 462 | 493 | 91.5 |
| **Total** | **106** | **48** | **4776** | **4930** | **96.2** |

a. The number of instances where an intervention recommended for use at least once a day in the Principle Plan was not provided to a resident even once on any given day during the study period.
b. The number of instances where an intervention was provided to a resident at least once on any given day during the study period despite not being recommended for use even once a day in the master care plan.
c. The number of instances where an intervention recommended for use at least once a day in the Principle Plan and was provided to a resident at least once on any given day during the study period OR where an intervention was not recommended for use by a participant and was not provided to that participant even once on any given day during the study period.
d. Reflects an omission on the Principle Plan- i.e. Despite brushing dentures not included in the care plan, the participant's dentures were brushed 26 times.

Overall, nurse compliance with the oral health intervention was found to be extremely high. Daily recorded notes indicated that interventions recommended for

use at least once a day in the principal oral health care plan were provided to participants in greater than 95% of instances over the study period. Compliance with individual interventions ranged between 92% (assisted brushing of dentures) to 99% (GC Tooth Mousse Plus)

Over the study period 154 instances of non-compliance were observed: 106 instances of a participant not receiving the recommended intervention (omissions) and 48 instances of participants apparently being provided with interventions that were not recommended for them (errors). The majority of instances of non-compliance related to a participant not being provided with re-buffer (32) or assisted brushing of dentures (31), and 26 instances in which a resident brushed their dentures unassisted despite this not being specifically recommended in the Principal Plan.

Table 24 summarises the compliance of all nurses, both trained and untrained to follow the Principal Plan as placed into participant's Oral Care Plan Folder over the 10 week study period; with 92.6% compliance over 4930 interventions. It should be noted that these compliance analyses were completed by the project's research assistant.

Table 24  Percentage nurse compliance of NCOCPs over 10 weeks
The number of instances in which daily recorded notes indicated compliance (agreement) or non-compliance (disagreement) with intervention* prescriptions in the Principal Plan.

| Intervention | Disagreement[a] | Agreement[b] | Total | Agree % |
|---|---|---|---|---|
| Neutraflour | 38 | 455 | 493 | 92.3 |
| Mousse | 4 | 489 | 493 | 99.2 |
| Oral7 | 6 | 487 | 493 | 98.8 |
| Gum | 67 | 426 | 493 | 86.4 |
| Rebuffer | 68 | 425 | 493 | 86.2 |
| Curascept | 12 | 481 | 493 | 97.6 |
| UB Teeth | 58 | 435 | 493 | 88.2 |
| UB Dentures | 32 | 461 | 493 | 93.5 |
| AB Teeth | 37 | 456 | 493 | 92.5 |
| AB Dentures | 43 | 450 | 493 | 91.3 |
| **Total** | **365** | **4565** | **4930** | **92.6** |

a. The number of instances where an intervention was not implemented at the recommended intervention*(times per day)
b. The number of instances where an intervention was implemented at the recommended intervention*(times per day)

Daily recorded notes also indicated a high nurse compliance with dosage recommendations prescribed in principal oral care plans, with residents receiving

interventions at the recommended dose in over 90% of cases (Table 24). Compliance with nurse intervention prescriptions for individual interventions ranged from 86-99%, with the lowest rates of compliance for Xylitol gum (86%), re-buffer (86%) and unassisted brushing of teeth (88%).

# Nurse Questionnaire Focus Group Findings

Nurse focus group meetings were held by the research assistant and the transcript of nurse focus group is provided in Appendix 23. Both the dentist/lead investigator and OHT involved in training the nurses did not attend the nurse focus group meetings.

Unexpectedly, the study generated considerable interest among the untrained nurses looking after the care of participants. Untrained nurses were sufficiently motivated to request a training session in their own free time. Four untrained nurses involved in the general care of the participants in the nursing home attended a 45 minute training session at about 5 weeks into the study during a lunch time / changeover period.

**In summary, trained and untrained nurses reported that:-**
- Care plans are easy to implement, effective and can be followed by untrained nurses.
- Nurses could see improvement in the oral health of residents.
- Nurses received positive reinforcement from being able to deliver effective oral care.
- Nurses became "incentivised" and participated actively in delivering oral care.

No changes to the study protocols were required after feedback from the nurse discussion group. Both trained and untrained nurses reported that they found care plans easy to implement.

Both untrained nurses (N2, N3) reported they had some confusion with the different preventive products and felt this was due to not having the benefit of the training. The same nurses reported that despite not understanding the purpose of the product they stated:-
*Answer: N3: yeah it's not that hard to follow the chart. At first I was like whoah! But it's not that hard just to follow it. Even though we don't know what the idea is behind that-it's kind of common sense as well to brush your teeth.*

**Summary of nurse responses during the focus group**

*Q: Have you found that there are any difficulties in implementing the interventions so far?*

*Ans:  All three nurses said they had no problems implementing interventions. Nurse 2 volunteered 'It's easy'.*

*Q: So feel that generally everyone is on board and following the plans*

*Ans:N2: yes.    N1: oh yes, every one of us*

*Q:  So it sounds like you found the education sessions interesting …how has it affected your skills or knowledge about oral health and oral care?*

*Ans: : Well a lot-as I have said, when you do that you feel like you are a dentist or a hygienist. All the technical side-learning about acidity and the saliva made it more interesting and exciting to do the procedures on the residents. You think at first that it will probably be yucky but after you do it and go along its quite exciting actually.*

*Q: And do you think that this is something that you would be likely to use again and implement after the study was finished for other residents?*

*Ans: Yeah, cos it also helps us because when you are giving care*

In summary nurses responded that they:-
- Were adequately trained to create care plans.
- Had enough support to create care plans.
- Understood the use of different preventive products for different purposes.
- Would have liked more training.  Although nurses gave very positive answers to all questionnaires, all three nurses answered that they could have spent more time in training, despite effectively having 12 hours of education, training on saliva testing and OHAT assessments before creating NCOCPs.  On further enquiry, this had more to do with enjoying the education and testing sessions and wanting to know more about oral health than feeling inadequate about their training.

## Table 25  Nurse answers to NSCOCP questionnaires

100% signifies 3 out 3 nurses agree, 67% signifies 2 out of 3 nurses agree

| | Comprehensive Oral Care Plans (AOCP) | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 1 | I feel knowledgeable and prepared to formulate an Comprehensive Oral Care Plan (AOCP) by myself | 0 | 0 | 100 | 0 |
| 2 | Using the AOCP improves my ability to manage problems in residents' mouths | 0 | 0 | 100 | 0 |
| 3 | I had enough time to learn about the AOCP before it was implemented | 0 | 0 | 100 | 0 |
| 4 | I feel supported in my efforts to implement the AOCP for residents | 0 | 0 | 100 | 0 |
| 5 | I need more help to use all the different preventive interventions in the AOCP for oral health | 0 | 0 | 100 | 0 |
| 6 | I understand the effects of Food Management in the care of Residents in an Aged Care Facility | 0 | 0 | 100 | 0 |
| 7 | I understand why it is important to re-mineralise teeth to prevent decay using high fluoride and GC  Tooth Mousse Plus  toothpastes | 0 | 0 | 100 | 0 |
| 8 | I feel confident how and when to use re-mineralising agents in an AOCP | 0 | 0 | 100 | 0 |
| 9 | I understand why it is important to maintain     adequate hydration | 0 | 0 | 100 | 0 |
| 10 | I feel confident how to maintain adequate hydration of Residents using an AOCP | 0 | 33 | 67 | 0 |
| 11 | I understand the importance and use artificial saliva | 0 | 0 | 100 | 0 |
| 12 | I feel confident how and when to use artificial saliva in an AOCP | 0 | 0 | 100 | 0 |
| 13 | I understand the importance and use of Xylitol gum to stimulate salivary glands. | 0 | 0 | 100 | 0 |
| 14 | I feel confident how and when to use Xylitol gum in an AOCP | 0 | 0 | 100 | 0 |
| 15 | I understand the importance and use of sodium bicarbonate toothpaste to neutralise mouth acids after meals | 0 | 0 | 100 | 0 |
| 16 | I feel confident how and when to use sodium bicarbonate toothpaste in an Comprehensive Oral Care Plan | 0 | 0 | 100 | 0 |
| 17 | I understand the importance and use Chlorhexidene toothpaste to reduce pathogenic micro-organisms in the mouth | 0 | 0 | 100 | 0 |
| 18 | I feel confident how and when to use Chlorhexidene toothpaste in an AOCP | 0 | 0 | 100 | 0 |
| 19 | I understand the importance and use of assisted brushing of teeth and dentures | 0 | 0 | 100 | 0 |
| 20 | I feel confident in being able to brush Residents teeth     and dentures | 0 | 0 | 100 | 0 |
| 21 | More time could have been spent on AOCP training | 0 | 0 | 100 | 0 |

# CHAPTER 4 – DISCUSSION

## Medical Diagnoses, Medications and Anti-Cholinergic Burden

Patient factors associated with higher anticholinergic burden are polypharmacy (i.e. taking five or more medications), increasing age, decline in cognitive status, dementia, depression and lower physical quality of life. (78, 103)

This study found anticholinergic medication(s) were used more frequently in people with dementia. An unrelated study found Level 1 anticholinergic drugs with an anti-cholinergic Burden Score (ABS score of 1) contributed on average, 70 % to the total burden.(103) Data from a United States 2004 national nursing home survey found that over one out of five elderly nursing home residents with dementia used medications with marked anticholinergic activities (ABS Scores 2-3).(104)

Similar findings were found in a large United Kingdom study which also found prolonged use (>16 weeks) of anti-cholinergic medications, particularly anti-psychotics was common in treating elderly people.(105)

Association by therapeutic category of medications combining together may determine an overall anti-cholinergic burden.(76)

Salivary function becomes worse with the greater the number of medications prescribed having anti-cholinergic activity. Epidemiologic studies show that the prevalence of xerostomia and SGH increases with age and is strongly associated with medications and health. (71, 106-108) Specific medications when taken alone may not have xerogenic effects but when taken with another medication, the combination yields an increased prevalence of xerostomia.(72)

Participant's medications in this study were scored using an anti-cholinergic activity scale formulated by St Vincents Hospital Pharmacy Department, Darlinghurst NSW. Medicines were given a score from 0-3, with 3 having the greatest anti-cholinergic effect.

St Vincents Hospital allocated ABS scores to the following categories of medications:- anti-psychotics scored as 3, anti-convalescent as 2, most heart medications, hypertensives and diuretics as 1, GORD medication as 1 and opioids scored as 1.

In this study Participants 1-8 were taking 9, 10, 11, 10, 10, 10, 8 and 4 total medications respectively and when converted to the St Vincents Hospital Anti-cholinergic Scale, participants 1-8 had ABS scores of 7, 11, 5, 7, 8, 5, 6 and 2 respectively.

**Laxatives**

Laxatives were monitored in this study despite having no anti-cholinergic (0) effect as regular chewing of sugarless gum with Xylitol was recommended for use in this study to encourage the production of stimulated saliva containing buffers to help neutralise mouth acids.

Labels on xylitol gums, other sugar free gums and sugar substitutes have warnings of possible laxative effects or abdominal discomfort. Many elderly are prescribed laxatives to improve bowel motility when adversely affected by polypharmacy, restricted non fibrous diets and frailty.

The researchers were concerned that chewing gum may potentiate the effects of laxatives. Nurses in this study, were advised to monitor changes in bowel movement and complaints of abdominal discomfort.

In an unrelated study, no clinically significant adverse events were observed where a population with polypharmacy-induced xerostomia used Xylitol containing topical products to relieve symptoms of dry mouth.(109)

In this study, Xylitol sugarless gum seemed to be well tolerated by participants with no adverse outcomes were reported.

# Oral Assessments

## Xerostomia and Salivary Gland Hypofunction (SGH)

Xerostomia is the subjective feeling of dry mouth and is measurable by direct questioning (110), while salivary gland hypofunction (SGH) is a measurable reduction in salivary output.(111)  Reviews of the literature show considerable variation in the prevalence of xerostomia.  One review reported the prevalence of xerostomia to range from 0.9% to 64.8% (112), while another review reported the prevalence of xerostomia in the general public to range from 5.5% to 39%, community-dwelling elders from 17% to 40% and institutionalised elders from 20% to 72%.(71)

The prevalence of xerostomia increases with age, multiple pathologies and increasing use of medications, particularly with medications having greater anti-cholinergic affects causing SGH. These conditions are commonly found with age associated chronic disease in the elderly.

### Xerostomia Questionnaires

Questionnaires can be used to assess the severity of dry mouths. Xerostomia Inventory (XI) is an 11 question multi-item instrument for measuring xerostomia symptoms which enables an estimate of severity to be made on a continuous scale. The XI was aimed at to developing an estimate of xerostomia on an ordinal scale to be used for modelling coronal and root surface caries incidence among elderly participants.(113)  The X1 is a summated rating scale that allows tracking of participants on a continuum of symptom experience.(76) The XI questionnaires can be repeated at a later date allowing monitoring of xerostomia over time. The possible range of scores are 11 (no xerostomia) to 55 (worst possible xerostomia).

## Shortened Xerostomia Inventory Questionnaire (SXI-D)

In this study, the shorter Summated Xerostomia Inventory-Dutch Version (SXI-D) containing only 5 questions was chosen as a more suitable questionnaire for a dementia oral health study in a RACF than the longer Xerostomia Inventory (XI) with 11 questions.(114, 115)

Participant's responses were scored and summed to give a single score.

The shortened Xerostomia questionnaires were completed at the beginning of the study and then again at the end of the study. Two residents were lost to the study due to illness and could not complete follow up questionnaires or saliva tests at 10 weeks.

Some early dementia residents needed assistance answering questionnaires and it was difficult to determine if participant answers were influenced by nurses or whether the nurses knew the resident's sufficiently well to prompt the resident to answer correctly. Nurses assisted residents answering questions at the beginning of the study while OHTs administered the questionnaires at the end of the study at +10 weeks.

The difficulty of early dementia participants in understanding questionnaires was shown to confound the recording of unbiased answers. Nurse assistance was required to explain individual questions and help answer the questionnaire and is likely to have biased the answers from the early dementia participants.

An expectation that participants on polypharmacy would have higher Xerostomia scores compared to the younger volunteers not on polypharmacy was not met in this study, even when the volunteer with Sjogren's was removed from the data set.

These results suggests that SXI-D may **not** be sensitive enough to be a predictor of the risk of decay or oral disease in RACF residents with cognitive decline and early dementia as higher SXI-D scores would be expected for those with poorer saliva test results and with a higher incidence of decay.

Although the SXI-D is suited for non-cognitively impaired elderly, the SXI-D may still have value, when used on an individual basis, provided the limitations in the ability of dementia patients to understand SXI-D questions are appreciated.

Participant numbers were too low to obtain statistically significant results.
Larger numbers of early dementia test subjects are needed to assess whether there is a correlation between this SXI-D and coronal caries, root caries and oral health in general.

# Oral Health Impact Profile (OHIP14)

The Oral Health Impact Profile (OHIP) is an instrument that measures people's perception of the social impact of oral disorders on their well-being. OHIP49 consists of 49 questions that surveys seven domains to assess a person's quality of life. (116) These domains are functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap.

The full 49 item version of the OHIP is unlikely to be practical in a RACF setting because of its length.(117)  Shorter quality of life questionnaires have been developed more suited to older adults. Three quality of life questionnaires, GOHAI, OHIP14 and OHIP-Dent are briefly discussed below.

The Geriatric Oral Health Assessment Index (GOHAI) measures 12 domains suitable for use with older adult populations.

The OHIP14 contains 14 questions developed from OHIP49. Although OHIP14 and GOHAI questionnaires are similar, the differences in item content may mean that the GOHAI is better at detecting impacts in the form of dysfunction and pain, while the OHIP-14 is better at detecting psycho-social impacts.(118)  Although a Japanese study found the GOHAI and OHIP14 had a strong correlation, the GOHAI was found to be more sensitive to the objective values of oral functions among independently living elderly.(119)

The OHIP-Dent is modified from OHIP14 and designed to be more sensitive in assessing the quality of life associated with chewing function of wearers of complete dentures compared to implant supported prosthesis.(117) A comparison between OHIP49, OHIP14 and OHIP-Dent found that discriminant validity properties were similar. However, the authors of the study felt that OHIP14 showed relatively poor responsiveness to clinically meaningful change with respect to improvements in chewing ability and may not be suitable for measuring change following prosthodontic procedures.

However, correlation between professionally assessed treatment needs and clinical indices (such as caries, periodontal disease, clinical health status) and summary scores derived from GOHAI and OHIP respectively are weak to moderate.(120)

OHIP14 containing 14 questions from each of the OHIP49 domains was used in this study. A large cohort South Australian study found OHIP14 accounted for 94% of variance in the OHIP49; had high reliability validity and precision with a good distribution of prevalence for individual questions. OHIP14 scores and OHIP49 scores displayed the same pattern of variation among socio-demographic groups of older adults.(121)

Participant numbers in this study were too low to obtain meaningful statistical results. Larger numbers of test subjects are needed to assess whether there is a correlation between this questionnaire, quality of life and oral disease in early dementia RACF residents.

The difficulty of early dementia participants in understanding OHIP14 questionnaires further complicates recording unbiased answers.

The findings from this study, suggests that the OHIP14 may **not** be sensitive enough or even an appropriate method to adequately assess quality of life in early dementia RACF residents. Nor would OHIP14 be a suitable predictor of the risk of decay or oral disease in early dementia RACF residents as higher maximum scores would be expected for those with poorer saliva quality and higher incidence of decay.

However, until a better tool is available for assessing quality of life in RACF residents with dementia, OHIP14 should continue to be used provided the limitations of OHIP14 are considered.

## Oral Health Assessment Tool (OHAT)

The OHAT was designed to be carried out by nursing and allied health staff to assess the oral health of residents residing in RACFs. The assessment tool has been validated in a three-year tri-state Australian trial and was introduced in 2009 as part of the Australian Government's *Better Oral Health in Residential Care Program (BOHRC).*(97),(98)  The BOHRC Program involves four key processes: oral health assessment; oral health care planning; daily oral hygiene; referral for dental treatment. The BOHRC Program is currently an integral part of nursing education and training at the Montefiore Nursing Home.

A 1995 study found nursing staff could be taught to carry out a Brief Oral Health Status Examination (BOHSE) to assess the oral health status of cognitively impaired and unimpaired nursing home residents with the aim of bringing dental problems to the attention of dentists.(122, 123)

In a 2009, Chalmers et al. modified an earlier oral assessment tool by Kyser-Jones, to undertake dental screening of 455 participants residing in 21 RACFs in New South Wales, Victoria and South Australia.(124)  The mean age of the participants was 82.1 years with 56.5% of participants having a diagnosis of dementia. The 2009 OHAT had a scoring system with minimum of 0 and maximum of 16.  'Healthy (score 0), Changes (score 1), Unhealthy (score 3)' were given to 8 categories  *(Lips, Tongue, Gums and Oral Tissues, Saliva, Natural Teeth, Dentures, Oral cleanliness and Dental Pain).*

Information collected from OHAT assessments, in the 2009 study, facilitated the training of RACF nurses and carers and the development of oral hygiene care plans in RACFs. OHATs were repeated at 3 and 6 months and found mean total OHAT scores decreased significantly over the study period from 2.71 at baseline to 2.5 at 3 months and 2.4 at 6 months. Validity analyses of the OHAT categories and examination findings showed complete agreement for the lips category, with the natural teeth, dentures, and tongue categories having high significant correlations and percent agreements. The gums category had significant moderate correlation and percent agreement. Non-significant and low correlations and percent agreements were evident for the saliva, oral cleanliness and dental pain categories. (125)

For the past 5 years, the Montefiore Nursing home has been using a slightly modified version of the original 2009 OHAT form (126), developed by Dr Peter Foltyn. The modified Montefiore OHAT form differs from the standard OHAT form in that it contains preventive intervention advice and preventive product information suitable to be delivered by RACF nurses should they discover an adverse finding in any of the 8 OHAT categories. The back page of the Montefiore OHAT form has

images of each of the eight unhealthy categories to assist nursing with scoring. (See Appendix 16.)

Although the Chalmers (2009) study included a notation for care plans to refer to a dentist when triggered by OHAT assessment findings, it did not score 'referral for treatment required' for any of the 8 categories assessed.

This study used the same OHAT form as the Chalmers (2009) study but made the following changes. A 'Healthy' finding was scored as 1 (not zero as per Chalmers (2009) study), and placed into a green column, 'Changes' was scored 2 (not 1) and placed into a yellow column, 'Unhealthy' scored 3 (not 2) placed into a red column) and 'Referral for treatment' scored 4, (not scored in the Chalmers (2009) study) and placed into black column.

The colours were based on a traffic light system to help nurses interpret the forms. Scores range from a minimum of either 7 if the subject was without dentures, or 8 if wearing dentures (the most healthy) to a maximum of 32 (worst possible, requiring referral for all 8 categories)

This study used OHAT scores that ranged from: 7-32 (without dentures) or 8-32 (with dentures). In this study, (Montefiore) OHAT scores differed from the Chalmers study with the Montefiore OHAT having a range from 7- 32 while the Chalmers study scores ranged from 0 -16.

When OHT mean (Montefiore Study) OHAT scores (n=8) were converted to the Chalmers (original OHAT) (n= 455) scoring system ('0 = healthy, 1= changes, 2 = unhealthy'), the mean total OHAT scores at baseline were comparatively close, with a mean 2.63 derived for the Montefiore OHAT and 2.71 for the original Chalmers OHAT.


**Differences Between Nurse OHAT, OHT OHAT and Dentist Clinical Examinations**
The clinical examination by the dentist was considered the gold standard. Four out of 8 residents were found to have decayed teeth.

Three residents had symptom free soft tissue fistulas probably associated with chronic endodontic infections. The taking of radiographs was not part of the study ethics approval and x-rays were not able to be used to detect interproximal caries or apical pathology. Participant 8 had 8 carious lesions and was unable to have a baseline nurse OHAT assessment as she joined the study late. Participant 8 had two OHAT assessments by an OHT at baseline and a single OHT OHAT assessment at 10 weeks.

Clinical examinations and assessments by the dentist (author) were carried out with the use of compressed air/water, dental mirror, probe, headlight (9500lux- JJ-Medical-B2-LED-Headlight-JJMB2LED) and a portable dental reclining chair. All of these aids are important for detection of soft tissue pathology, early root and coronal caries.

By contrast, nurse assessments were carried out with only bent toothbrushes, dental mirrors and usually with inadequate lighting from a torch that greatly limited their ability to assess decay and soft tissue pathology. All nurses trialled headlights and found the stronger light helped them to perform OHAT.

The nurses chosen for this study had no prior experience with OHAT.
The Original planning envisaged nurses would perform 10 OHAT volunteer assessments, (six OHATs on volunteers and on the four nurses involved in the study), as part of their training before assessing participants. However, nurses had difficulty completing OHAT and saliva tests on the 6 volunteers in the 4 hour allotted training time and were unable to assess themselves.

A total of 27 OHAT assessments were performed during this study. Four nurses completed six OHAT assessments on volunteers and seven OHAT assessments out of the eight participants.

Oral health therapist OHAT assessments were performed within 3 days of nurse assessments with the aid of a dental headlight, dental probes, mirror and gauze to dry teeth, but they did not use compressed air/water or a reclining chair. OHTs performed a total of 14 OHAT assessments, eight at baseline and six at the end of the study period.

Nurse mean OHAT scores for participants and volunteers were 9.4 and 7.5 respectively.

**OHAT Assessment of 'Natural Teeth' Category**
Both nurses and OHTs underestimated decay - with nurses underestimating much more. Neither the four nurses nor the two oral health therapists scored participants for referral (Montefiore OHAT score = 4) for dental treatment despite four participants having multiple carious lesions and three participants with soft tissue fistulas when examined by the dentist (author).

The 6 month, 2O09 OHAT study by Chalmers(124), (455 participants in 21 RACFs, average age 82.1years, 56.5% diagnosed with dementia), reported mean baseline scores for Saliva, Natural Teeth, and Oral Cleanliness (0.16, 0.72, 0.65 respectively) which improved at 6 months (0.13, 0.62, 0.57 respectively). Despite a statistically

significant improvement in total mean OHAT scores from 2.71 to 2.4 during this time, signifying improvement in oral health -the average number of root stumps increased in the upper arch from 5.9 to 9.1 and 8.4 root stumps in the lower arch to 9.2 over the 6 months. In other words, while oral health indices in the Chalmers study were improving (including 'Natural Teeth' -from 0.72 to 0.62) actual decay was apparently progressing rapidly. Either these lesions were new lesions, or more likely, were lesions that were missed at the initial OHAT assessments and continued to progress until the decayed coronal tooth portion fractured away over the 6 months.

These findings are not unexpected as nurses do not have the necessary training or experience to detect early or even moderate decay involving interproximal, lingual or subgingival surfaces, often covered by plaque and debris and which would require compressed air/water, lighting and a probe to detect. These surfaces cannot be well visualised using a dental mirror and torch light as used in most RACF OHAT assessments. Even root stumps can be missed by nurses when roots are in the back of the mouth and where there is full or partial gingival overgrowth of roots.

Retained roots are more obviously visible than early or moderately decayed teeth and may help explain the increased number of root stumps found in the Chalmers (2009) study while other health indices improved.

The Chalmers (2009) OHAT score of 2 is described as '1-3 decayed or broken teeth / roots, or teeth very worn down teeth' and is classified as 'Changes', while OHAT score 3 is described as '4 or more decayed or broken teeth/roots or fewer than 4 teeth, or 'very worn down teeth' and is classified as 'Unhealthy'.

Although the Chalmers (2009) OHAT score of 3 (Unhealthy) expected a referral to a dentist, there was no scoring category to track referrals for treatment. In this early dementia study a score of 4 was an additional category added to the OHAT form requiring a 'Referral' to a dentist which could be monitored and tracked for statistical data.


**OHAT-Natural Teeth Category and Detection of Decay**
The prevalence and incidence of coronal and root caries in residents in RACFs is very high.(3, 7, 45)  Prevention, early detection of caries and referral for treatment by nurses is a primary purpose of developing any oral assessment and comprehensive oral care plan.

In hindsight, although nurses in this study had considerable training as compared to other studies, they probably did not have adequate training in the appearance of early decay. As decay is a major oral co-morbidity of the elderly in RACF, future nurse oral health studies should place more emphasis on training nurses on the

clinical appearance of both early and late decay. Nurses should use a 9000lux headlight for their assessments in future studies.

The scoring can be simplified if both the Chalmers and Montefiore scoring systems are combined with scoring '0 = healthy, 1= changes, 2 = unhealthy, 3 = treatment referral required' resulting in a range 0 to 24 (not 0-16 as per the Chalmers study or as in this study 7-32).

The importance of educating RACF nurses to establish a referral system or pathway to a dentist for treatment should be stressed. None of the nurses or OHTs scored any participant as a 4 (Referral required-black column) despite 4 participants having 3 or more decayed teeth.

The inability of nurses to detect early decay and be only able to detect very late decay or root stumps suggests that the OHAT sub-category on 'Natural Teeth' is problematic as:-

- OHAT (Chalmers 2009) score of 2 is classified as 'Changes' (described as '1-3 decayed or broken) currently allows an unacceptably high incidence of decayed teeth. Under the Chalmers 2009 OHAT system, a score of 3 is the with 4 visible decayed teeth is the threshold before referral to a dentist is considered.

- Nurses do not have the training or equipment to detect early decay.
  It is unlikely nurses can detect even advanced decay on lingual tooth surfaces without a dental mirror and good lighting. Interproximal and subgingival decay detection, particularly when covered by plaque and debris requires a dental probe and compressed air, both of which would not be available to nurses.

  Nurses will tend to underscore the real incidence of decay and will tend to only score gross visible caries and root stumps.

- The real incidence of decay will likely be substantially greater when examinations are carried out by dental professionals using compressed air/water, good lighting, dental mirror, probe and even more when x-rays are used.

- As shown in this study and in the author's opinion Nurse OHAT section on 'Natural Teeth' is **not** technique sensitive enough to detect early decay and poorly correlates with risk of future decay.

**Proposed New Subsection Within OHAT**

Although the OHAT form in general use in RACFs scores 'Natural Teeth' as 1 (changes), 2 (unhealthy) or 3 (referral), this form does not record the number or extent of decayed teeth.

This study strongly suggests that in future studies the OHAT 'Natural Teeth' category includes a new subsection to record 'number of decayed teeth and retained roots' as nurses will under-report decay in RACF residents who are susceptible to rapidly progressing decay.

This exploratory study has shown that RACF nurses will probably significantly underestimate decay due to the limitations of their training and equipment, however their overall OHAT assessment is important as a validated tool to assess overall base risk factors associated with the other OHAT categories and as a method to involve RACF nursing staff in oral care.

Despite the small sample size, nurse and oral health therapist OHAT assessments showed similar findings. It is concluded that nurse OHAT is useful as an assessment tool for creating comprehensive oral care plans and as a screening referral tool.

In this study both nurses and OHTs did not undergo a standardisation process prior the study's commencement as this study was considered a "proof of concept pilot study" and not designed to collect data for statistical analyses. Lack of standardisation proved problematic at times and probably accounted for a number of variations found with oral health therapist OHAT assessments at baseline and at 10 weeks as well as other parts of the study such as plaque score assessments. Future larger studies will require standardisation of researchers and oral health assessors.

In this study, these results may suggest that the OHAT **is** sensitive enough to be a predictor of overall oral health but may **not** be a predictor of the risk of decay in early dementia RACF residents as clinical findings of decay were not reflected in OHAT findings.

Other methods for assessing risk factors associated with caries progression and detecting early caries in RACF, such as sublingual resting pH, other saliva test parameters and plaques scores may need to complement OHAT findings.

A study with larger numbers of test subjects is needed to assess whether there is a correlation between OHAT assessments complemented by other assessment methods can detect poor oral health and refer RACF residents for treatment.

## Nurse OHAT Focus Group Discussion and Questionnaires

Only three out of the four nurses who completed the training filled out the nurse questionnaires as one of the nurses had left her employment during the 10 week study. The OHAT questions were taken directly from a 2009 study by Chalmers et al. 'Caring for oral health in Australian residential care' (124) which validated the use of OHAT. The rational for following the Chalmers' questionnaires were that this pilot study looked at methods that may be used in future larger studies and that standardising OHAT nurse questionnaires make comparisons between past and future studies possible.

As a result, nurse answers are recorded in percentages despite the number of nurses being only 3. In this study, three nurses selecting the same category is recorded as 100%, 67% if two nurses select the same category and 33% if only one nurse selects a category.

Nurses in general had a positive response agreeing with all questions except for questions 3, 10 and 12 where one nurse disagreed.

Question 3 relates to learning about OHAT before implementation and may be valid due to the limited time available for nurse training. Question 10 relates to completing the denture category. The author is unsure as to why this was an issue as adequate time was spent on denture classification and assisted brushing of dentures.

Question 12 relates to assessing dental pain. Again the author is unsure as to why this was a problem as all participants (n=8) were symptom free and not suffering from pain, despite 4 of the participants having decayed teeth and 3 participants found to have fistulas.

# Recruitment of Participants

An early and unexpected problem encountered in this study was that the organisers had great difficulty recruiting participants. Attempts to recruit participants involved in-house poster advertising, leaflets, two resident meetings open to families, family next of kin meeting, knocking on resident doors, attending morning and afternoon teas, attending week end peak family visiting times, sending mail outs and email notices to next of kin.

The Ethics Committee approval required the study to select early dementia participants who were able to understand the study and able to sign their own consent forms without next of kin consent. Signing consent forms proved problematic as some residents who were initially willing to participate in the study withdrew only when asked to sign a consent form. Other potential participants were willing to participate when the study was explained to them by the researchers but withdrew from the study as soon as the Participant Information Sheet was handed to them without even reading the information sheet.

Possible explanations are:-

- It was noticeable that some dementia residents had difficulty making decisions, exhibited reluctance to sign forms, had forgotten to discuss the study with their next of kin and needed a member of their family to be present to approve signing a consent form. Early dementia participants seemed to be confused with too much printed information and any forms needing an explanation or signature.

- A difference was observed between family involvement at Randwick and Woollahra Montefiore campuses which may have adversely affected participant recruitment. The Randwick facility has a greater numbers of residents with more advanced physical and cognitive deficits than the Woollahra campus. The next of kin at Randwick have a greater interest and were more involved in the care of their relatives, probably due to more advanced dementia sufferers having greater dependence on family support. About 10-15 next of kin attend regular family evening meetings at the Randwick campus high care dementia section. The author has attended a number of these meetings at Randwick where next of kin show great interest in the oral health of their relatives.

- In contrast, there was noticeably less interest in family involvement at Woollahra as no next of kin attended a number of advertised family meetings at Woollahra campus probably due to residents generally being more independent. No family or next of kin replied to the emails or letters distributed

to promote the study.

The small participant sample size (n=8) and short 10 week study period precluded any statistical determination of oral health outcomes. A longer study period is needed to determine any decrease in decay rates and improvement in oral health.

Montefiore managers issued attractive appointment cards for each resident one week prior to testing and then reminded residents of their appointments at breakfast on test days. From previous experience working in a RACF dental clinic, about 20% of residents do not attend their dental appointments due to illness, forgetfulness or nurses failing to bring residents to the clinic.

Reminding residents often is important as early dementia residents may forget, mix up their appointment times, attend an activity within the RACF or leave for excursions. Similar problems occurred in this study with assistants and nurses often looking for residents within the RACF who had forgotten to keep their appointment times while other participants left on day trips. The study found that additional appointments were needed to be scheduled for missed appointments. Re-appointing participants resulted in the additional time / cost over runs as additional nursing staff and oral health therapists had to be employed to complete all assessments and saliva tests. A further problem arose when the use of borrowed portable equipment had to be extended when required elsewhere. Similar dementia oral health studies may face similar problems.

Informing rostered nurses of resident's scheduled test and examination appointment times, sending email and phone reminders to nurses and managers a day earlier and again in the morning of a test session helped residents to keep their appointment times.

Greater number of dementia participants need to be recruited for similar future studies to statistically assess outcomes. It may be possible to recruit more dementia participants in facilities where residents are more dependent as there seems to be greater next of kin involvement in the care of their relatives. Relatives may be more likely to encourage RACF residents to participate in an oral health study. The Ethics committee approval for this study limited participants to early dementia participants able to give their own consent and may have contributed to the low number of participants recruited for this study.

Future dementia oral health studies may be able to recruit larger number of participants where ethics approval allows consent of either or both next of kin and participants.

# Nurse Education and Training

Nurse understanding of oral health in RACFs will remain poor unless advanced oral health education and the teaching of appropriate care interventions in RACF becomes part of the nursing undergraduate education curriculum.

Through the researchers' earlier experiences, not related to this study, attempting to introduce nurse assisted brushing and oral health programs within the Montefiore Nursing Home have met with various levels of success. There is a wide range of competencies in the nurses' ability to understand oral health education and their ability to carry out assisted brushing programs and use preventive products appropriately.

Prior to commencement of this study, a specific request was made to Montefiore managers to select four nurses who were competent team leaders and be able to be responsible for and manage untrained nurses to follow care plan protocols. Of the 4 nursing staff selected only 2 were registered nurses. The nurses participating in the study were very well chosen by Montefiore managers for their leadership skills and seemed to be able to absorb and understand the educational material and training.

The time/cost involved in training nurses and nurse assessment/saliva testing was an unexpected major barrier. Temporary agency staff had to be employed to cover for the 12 hours that 4 nurses would be involved in the study and not be able to perform their normal floor duties. Montefiore employs temporary agency nurses according to nurses' award (AN120387 – Nursing Homes, &C., Nurses' (State) Award). The Award requires a minimum 4 hour working shift. As a result, RACF nurse training and testing sessions had to be in 4 hour blocks. Furthermore, agency staff costs vary depending on nurse experience and whether nurses work morning, afternoon or evening shifts with morning shifts being the least expensive. A budget and a nurse roster schedule had to be developed in order to employ nursing agency staff which needed to be booked one month ahead.

Three 4-hour training/testing blocks were scheduled in the mornings as testing protocols required morning saliva testing. One 4-hour block was allocated for education and training and two 4 hour blocks for volunteer and resident assessments and saliva testing. Nurses in this pilot study received over 12 hours of education and practical hands on training in saliva testing and OHAT assessments before creating NSCOCPs.

Most other studies in this field usually have one 60-90 minute education session often without further follow up training. A review article investigating nurse training strategies showed training / education sessions varied between one 45 minutes to 4 hours with the majority between 1 and 3 hours. (38, 44, 87)

Literature reviews of oral health initiatives attempt to implement oral health programs by providing special training of some nurses to become 'Dental Champions' or 'Oral health promotor' within the RACF. Most oral health program content implementation strategies focus on theoretic lectures and demonstrations of the importance of oral health through PowerPoint presentations and other visual aids, various plaque control methods including assisted brushing, and in some studies the use of high fluoride toothpaste and chlorhexidine rinses or toothpaste.(38, 48)

A literature review of studies investigating interventions to improve oral hygiene delivered by nurses or nursing assistants yielded eight moderate to strongly rated studies reporting in-service educational sessions, either alone or augmented in some way (i.e., single in-service education sessions, single in-service education sessions supplemented by a "train-the-trainer" [or pyramid] approach and educational sessions supplemented with ongoing active involvement of a dental hygienist).(48)

In this study, nurses effectively received 12 hours of education and training on saliva testing and OHAT assessments before creating NCOCPs. This level of training is probably far greater than most other oral health studies involving nurses in oral care programs in RACFs.(47)

The training of nurses, in this study was much more advanced in both content and in the time spent in training as compared to other studies found in the literature. The 12 hours of training including both theoretical and practical components allowing nurses to have a more thorough understanding of assessments to detect oral disease, the use of a much wider range of preventive interventions needed to maintain oral health and how to implement these interventions through care plans in a RACF. The author suggests that this study shows this level of training is possible and is an effective method to deliver an oral health programs in RACFs.

Trained nurses may require special recognition within the Aged Care Industry and among dental professionals as a subspecialty in nursing due to their advanced training to formulate and implement NSCOCPs.

Additional funding to be found for agency staff to replace 2 nurses at the AIN pay rate and 2 nurses at RN rates for 3 sessions of 4 hours each totalling 48 hours. (4x4x3 = 48 hours -24 hours @ RN rate and 24 hours @ AIN rate). Furthermore, pay rates vary with additional loadings for afternoon shifts and a further loading for an evening shift.

The most senior of the four RNs, completed her training and formulated her allotted care plans but left her employment at Montefiore within 2 weeks of the start of the study. This RN did not participate in overseeing her care plans over the 10 week period of the study, nor did she complete nurse questionnaires. The three remaining

nurses were all able to easily complete their responsibilities and those of the nurse that had left Montefiore.

Three out of four nurses completed the questionnaires. The first part of the questionnaire sought to find out whether nurses felt they had adequate training to understand how to create care plans and whether they had enough support by the researchers and trainers to do so.

The second part of the questionnaire focused on the use of the preventive interventions while the final part of the questionnaire enquired about assisted and unassisted brushing.

All three nurses gave positive responses (100%) to all 21 questions, except question 9 concerning hydration. Nurses during their training were advised that this study would not monitor hydration as the participants were too independent to monitor their fluid intake. Although nurses needed to be aware of the importance of hydration in general, hydration may be more suited to monitor in high care nursing where residents are less physically independent.

This pilot study examined a wider range of nurse related research questions than was examined in the Chalmers 2009 study. Although OHAT assessments were common, this study used a more complex approach to create nurse care plans by the inclusion of complex  saliva testing procedures and the interpretation of participant answers to OHIP14 and SXD-I questionnaires. The nurse assessments and testing were then verified by repeating the same tests and assessments by OHT's.

# IMPLEMENTATION of NURSE SCHEDULED COMREHENSIVE ORAL CARE PLANS (NSCOCPs)

A literature review of studies investigating interventions to improve oral hygiene delivered by nurses or nursing assistants yielded eight moderate to strongly rated studies reporting in-service educational sessions, either alone or augmented in some way (i.e. single in-service education sessions, single in-service education sessions supplemented by a "train-the-trainer" [or pyramid] approach and educational sessions supplemented with ongoing active involvement of a dental hygienist).(48)

However, attendance rates were not given in all studies, and when reported, ranged from 15% to 75%. It was not clear in any of the studies whether the caregivers attending the sessions were the same as those providing the care and therefore contributing to outcomes. Adherence to protocols was not reported, and treatment of the control groups was vague, if reported at all.(48)

In this study, the author observed that the social dynamic of 'ownership' of the care plan was an important motivating factor and provided the following of benefits:-

1  Once a trained nurse had created a care plan they seemed have a more of an invested interest in the success of the plan and monitored compliance more closely.

2  Trained nurses felt they had greater understanding and control of residents' oral health problems.

3  Untrained nurses seemed to take a greater interest in the plan as the care plan came from within their own nursing profession rather than a plan imposed from outside their nursing profession by a dental professional.

4  Untrained nurses became motivated enough to request their own in house training, in their own time, to better understand the purpose of the study and use of preventive products and interventions.

Compliance over-all was very high (see Results section) and would probably be greater than if care plans would have been developed by a dental professional and imposed from outside the RACF.

Originally, the nurses kept the 'Oral Care Plan Folder in each participant's room. However, nurses found it better to keep folders at their nurses' station due to greater convenience and for privacy reasons. Keeping the Oral Care Plan Folders at the nurses' station was found to have an unexpected benefit of allowing both the trained and untrained nurses to discuss the different oral care plans, how to handle different oral care situations and the use of different preventive products and interventions.

Untrained nurses, within two weeks of commencing the study, took a noticeable interest in the reasons for the interventions and in oral health in general, particularly after noticing signs of improved oral health in some participants.

The study generated sufficient interest that untrained nurses, requested the study organisers provide them with their own education session. A 45 minute oral health training session for untrained nurses was provided at about 4 weeks into the study during the nurses' lunch time, and not paid for by the study. Feedback from the executive care managers, trained and untrained nurses was very positive with a much improved awareness of oral health needs required to maintain resident's oral health.

Although these care plans were on paper using a folder system, it should be possible to computerise nurse care plans into RACF computer software systems.

The four nurses selected by Montefiore managers for this study were selected on the basis that each nurse was considered as having 'team leader' status or above and were not selected on the basis of seniority. Team leadership was found to be very important as these nurses seemed to be able to mentor untrained nurses and motivate staff to comply with care plans.

The research assistant and author initially monitored implementation of care plans by checking participant oral care plans folders for compliance on a weekly basis during the first four weeks and then bi-weekly. No other attempt was made to influence compliance apart from checking folders and asking the trained nurses who were monitoring the care plans if there were any problems.

## Saliva Testing

Test procedures in a saliva test kit (GC Saliva Check Buffer [TM]) were modified by the author for this study. The rational for using this particular saliva test kit was that the kit was:- commercially readily available, relatively inexpensive (20 test subjects can be tested per kit), could be easily used by RACF nurses and came with adequate instructions and education material.

The following modifications to the saliva test kit procedures were made to better suite a dementia study were:--
Measuring resting pH sourced sublingually, shortening the saliva collection period to 3 minutes, measuring saliva pH after a glucose challenge, measuring pH and buffering capacity after chewing for 3 minutes and measuring mouth pH after a small increment of sodium bicarbonate toothpaste was introduced into the mouth.

Nurses were able to appreciate the differences in saliva test results between volunteers and participants through their own practical 'hands on' testing procedures. Nurses found volunteers generally had good or far better quality saliva results in all nurse assessments and saliva test results than participants. Differences became more obvious to nurses once the outlier volunteer results with Sjogren's Syndrome and anti-cholinergic medication were explained to nurses.

Nurse testing enabled the nurses to have a much better understanding of the role of saliva in oral health. Nurses through testing were able to measure mouth pH at rest, the effects of a glucose challenge to cause a drop in mouth pH, the importance of chewing to produce stimulated saliva to neutralise mouth acids, how buffering capacity affects neutralisation of mouth acids and the use of sodium bicarbonate dentifrice to ultimately raise mouth pH when saliva function is very poor.

Nurses reported they felt they understood oral health in far greater detail, felt empowered and more confident in creating NCOCPs by completing intensive practical hands on training course than if they had they only completed a classroom lecture program.

Ideally this saliva testing protocol should be performed on all new residents soon after entry into a RACF. It is suggested that training a few specially trained nurses in more advanced oral health, OHAT assessments and saliva testing in each RACF would result in more effective oral care plans. Trained nurses would be able to use information obtained from all assessments to create better individualised oral health care plans than by just relying on OHAT assessments.

Once trained, these nurses would be able to re-test RACF residents periodically or when there is a change in a resident's health or dependencies and not be reliant on infrequent or unlikely assessments by dental professionals to create oral care plans

Some elderly people will have a continued and progressive loss of saliva function due to disease, frailty or polypharmacy over time. It should be realised that preventive interventions may not be able to improve salivary function in all cases after implementation of NSCOCPs, yet these oral care plans should still be able to improve oral health. Re-testing a cohort of very frail older people may not show any improvement in saliva function and may even show deterioration in saliva test results over time as people age and develop more co-morbidities associated with ageing. Other markers, such as a decrease in decay increments over time may need to be included into the mix of risk assessments when adequate saliva function is not possible.

However an understanding and elucidation of the role of oral assessments and salivary markers in older residents in RACF will potentially allow early advanced preventive interventions and strategies to be instituted in the early stages of dementia to reduce potentially serious consequences.

There are a number of acceptable saliva collection and saliva test protocols in the literature. (67) (73) (111) (127)

Despite some authorities recommending saliva be collected over a minimum of 5 minutes, this study shortened saliva collection to 3 minutes for the following reasons:- to minimise any possibility of causing stress to early dementia participants, to allow time for additional procedures such as a glucose challenge and sodium bicarbonate, to assess whether nurse saliva testing is practical in RACF settings and to determine whether saliva testing can be used as a teaching tool as well as an assessment tool for nurses to develop nurse comprehensive oral care plans.

Although useful saliva scientific test data was obtained by nurse and OHT saliva testing, it is important to stress that the primary purpose of the saliva testing was as a teaching/assessment tool for nurses to create NSCOCPs by enabling a better understanding of saliva function and not to collect strictly accurate scientific research data. The modified testing allowed nurses to better formulate NSCOCPs by having a more comprehensive understanding of:-oral dryness, mouth acidity at rest by recording resting saliva pH, mouth acidity when stimulated by chewing and recording stimulated saliva pH, resting and stimulated saliva flow rates, buffering capacity, saliva pH fall after a glucose challenge or eating, how chewing raises saliva pH and helps neutralise mouth acids naturally and how sodium bicarbonate toothpastes will rapidly raise saliva pH independent of chewing.

Where possible, nurses were asked to take a second or third pH measurement at 5 minute intervals after the glucose challenge, chewing and sodium bicarbonate toothpaste. Although these readings were undertaken infrequently, it was performed enough times for nurses to understand saliva pH is dynamic and not static.

Tracking pH over time, even in a very limited way, helped re-enforce nurse training by moving from a theoretic concept of Stephan Curves explained in the class room to a practical appreciation of the importance of saliva pH through saliva testing. Whenever possible, the additional pH readings allowed nurses to understand how people with poor salivary function and poor oral hygiene have a greater drop in pH and a more prolonged pH drop before being able to return to normal saliva pH after eating.

## Saliva Test Protocols

The instructions supplied in the Saliva Check Buffer $^{TM}$ kit was modified for this study by the following new protocols and methods:-

Sublingual Resting Saliva pH (SRSpH) readings were sourced from under the tongue. Resting saliva pH was obtained by wetting a small disposable sponge applicator placed under the tongue for 2-3 seconds and then used to wet pH paper test strip.

Whole Resting Saliva pH (WRSpH) readings were made after 3 minute resting saliva collection. Immediately after SRSpH was recorded, whole resting saliva (WRS) was collected into a receptacle for 3 minutes by the spit or drool method and the saliva pH measured using pH paper test strip.

Both SRSpH and WRSpH results were compared.

Although all participants in this study were co-operative, the study also looked at possible testing procedures that may be used when co-operation was not possible due to challenging behaviours that may make a 3 minute collection of saliva unlikely.

The rationale for wetting a sponge applicator under the tongue was that this procedure requires the least co-operation, is rapid, non-threatening and easily performed by untrained nurses. An equally important consideration is that wetting an applicator with saliva may be the only test available where dementia patients lack any ability to co-operate.

This procedure offers further information about saliva function as a significant proportion of test subjects had insufficient saliva sourced from under the tongue to adequately wet a micro-brush to wet pH paper test strip. In these cases the mouth can be assumed to be very dry and likely to have SGH and Xerostomia even when other saliva assessments may not be possible.

Preliminary studies showed that the SRSpH assessment gave a similar or slightly lower pH reading to the conventionally accepted method of assessing resting pH by spitting or drooling into a receptacle from which saliva pH is then measured using pH paper test strip or a pH metre. The process of spitting and drooling may cause a slight rise in resting saliva pH.

Finally, SRSpH may be a valid assessment of the acidity of the mouth at rest as many elderly have limited social interaction such as speaking, smiling or may lack the ability to move their mouths due to stroke, Parkinson's Disease and in dementia patients. Many elderly may remain in this unstimulated state for prolonged periods of

each day maintaining a low pH purely through inactivity. Simple oral exercise can raise salivary flow and influence oral pH.(128)

An oral function promotion programme in Japan was effective in improving the oral health status and oral function of an independent elderly population by simple mouth, cheek, facial, tongue, swallowing exercises as well as manually stimulating salivary glands.(129)  A significant improvement in all oral functions, including bite force, swallowing ability, as well as unstimulated and stimulated salivary flow rate, was observed and this improvement appears to be influenced by the number of remaining teeth.(128)

Stimulating the mouth through active participation in normal social inter-reactions and an active oral exercise programmes should be part of dental interventions recommended by dental professionals in aged care and where possible in for dementia RACF residents. Oral exercise programmes would involve a team approach utilising physiotherapists, speech pathologists and dental professionals.

Intraoral pH measurement might be clinically useful to determine acidity of the local environment of carious lesions as one aspect of the caries activity assessment.(130)

The author suggests that SRSpH may be a valid and simple assessment of the acidity of the mouth at rest suitable for oral health risk assessment of the elderly and early dementia patients.

## Glucose Challenge and Food Management

Participants were asked to rinse with a 20% glucose rinse for 1 minute prior chewing wax. SRSpH was recorded after a 5 minute wait by wetting a sponge applicator which was then applied to pH paper test strip.

Due to time limitations and the possibility of causing stress to early dementia participants, it was not possible to consistently record more than one 5 minute interval pH reading of all dementia participants The glucose challenge test protocol for this study only required one pH reading after 5 minutes. It is likely that this was insufficient time for the oral biofilm to utilise the glucose and cause the mouth to reach maximum oral acidity as would be expected in Stephan curves by waiting 30 minutes or more.(131)

Had multiple 5 minute readings been possible, it would be expected that pH would have continued to drop further, more steeply and remained longer in the very acidic

zone particularly in people with poor salivary function and as time is needed for oral bacteria to utilise the glucose.(131)

The role of the diet, provided that it contains even small quantities of carbohydrate stimulates plaque glycolysis causing plaque pH levels to fall with pH gradients varying in different parts of the mouth(132), making some areas of the mouth more susceptible to decay than other areas. The increased frequency of taking sweetened foods leads to rapid decay and acidification of the mouth. As discussed in the literature review, adverse food management practices in RACFs are common and their effects on oral health need to be better understood by nursing staff and RACF managers.

The frequency of eating carbohydrates is a major risk factor for the rate of new decay.(133, 134)  In this study, residents were too mobile and independent to monitor snacking and meals. Tracking the frequency of foods is more suited to high care nursing and high care dementia where residents are confined to their rooms or areas. However, from their training, nurses understood the association between the frequency of eating carbohydrates/sugars and the resultant drop in the pH of saliva. A food management column was included in the care plan as a reminder to nurses to schedule interventions after meals, even though food and snacking was not monitored during the study.

A glucose challenge is not part of the commercially available saliva test kit protocols but was added to enable nurses to see the effects of ingesting sweetened foods and the resultant pH drop in a practical way. This study showed the addition of the glucose challenge to be a useful educational tool for nurses.

## Chewing Versus Sodium Bicarbonate Intervention to Neutralise Mouth Acids

After the glucose challenge, nurses found they could raise saliva pH by either chewing or introducing a small increment of sodium bicarbonate toothpaste into the mouth.

Normal masticatory function and the ability to chew foods are required to naturally neutralise mouth acids by producing stimulated saliva containing buffers.(69) Nurses were able to see the importance of producing adequate stimulated saliva through chewing by recording the pH rise in stimulated saliva. Whole stimulated saliva was collected to measure flow, volume, buffering capacity and measure pH as per the commercially available saliva test kit.

In an unrelated study investigating chewing ability with age, of people aged over 50 years, found a decline of masticatory function at 3 and 7 years compared to baseline.(135)  The elderly including people suffering dementia who have poor masticatory function and limited salivary capacity will be unable to produce sufficient stimulate saliva to adequately neutralise mouth acids.(71)
Predictors for the prevalence of dental caries are oral sugar clearance, oral function and glucose in saliva. (133)  Age-related decrease in bite force, regardless of age or gender, is correlated with a decrease in salivary flow.(136)

Poor masticatory and salivary function, poor glucose clearance, frequent high sugar/carbohydrate diet and poor oral hygiene combined with chronic medical conditions and polypharmacy will likely result in a progressively worsening dry acidic oral environment conducive to increased oral disease due to the development of more aggressive acidophilic oral biofilms.(137)  A therapeutically useful strategy would be to alter the composition and chemistry of dental plaque so as to reduce the quantity of cariogenic bacteria and reduce the degree of acid production of those that remain.  Daily use of a bicarbonate based dentifrice can significantly reduce the number of Strep. Mutans and lower numbers of Lactobacillus in dental plaque.(137)

Advantages of sodium bicarbonate to neutralize mouth acids are:- only small increments of sodium bicarbonate toothpaste is required to rapidly neutralise mouth acids, the intervention is inexpensive and commercially readily available, this procedure requires minimal co-operation, quick, non-threatening and easily performed by untrained nurses and can raise oral pH independent of chewing and masticatory function.

This study allowed nurses to understand that mouth pH could be altered using multiple applications of small increments of sodium bicarbonate toothpaste. Nurses understood that sodium bicarbonate intervention delivered through scheduled care plans throughout the day may be able to maintain a less acidified oral environment. Nurses were able to use sodium bicarbonate toothpaste as an alternative preventive option when adequate chewing was not possible (in dentures wearers or disease), or if residents did not like to chew gum.

# SALIVA TESTING

## Saliva Consistency

Variation in participant's saliva consistency assessments between baseline nurse and OHT assessments and with baseline OHT and OHT +10week assessments were found.

Baseline nurses assessments of volunteers was as expected, with 4 volunteers in the healthy range and Volunteers 2 (Sjogren's) and 3 (anti-cholinergic medication) in the very low range.

Despite OHT findings of mucopurulent saliva consistency (-1) for participants 1, 6 and 8, findings on the same patients were found to be 'sticky and frothy' (score 2) for these participants.

A probable explanation for this discrepancy may be due to the nurse lack of experience in assessing saliva consistency as the nurses only previous experience in assessing saliva consistency was on healthy volunteers and possibly due to the lack of adequate emphasize during nurse training.
There was also some variation in OHT assessments due to lack of calibration among the dental professionals prior starting the study.  The classifications of 'Mucous purulent' (-1) and 'No saliva -Totally dry' (1) were new classifications introduced specifically for this study of which the OHTs had no experience.

On the basis of the study findings it is suggested that a new five category Saliva Consistency Scale be trialled in a more extensive study. The Author's suggested the following Saliva Consistency Scale:- Normal ( watery clear- score 4); Low (frothy, bubbly – score 3; Poor (sticky frothy, viscous –score 2); No Saliva (totally dry-score 1); Mucopurulent (mucous thick sludge-score -1).

This proposed new qualitative system can be scored to give a quantitative result for analysis in larger studies and better reflects circumstances likely to be encountered in RACFs and may be useful in future studies.

Table 26  Proposed New Aged Care Consistency Scale

| SALIVA CONSISTENCY | | SCORE |
|---|---|---|
| Normal | (watery, clear) | 4 |
| Low | (frothy bubbly) | 3 |
| Poor | (Sticky, frothy, viscous) | 2 |
| No saliva | (totally dry) | 1 |
| Mucopurulent | (mucous, thick sludge) | -1 |

Score -1, +1, 2, 3, 4 adapted from GC Saliva Check Buffer [TM]

It is suggested that mucopurulent saliva is usually seen only in high care nursing, high care dementia or near end stage of life. The importance of recognising mucopurulent saliva is that in some circumstances this condition may be a serious medical emergency requiring suction to clear the mouth and usually signifies major systemic problems needing urgent medical referral and assessment.

In general, when Volunteers 2 (Sjogren's) and 3 (anti-cholinergics) were removed from the data set as being outliers. Baseline volunteer saliva consistency assessments were better than participant assessments. These results may suggest that saliva consistency is a suitable method to assess the oral health in early dementia participants.

Participant numbers were too low to obtain meaningful statistical results. Larger numbers of test subjects are needed to assess whether this classification of saliva consistency is of benefit in risk assessment of early dementia patients.

# Hydration

Participant's hydration time results were recorded into their respective colour band and recorded for charting.

Differences between baseline Nurses (mean 0.30 sec.) and OHT (mean 67.5 sec.) hydration estimates were observed. A possible explanation for this difference may be due to this test being considered "too easy" and OHTs not calibrated before the study began. Nurses were given adequate demonstration of the lip hydration test during their training while the OHTs did not have these demonstrations. The difference may also be exaggerated due to the selection of the midway points taken as a reference of each band to create a graph as shown in Fig 18.

Despite the difference between baseline nurse and OHT assessments, the OHT assessments at baseline and at +10 weeks, were similar with mean scores of 67.5 sec. and 63.0 sec. respectively.

Lip hydration assessment is a very simple, non-threatening test requiring no special training and can be easily used by nurses for oral health assessment.

The discrepancy between nurse and OHT assessments is an unexpected result and worth further investigation as this assessment is probably one of the easier saliva tests to administer.

Nurse baseline hydration assessments of participants were half that of volunteers hydration assessments (mean 30 sec. versus 60 sec. respectively). Baseline nurse assessments of participants and volunteers may likely be more accurate than OHT assessments as the better reflect expected results.

This study found that lip hydration test may be suitable for oral health risk assessment of early dementia participants.

Larger numbers of test subjects are needed to fully assess whether assessing hydration time is of benefit in risk assessment of early dementia patients. Findings from this study suggest that this Hydration test to be feasible and a practical risk assessment tool.

## Saliva Flow

Although measurements of unstimulated (resting) whole saliva flow rate is not part of the commercial saliva test kit protocol, resting saliva flow rate was included is this feasibility study to determine if the test was suitable in a RACF setting.

Unstimulated saliva is important in providing protection of oral tissues through lubrication, preventing tissue desiccation, re-mineralisation of teeth, agglutination of oral micro-organisms and contains anti-microbial enzymes. Saliva contains anti-viral, anti-bacterial, anti-fungal properties, aids in digestion, taste, bolus formation and buffering capacity to neutralise mouth acids.(66, 67)

Salivary Gland Hypofunction (SGH) is generally accepted as occurring when resting saliva flow rates are less than 0.1ml/min and stimulated saliva flow rates are less than 0.5ml/min, causing the loss of the normal protective functions of saliva. Xerostomia is the subjective feeling of dry mouth and may or may not be associated with SGH. Saliva is essential components for good oral health, swallowing and systemic health containing a supersaturated solution of calcium and phosphate ions, multiple buffers, anti-microbial agents, lubricants & digestive enzymes.(69-72)

Unstimulated (resting) whole saliva is a better indicator than whole stimulated saliva of the degree of wetness of the oral cavity.(67)

Previous studies have reported variation in resting whole saliva flow rate in populations, with and without medication, sex and ageing. A recognised classification for resting whole saliva is:-

- Green     Normal     >0.25 - 0.35mg/min
- Yellow    Low        0.1-0 -0.25mg/min
- Red       Very Low   <0.1mg/min          (67)

In this study, a modified and more simple version was used to create a data set. The traffic light system was used to measure 3 minute collection of saliva and then classified as:-

- Green     Normal     >0.3mg/min
- Yellow    Low        0.1 -0.3mg/min
- Red       Very Low   <0.1mg/min

A resting saliva flow rate per minute was obtained by weighing saliva collected over a 3 minute period and dividing by 3 to obtain a flow rate per minute. These simple diagnostic tools were found to be useful and a feasible addition to saliva testing currently used in the assessment of oral health of older people in RACFs.

In aged care, degradation or loss of normal salivary function results in the loss of many important protective functions of unstimulated saliva that causes considerable morbidity from oral discomfort, pain, difficulty wearing dentures, difficulty with speech, swallowing and increased risk of oral disease.(67, 72)

In a text summarising research from around the world from 13 out of 17 studies investigating resting saliva flow rates found significant decrease in unstimulated whole saliva flow rates with age, irrespective of whether test subjects were healthy, medicated or non-medicated. The reduction in flow with increasing age is due largely to decrease in submandibular/sublingual flow. However, 4 out the 17 studies did not find this effect.(67) Increasing polypharmacy and disease will further suppress whole resting saliva flow rates.

Nurses assessment of volunteers with both normal and poor salivary function allowed nurses to better understand saliva function and helped nurses to better understand the benefits of saliva testing early dementia participants.

In this study, 'Low' (<0.1mg/min) resting whole salivary flow rates may correlate with decay rates. Participants 1,2,3,7 and Volunteers 2 and 3 may be considered at higher risk of oral disease.

Participant numbers were too low to obtain meaningful statistical results. Larger numbers of test subjects are needed to assess whether measuring unstimulated (resting) whole saliva flow rates are of benefit in risk assessment of early dementia patients.

In general, this study suggests unstimulated (resting) whole saliva flow rates were worse for early dementia participants than volunteers and is a suitable method for oral health risk assessment and in formulating nurse care plans for early dementia participants.

Previous studies on stimulated whole saliva flow rate in populations with and without medication, sex and ageing have recognised the classification below for stimulated whole saliva as:(67)

- Green      Normal'           1.0 – 3.0mg/min
- Yellow     Low'              0.7 – 1.0mg/min
- Red        Very Low          <0.7mg/min           (67)

In this study a modified and more simple version was used to create a data set. The traffic light system was used where 3 minute collection of stimulated whole saliva was assessed as:-

- Green       Normal              >3.0mg/min
- Yellow      Low                 2.1 – 3.0mg/min
- Red         Very Low            <2.1mg/min


The simple act of chewing produces stimulated saliva causing a rapid increase in saliva volume and speed of flows to help flush the mouth of food debris and micro-organisms, clears glucose from the mouth, facilitates swallowing and produces saliva rich in buffers able to neutralise mouth and plaque acid thereby promoting a healthier oral environment.[65] [69]  Paraffin wax stimulated flow rate is approximately 3 to 6 times the mean resting flow rate, while citric acid stimulated flow rate is 7-9 times greater.[67]  This study used the paraffin wax in the commercially available saliva test kit.

The main buffering system in stimulated saliva is predominantly produced by the Parotid Gland through the carbonate/bicarbonate system. Salivary carbonate concentrations increase with increasing flows to neutralise mouth acids.[68, 138] Most studies show no change in stimulated whole saliva flow rates or only a modest decrease in flow rate with increasing age.[67]

Very low resting and stimulated saliva flow rates may be a very strong indicator as to why Participants 1, 2, 3 and8, had a high incidence of decay. Participants 1, 2, 3, 4 and possibly 8 may be considered at higher risk of further oral disease based on their poor stimulated whole saliva flow rates and need care plans with more intensive preventive interventions.

In general, this study suggests stimulated whole saliva flow rate assessments are an important indicator of the risk to oral health of early dementia RACF residents and may be a suitable method in RACF settings to help formulate nurse care plans.

Participant numbers were too low to obtain meaningful statistical results.
Larger numbers of test subjects are needed to assess whether measuring stimulated and resting whole saliva flow rates are a suitable method of oral health risk assessment of early dementia patients.

## PH paper test strip and pH

Most oral assessments performed by both nurses and dental professionals involves qualitative interpretations of the mouth using OHAT, saliva consistency or general dryness to determine good or poor oral health. These qualitative assessments with inexperienced operators may lead to considerable variation and may miss obvious problems.

One of the advantages of pH assessments using pH paper test strip is that it provides a quantitative assessment of the acidity of the mouth, does not require specialised equipment and is a very rapid and non-threatening method to assess pH. Although, at times it may be difficult determine an exact colour match with the colour guides provided in the test kits, the exact match is not critical.  This study suggests that a general match or trend within a traffic light colour band system for mouth acidity (and other salivary markers) may be sufficient for nurses to assess risk.

Table 27  GC Saliva Check Buffer $^{TM}$ pH paper test strip colour descriptors



From GC- Saliva-Check BUFFER kit

This system is easy to understand and ideal for training nurses. The manufacturer does not advise placing pH paper test strip directly into the mouth and saliva needs to be either collected in a receptacle or by a disposable sponge applicator wetted by saliva sourced directly from the mouth to wet pH paper test strip.

There are a number of advantages and disadvantages using pH paper test strip for saliva testing in RACFs.

PH paper test strip is easy to use, suitable for untrained RACF staff, requires minimal training or equipment and does not require calibration.  The pH paper test strip is inexpensive and individual pH paper strips can be cut into several squares to take multiple readings. Although pH paper is not as accurate as a pH meter, it is more suited in a RACF setting as a pH metre would require special training, have additional running costs as calibration and cleaning solutions are required and there is a possible risk of cross contamination. The use of pH paper test strip is inexpensive and the costs involved in introducing routine pH assessments in RACFs

are unlikely to become a barrier.

The disadvantages of using pH paper test strip sourced from the commercially available saliva test kit is that the pH paper is designed to be used on people within the general population having relatively normal pH saliva values. In Aged Care, it may be possible to have mouth pH well below the level of the general community and well below the range the commercially available pH paper test strip can assess. In this study the range of the pH paper test strip was between pH5.0 andpH7.8. A number of the participants in this study had pH readings of pH5.0 and it is possible their actual pH was much lower.

A pH above pH7.8 is not likely to have oral health problems. However, serious oral health consequences are likely to occur where pH remains below pH5.0. It is suggested that the lower limit of the commercially available pH paper test strip used in this study was inadequate and pH paper test strip used in future aged care studies should be able to read pH3.0, as this is more likely to be below the lower limit when testing people with severe SGH.

Some nurses when comparing the same sample occasionally had difficulty on agreeing on an exact colour band requiring a third arbiter, particularly when there was insufficient saliva to wet pH paper test strip adequately.

The shelf life of the pH paper may be important as there may be colour variations of pH paper test strips with the age of the paper.(102)

Low resting saliva pH results in acidification of the mouth causing demineralisation through mineral loss from tooth structure and promotes growth of more aggressive acidophilic biofilm resulting in an increase of oral and systemic disease.

Resting saliva pH in this study was measured by two methods: Sublingual Resting pH (SRSpH) and the spit and drool method and the results compared:-

The rational for the comparing the two methods of assessing resting saliva pH was to determine whether a much simpler method of measuring resting pH, by wetting an applicator under the tongue (SRS pH) is valid and comparable to the more conventional spit/drool method of measuring pH of saliva collected over 3-5 minutes.

Comparisons between the two methods consistently found Volunteer SRSpH to be lower than the +3 minute collection method (n=5, mean pH6.9 to pH7.4 respectively), when the Sjogren's volunteer was removed from the data set as an outlier. This may be a normal finding in healthy adults and expected as spitting may stimulate salivary function and produce saliva with more buffering capacity

All participants, except Participant 5, had SRSpH and +3 minute saliva pH in the acidic (pH6.0-6.6) or highly acidic zones (pH <5.8). Although 2 participants had resting pH values at pH6.8 (healthy), no participant had resting pH above pH6.8. In contrast, all volunteers except for the Volunteer 2 (Sjogren's) had resting pH values above pH6.8 (healthy).

Although the test numbers were very small, the pattern of having a lower SRSpH compared to the +3 minute saliva pH in early dementia participants was not observed. This may suggest either that the quality of saliva in early dementia participants may be different to volunteers or they may not be able to produce saliva containing buffers when slightly stimulated by spitting as seen in volunteers.

Very low resting saliva pH may be a very strong indicator as to why Participants 1, 2, 3 and 8 had a high incidence of decay. Participants 1, 2, 3, 4 and 8 may be considered at higher risk of further oral disease based on their poor resting saliva pH and need care plans with more intensive preventive interventions.

In this study, low resting saliva pH and poor resting saliva flow rates showed a positive correlation.

SRSpH readings may be a more accurate reflection of the acidity of the mouth compared to the spit/drool method in people where oral stimulation and socialisation is lacking and physical oral movement is limited. SRSpH measured by wetting an applicator under the tongue to wet pH paper test strip was found to be a valid method to assess resting pH and comparable to the +3 minute saliva collection method.

When assessing RACF dementia residents, SRSpH may be a more suitable and preferred method to assess resting pH having the advantage that it is a much more rapid technique and more suited people with limited co-operation. This study found that it would be an important and a very simple assessment for nurses to routinely incorporate SRSpH as part of their OHAT assessments to assess the risk of oral disease when developing nurse oral health care plans. Regular saliva pH assessments or RACF residents should be within the scope of RACF nurse duties.

Participant numbers were too low to obtain meaningful statistical results. Larger numbers of test subjects are needed to assess whether SRSpH is a suitable method of oral health risk assessment of early dementia patients.

In summary, saliva testing allowed nurses to understand the importance and relevance of saliva pH and utilise this knowledge in the development of their oral care plans. SRSpH may be the only indicator of the risk of oral disease where there is poor co-operation.

Being able to periodically raise oral pH over the course of a day above that person's base resting saliva pH may decrease the risk of oral disease and decay. This may be achievable through a combination of preventive interventions aimed at raising oral pH, deliverable through scheduled nurse comprehensive oral care plans.

## Saliva Buffering Capacity

An understanding of the interplay between resting saliva pH, stimulated saliva pH and buffering capacity as related to salivary flows is important in understanding the risk associated with acidification of the mouth and demineralisation of teeth.

The main buffering system in saliva is the carbonate/bicarbonate system in stimulated saliva while a less active phosphate buffer system is present in unstimulated and mucous saliva. The carbonate/bicarbonate concentration in saliva decreases with decreasing salivary flow. Stimulation of saliva flow rates will increase bicarbonate concentration and resultant buffering ability to neutralise mouth acids.(64) (67)

Testing the buffering capacity of saliva gives an indication of the effectiveness of the saliva in neutralizing acids in the mouth, which may come from the diet, from dental plaque or from internal sources (such as gastric reflux). Unstimulated saliva has very low levels of bicarbonate while stimulated saliva has levels of bicarbonate more than 60 times higher. The GC Saliva Check Buffer test kit is designed to correlate with results obtained by titration techniques as specified in Ericsson's method (1959). (139)

The simple act of chewing produces stimulated saliva with properties very different to resting saliva. Stimulated saliva has much increased speed and volume aiding swallowing, flushing the mouth of food debris and micro-organisms, clears glucose from the mouth and produces saliva rich in buffers able to neutralise mouth and plaque acidity encouraging growth of a healthier oral biofilm and environment.

The buffer measuring strips in the commercially produced saliva test kit in this study had a range from 0 to 12, based on the traffic light system with red for 'Very low' (0-5), yellow for 'Low' (6-9) and green for 'High" (7-10). This system is easy to understand and ideal for training nurses.

Nurse baseline buffer assessments of participants (n=8) found 3 participants with buffering capacity at or above the normal limit (10), 3 at the low range (6-9) and 3 at the very low range (0-5).

OHT testing was consistently lower with no participant placed in the normal range, 3 in the low and 6 in the very low range. The OHT pattern of scoring is somewhat reflected by nurse results, albeit with higher scores, with nurse scores either within the same category as OHT assessments or one category above. Only Participant 6 may be an exception as there was a 2 category difference between nurses and OHT results (Normal versus Very Low).

It may be possible that the actual saliva buffering capacity was higher (or lower) than the buffer test strips indicate as 4 volunteers scored the maximum score of 12. Assessing the colour variations within the buffer strips can at time be difficult requiring a second and often a third arbiter and variations in scoring may also occur due variability in people determining colours.

The poorer the buffering capacity, the greater and steeper is the resultant pH drop after a glucose challenge, the more prolonged saliva remains in the acidic and very acidic zones leading to increased acidification of the mouth and increased risk of oral disease and demineralisation of teeth.(138)

Participant numbers were too low to obtain meaningful statistical results. Larger numbers of test subjects are needed to assess whether buffer assessments by RACF nurses are of benefit in risk assessment of early dementia patients and can help formulate nurse care plans that emphasize preventive interventions aimed at raising oral pH.

**Summary**

In summary, saliva testing is useful as a teaching tool for nurses and the saliva test results can be used as another tool to assess risk of oral disease. However, the ultimate determinate of effectiveness of an approach using daily scheduled intensive multi-intervention combination therapies deliverable through nurse care plans, will be a decrease in oral and systemic disease over time and not necessarily an improvement in saliva test results in those people completely lacking adequate salivary function.

## Plaque Scores

Poor oral hygiene results in growth of an oral biofilm, which over time matures and becomes progressively more aggressive adversely affecting hard and soft dental tissues of the mouth. Mature dental plaque can cause periodontal disease, tooth decay and poor oral and systemic health. In aged care, the inability to maintain one's own oral health due either to frailty, illness or dementia directly impacts oral and systemic health.

A number of indices have been developed to assess and monitor functional dependency in manipulating aids used in oral self-care such as the Index of the Activities of Daily Oral Hygiene (ADOH)(140) and Activities of Daily Living Oral Health (ADLOH).(35)

A Perth cohort study found mean plaques scores and extent of gingival inflammation were higher for residents classified as having a disability that affected their ability to maintain their own oral care. Residents who needed assistance with brushing had higher mean plaque score and more moderate gingival inflammation. Residents with disability and dementia had significantly worse results.(35)

Assessing the amount of plaque present in the mouth may give an indication of the risk of oral disease, the effectiveness of oral hygiene measures to prevent or control oral diseases and help prevent respiratory infections and systemic disease. (8, 10, 141) A systematic review revealed that root caries incidence can be predicted by risk models and that the most frequently described predictors of root caries incidence in published studies of risk models are root caries prevalence, number of teeth, and plaque index.(7)

Despite a simplified Oral Hygiene Index (OHI-S) being available (142), the longer Greene and Vermillion Oral Hygiene Index (OHI) was chosen for this study.(101, 142, 143)

The OHI was chosen as plaque and calculus scoring was intuitive and any tooth with the greatest coverage of plaque and debris could be chosen in each sextant allowing flexibility in selecting which tooth to score in a sextant due to the increased prevalence of tooth loss in the elderly. The scoring was rapid and suitable for early dementia participants in this study

The use of compressed air to dry tooth surfaces and water to remove gross debris allows easier and probably more accurate plaque score readings. OHT's did not have the benefit of compressed air and water during their assessments which

confounds the estimates of plaque scores between operators.

A further limitation was that Greene and Vermillion plaque scores are taken from buccal and lingual surfaces of teeth without scoring interproximal surfaces. Interproximal and lingual cleaning of teeth are much more difficult procedures than buccal and lingual surfaces. Cleaning interproximal surfaces may not be performed adequately particularly when assistance is required and resistive behaviours occur. Poorer interproximal cleaning may not be reflected in Greene and Vermillion plaque scores, nor would an association be detected of an increased risk of interproximal caries due to poor interproximal cleaning.

Assisted cleaning of buccal and lingual surfaces by RACF staff is more likely to be adequate on buccal and lingual surfaces. Plaque scores might even decrease after adequate assisted cleaning of buccal and lingual surfaces giving a false sense of improvement in a key oral health index yet the risk of interproximal caries may remain unchanged.

Another limitation of the OHI plaque scoring system is the inability to assess the thickness of dental plaque and oral biofilms and hence the total volume of cannot be assessed. The thickness of plaque will affect how well plaque acid can be neutralised by the normal flow of saliva and the effectiveness of preventive products and re-mineralising agents to penetrate plaque.

In this study, examiners (one dentist and two OHTs) were not calibrated prior commencement of the study. Future studies will require calibration between all examiners.

# Total Oral Bio-Burden Index (TOBI)

Current plaque scoring systems have a number of limitations. Most plaque scoring systems give an average score for selected teeth in each sextant which when added together give an indication of risk based only on dental plaque on teeth based on surface area not on volume. A further limitation of plaque scoring systems is that they do not assess the total bio-burden on all surfaces in the oral cavity which would include:- soft and hard dental tissues, fixed prosthetic units (implant retained overdentures or bridge pontics) and dentures.

The Total Oral Bio-burden Index (TOBI) is a new preventive oral health concept developed by the author and is the summation of plaque scores on all surfaces in the oral cavity consisting of:-

- **Soft Tissue Bio-burden Score:** The total plaque or microbial soft tissue load of the soft tissues of the mouth and tongue from the base of the tongue forward, including soft and hard palate, gingiva and mucosa.

- **Dental Bio-burden Score:** The total dental plaque score for all teeth and fixed dental units in the mouth including bridge pontics or fixed implant retained overlay dentures. In other words a plaque score is given to any structure in the mouth that cannot be removed.

- **Denture Bio-burden Score:** Plaque scores given to both tissue fitting surfaces and occlusal surfaces of dentures. The denture bio-burden score is obtained by the addition of tissue fitting and occlusal surface plaque scores.

The Total Oral Bio-Burden Index (TOBI) is proposed a method to establish a score for the total oral bio-burden based on surface area on all surfaces in the mouth. It is suggested that TOBI may better correlate with the over-all risk of oral and systemic disease emanating from the mouth, particularly with respiratory infections.

An assessment of the soft tissue bio-burden was beyond the scope of this study. The author is not aware of a method to assess the biofilm covering oral soft tissue surfaces needed to obtain a Soft Tissue Bio-burden score and at this stage this assessment is a theoretic concept related to a total oral bio-burden concept.
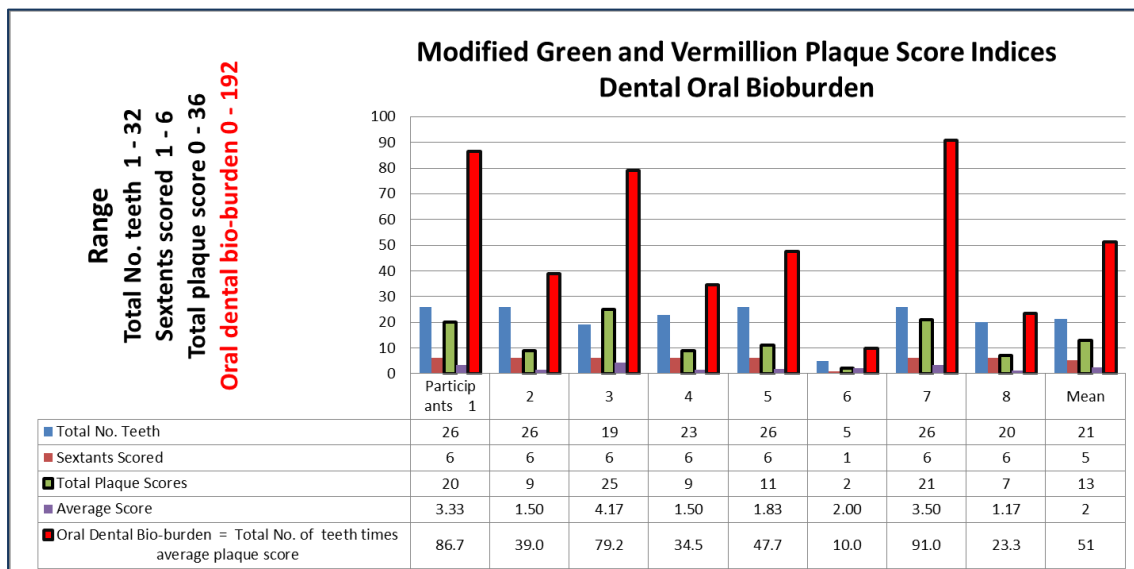
A study to evaluate a mucosal-plaque index (MPS) has been trialled which used a 1 to 4 scale with: 1 = Normal tissue appearance,  2 = Mild inflammation,  3 = Moderate inflammation,  4 = Severe inflammation.(144)  Although, the mucosal scoring was based on the appearance of mucosal inflammation and not on the biofilm, their findings may still be useful in assessing oral health risk.

In this study, only a Dental Bio-burden Score was assessed. Further studies need to be completed to see if these proposed bio-burden scores are effective in assessing risk.

Although a chemical approach to reduce oral micro-flora is not ideal, it may be the only option where assisted brushing is not effective or possible.

The Soft Tissue Bio-burden Score, used alone or in combination with the Dental and Denture Bio-burden scores, is a theoretical concept that may help explain the rationale for when to use more intensive chemical anti-microbial interventions containing chlorhexidine and sodium bicarbonate in care plans to reduce total oral pathogenic bio-burden.

Fig 36: Dental Oral Bio-burden Score
Modified from Greene and Vermillion: Average plaque score per sextant multiplied by the number of total fixed dental units in the mouth



**Modified Green and Vermillion Plaque Score Indices Dental Oral Bioburden**

| | Participants 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Total No. Teeth | 26 | 26 | 19 | 23 | 26 | 5 | 26 | 20 | 21 |
| Sextants Scored | 6 | 6 | 6 | 6 | 6 | 1 | 6 | 6 | 5 |
| Total Plaque Scores | 20 | 9 | 25 | 9 | 11 | 2 | 21 | 7 | 13 |
| Average Score | 3.33 | 1.50 | 4.17 | 1.50 | 1.83 | 2.00 | 3.50 | 1.17 | 2 |
| Oral Dental Bio-burden = Total No. of teeth times average plaque score | 86.7 | 39.0 | 79.2 | 34.5 | 47.7 | 10.0 | 91.0 | 23.3 | 51 |

Participants 1,2,3,8 with 3,3,6,8 carious lesions respectively

In the Greene and Vermillion Oral Hygiene Index (OHI), plaque scores are totalled and divided by the number of sextants scored. This score is an average score obtained by scoring a tooth in each sextant and does not take into account the total number of retained teeth or fixed dental units that cannot be removed from the mouth. The greater number of teeth retained and the larger the surface area of fixed dental units such as bridge pontics and implant retained prosthesis, the greater will be the overall dental bioburden.

Figure 36 illustrates how a Total Dental Bio-burden Score could have an increased sensitivity as a measurement tool as compared to OHI scoring systems.

For example, Participant 6 above, has only 5 remaining anterior teeth, wears a full upper denture opposing a 6 teeth part lower chrome denture. Her average sextant plaque score was 2.0. When multiplied by her remaining teeth, Participant 6 has a total dental bio-burden score of 10.0. Her Denture Bio-burden score needs to be added to the dental bio-burden score to give a Total Oral Bio-burden Index result. However, even when dementia patients show resistive behaviours making assisted brushing difficult, dentures can usually be removed, cleaned and disinfected, while natural teeth and fixed dental units cannot.

Participant 5 had 26 remaining teeth, did not wear a denture and had a lower average sextant plaque score of 1.83. When multiplied by the total number of remaining teeth (or fixed dental units), Participant 5 had a Dental Bio-burden Score of 47.7.

Although participant 5 had a lower average plaque score than participant 6 (2.0 versus 1.83 respectively), participant 5 has a greater Total Dental Bio-burden Index (47.7 versus 10 respectively) due to increased number of retained teeth placing her at higher risk of oral and systemic disease sourced from the mouth.

It is suggested therefore that a person with a plaque score of 10, from 6 sextants, but with a full complement of 32 teeth would have a greater dental bio-burden than would another person with the same plaque score of 10 but with 20 remaining teeth in 6 sextants. In the first example, dividing the plaque score of 10 by the 6 sextants scored results in an average plaque score per sextant (10/6=1.7). Multiplying the average plaque score by the total number of teeth in the mouth results in a Total Dental bio-burden of 53 (1.7*32= 53) for a person having 32 teeth.

In the case of the second example, multiplying average plaque score by the total number of teeth results in a Total Dental Bio-burden of 34 (10/6=1.7 * 20 = 34) for the person having 20 teeth.

Having a similar average sextant dental plaque scores may have very different oral risk profiles dependant on the number of teeth retained. The Total Dental Bio-burden Index may better reflect this risk. In the above example, the first person would be at higher risk of oral and possibly respiratory disease than the second with dental bio-burden scores of 53 and 34 respectively despite having the same OHI plaque scores.

Under this scoring system the range of Dental Bio-burden Scores would be between 0 – 192 for 32 teeth.

The concept of assessing risk based on measuring the surface area occupied by pathogenic biofilm on oral soft tissues, fixed dental units and dentures to obtain an oral bio-burden score was not considered as part of the study protocols prior the commencement of this study and only developed as the study progressed. As a

result, dentures in this study were not plaque scored and the concept of an assessable denture bio-burden score based on total denture size was not included in this study but may be useful in future oral health studies.

**OHAT Limitations with Respect to Bio-Burden**

The OHAT section 'Dentures' assesses the structural integrity and function of the denture by assessing the denture base, number of fractured or worn teeth and number of hours worn during the day.

Three participants with dentures were assessed through OHAT, by nurses and an OHT at baseline and again at 10 weeks by an OHT using the Montefiore OHAT scoring system:- 1 (healthy), 2 (changes), 3 (unhealthy), 4 (referral) is equivalent to scores 0, 1, 2, 3 in the Chalmers 2009 study.

Table 28  OHAT Denture Scoring System

| Participant | Nurse baseline | OHT baseline | OHT +10 weeks |
|---|---|---|---|
| 3 | 2 | 2 | 1 |
| 5 | 1 |  | 1 |
| 6 | 1 | 1 | 1 |

Participant 8: had recently lost her denture just prior the commencement of the study
Participant 5 attended her baseline OHT assessment visit without taking her denture

The OHAT section 'Oral Cleanliness' does not attempt to assess dental plaque but comes closest to assessing oral bio-burden by combining both mouth and dentures cleanliness into one assessment.

Montefiore scoring system and descriptors are:

1 scores 'Clean and no food particles or tartar in mouth or on dentures'

2 scores 'Food, tartar, plaque 1-2 areas of mouth, or on small area of dentures'.

3 scores 'Food particles, tartar, plaque most areas of mouth, or on most of dentures'

Participants 1- 8 nurse oral cleanliness scores at baseline and +10 weeks were

Table 29  OHAT Oral Cleanliness Scoring System

| Participant | Nurse baseline | OHT baseline | OHT +10 weeks |
|:---:|:---:|:---:|:---:|
| 1 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 |
| 3 | 2 | 1 | |
| 4 | 1 | 1 | 1 |
| 5 | 1 | 1 | 2 |
| 6 | 1 | 1 | 1 |
| 7 | 1 | 1 | |
| 8 | | 1 | 1 |

Baseline Participant Nurses OHAT versus OHT OHAT for oral cleanliness and
OHT OHAT cleanliness assessment at Baseline versus +10 weeks
The lower the better

Neither the OHAT categories for 'Dentures' or Oral Cleanliness' differentiate the relative risks from bio-burden sourced from the surface areas of a dentures or fixed dental units.

A Denture Bio-burden score would recognise and quantify the relative risk based on denture surface area. The poorer the cleanliness and the greater the surface area of a denture, the greater will be the biofilm colonising denture surface areas and the greater will be the effect on the total dental bio-burden of the mouth.

A number of studies to assess denture plaque have used erythrosine and fluorescein plaque disclosing dyes to score a denture plaque index. The scoring is usually per denture quadrant and is suitable for use in a RACF setting. (145-147)

Full dentures in the studies above were scored according to the percentage plaque coverage of denture surfaces quadrants on both tissue fitting surface and the outer facial surface quadrants as follows:-   0 = no plaque;  1 = light (25%),  2 = moderate plaque (26% to 50%),  3 = heavy plaque (51% to 75%),  4 = very heavy plaque (76% to 100%).(145)

However, a disadvantage of the denture visual scoring index in the studies above is that the plaque on palatal non tissue fitting surface and dentures plaque thickness or volume of plaque on all denture surfaces are not scored.

Additionally, the size of the denture may affect the amount of biofilm retained in the mouth. A poorly maintained 3 tooth partial denture will have less bio-burden than a poorly maintained 6 tooth partial denture.  Denture surface area is difficult to determine clinically, however a possible solution may be to multiply the denture plaque score by the number of teeth in a partial denture. Further studies need to be carried out to see determine if this is a suitable strategy.

It is suggested that the theoretic Soft Tissue Bio-burden Score, together with the assessable Dental Bio-burden Score and assessable Denture Bio-burden Score should be considered together when assessing total oral bio-burden risk in a summated TOBI score. The main distinguishing feature between dental and denture

bio-burden indices is that fixed dental units such as teeth, implant retained over dentures and bridge pontics cannot be removed from the mouth while denture bio-burden risk can be more easily reduced as dentures can be removed, regularly cleaned and disinfected.

Participant numbers were too low to obtain meaningful statistical results of plaque indices.

Although not part of this study, the author recommends the periodic use of disclosing solution on dentures prior cleaning by RACF nurses to better visualise dental plaque on denture surfaces.


# Rational for Preventive Combination Therapies

The design of clinical trials to test multicomponent interventions, such as geriatric syndromes (148) or on how to prevent falling (149), in which more than one risk factor is related to the outcome (99) may be a more effective strategy than concentrating on an individual risk factor and a single preventive intervention.(150) This early dementia feasibility study followed a similar study design principle as poor oral health is also a multifactorial condition requiring multi-component interventions to improve oral health. The combination of all or some of the preventive interventions acting together may have an additive effect on positive outcomes. Multifactorial assessment of risk allowed nurse care plans to deliver multicomponent interventions as a form of combination therapy.

Some procedures and interventions may have a greater level of compliance. Offering a range of interventions, particularly when 2 interventions serve similar functions (such as chewing and sodium bicarbonate toothpaste to neutralise mouth acids), allows greater flexibility in personal likes and dislikes which then may directly affect compliance. Furthermore, oral health benefits may occur even when only some or most but not necessarily all of the scheduled interventions are adhered to.

Additionally, saliva is a multi-constituent material with multi-functional properties. Normal saliva functions include: protection against demineralisation, lubrication, anti-microbial, digestion, bolus formation and buffering capacity to neutralise mouth acids.(66, 67) Saliva alone, also has the ability to exert an important remineralization effect over time to retard or prevent caries.(151) The loss of normal saliva quality results in the loss of saliva's normal multi-functional activity and protective capacity. Currently there is no one material or product that can adequately perform all the functions of saliva.

Attempting a single preventive intervention to mitigate against one risk factor, such as prescribing high fluoride toothpaste to reduce the incidence of decay, may not be an effective strategy. Saliva dysfunction as a whole may be so great that the totality of the dysfunction may overwhelm the protective benefit of the one intervention used alone. Reversing the effects of the loss of saliva's multi-functional activity may require using multiple preventive products directed at mitigating the loss of saliva function as a whole and not just selecting interventions directed at one single salivary deficit.

When high fluoride substances, (toothpastes, rinses and gels) are used in people with impaired oral clearance (due to SGH and disease) the concentrations of fluoride levels remain higher in the mouth and remain for a longer periods of time as compared with those individuals with normal clearance.(152)  Slower clearance of preventive products, including CPP-ACP and anti-microbial toothpastes in people with SGH, may prove to be an advantage and may provide a possible strategy to help maintain better oral health in the elderly.

Introducing preventive products frequently and allowing these products to slowly dissolve in the mouth without rinsing may have a greater benefit in older people with poor salivary function than in younger people with better saliva function.

The study organisers provided a range of products that might help compensate for some of the important constituents missing in poor quality saliva suitable to be used in a dementia study in a RACF setting and for aged care in general. Individualised multifactorial nurse assessment allowed nurse care plans to deliver multicomponent interventions as a form of combination therapy to improve many of the functions lacking in poor quality saliva. The selection of the type of product, number of products and frequency of use was determined by nurses from a range of products.

In this study, the only compulsory product used in NSCOCPs was high fluoride toothpaste in the mornings while other products were optional depending on nurse assessments. The author considers high fluoride toothpaste to be a universal preventive intervention product in a RACF setting and is recommended in Australian Government Better Oral Health in Residential Care process.(97, 98).

The author found that nurses better understood what product to use, when to use each product and the frequency of use of each product once they understood the reason for the intervention. Additionally, nurses found that understanding the reason for the use of a product was easier than trying to memorise a list of product names without knowing why they were using that product.

# Preventive Products: Scheduled Combination Therapies

## High Fluoride Toothpaste

Product: Neutrafluor5000: Colgate-Palmolive Co.

The benefits of high fluoride toothpaste in high risk caries individuals have been well documented.(37, 152-155) An in-vitro study concluded that 1.1% sodium fluoride (5000 ppm F) dentifrice demonstrated greater remineralization ability than 10% CPP-ACP topical tooth cream.(151) A review of the literature showed regular use of dentifrices containing 5,000 ppm F seem to be efficacious in decreasing progression and initiation of root caries.(156)

The application of a high-fluoride containing dentifrice (5000 ppm F) in adults, twice daily, significantly improves the surface hardness of untreated root caries lesions when compared with the use of regular fluoride containing (<1350 ppm F) toothpastes. The potential application of such a product is particularly beneficial in improving oral health and reducing root caries susceptibility in elderly adults.(157)

The importance of high fluoride toothpaste was stressed to nurses during their training. High fluoride toothpaste was considered to be the only obligatory intervention for use in RACF comprehensive oral care plans.

Fluoride interventions (varnishes, gels, and toothpaste) seem to have the most consistent benefit in decreasing the progression and incidence of noncavitated carious lesions in enamel.(158) This paper also mentions a significant shortcoming of high fluoride toothpaste in that it requires up to 6 months to be effective which may be beyond the capacity of fluoride to stop root caries in some high risk elderly.

This time lag before high fluoride toothpaste becomes effective is critical as caries will continue to remain active. Relying on a single intervention approach, such as high fluoride toothpaste may not prove effective when risk factors combine to create an oral environment able to overwhelm the effectiveness of the high fluoride toothpaste when poor oral hygiene, SGH and increased dependencies on carers to maintain oral health combine.

Unrelated to this study, the author has found that applying silver fluoride followed by stannous fluoride arrests caries and prevents re-activation for up to 3-4 months in patients with poorer salivary function and up to 6 months in people with better salivary function.(13-15) The author suggests combining silver fluoride followed by stannous fluoride applied 3-4 monthly together with daily high fluoride toothpaste may help overcome this time lag in which tooth structure remains at higher risk.

## Amorphous Calcium Phosphate Stabilized by Casein Phosphor-Peptides (CPP-ACP)

Product: GC Tooth Mousse Plus, GC Co.

GC Tooth Mousse Plus contains RECALDENT™ (CPP-ACPF: casein phosphopeptide amorphous calcium phosphate fluoride) with 900 ppm fluoride. (159)

CPP-ACPF applied in the oral environment binds to biofilms, dental plaque bacteria, hydroxyapatite and soft tissue to become reservoirs for calcium, phosphate and fluoride (160)(161) The addition of fluoride to CPP-ACP formulation was found to enhance remineralization.(151) (162) The anti-cariogenic potential of CPP-ACP has been demonstrated in in-situ human caries model, in vitro remineralization models and in human trials. CPP-ACP with fluoride was shown to have additive effects in reducing caries experience. (161, 163, 164). An in vitro study found CPP-ACP on dentine surfaces provoked lower demineralization and higher remineralization in comparison to untreated dentine surfaces (165) which may affect root surface caries.

However, a review article found, 'CPP-ACP vehicles alone or in combination with fluoride therapy are very limited in number and in the majority of the cases did not show a statistically significant reduction in anti-caries benefit' of noncavitated carious lesions.(158) Although this review was comprehensive (with 29 publications included out of 103 publications examined from 625 publications found), most of the articles selected were on children with only 4 publications on adults with ages ranging from mid-teens to mid to late thirty years of age.

The review above did not include papers on the elderly where the saliva quality may be very different to younger people as the elderly have a higher incidence of polypharmacy induced SGH with a resultant reduction in naturally available calcium and phosphate ions to re-mineralise teeth.

Slower salivary clearance is associated with poor saliva function and is more commonly found in older people. Slower clearance of CPP-ACP paste may have a greater beneficial effect on the elderly than in younger people. This effect may hold greater importance in the elderly who are unable to maintain their own oral care, carry a greater pathogenic bioburden and higher incidence of root caries.

The lack of randomised controlled studies or even cohort studies on CPP-ACP in aged care is a major problem. No articles using CPP-ACP and dementia as key words were found by the author.

Where compliance with assisted brushing is poor, due to resistive behaviours, nurses were recommended to introduce small increments of a high fluoride toothpaste and CPP-ACP paste into the mouth at the same time, twice daily on a disposable applicator stick or spoon and left to dissolve without brushing.

High fluoride toothpaste is recommended for routine use in RACFs. CPP-ACP paste can be added to this intervention where risk is assessed as high.(32, 84)

## Hydration

Water is often overlooked as an intervention. Reduced thirst and fluid intake in the elderly in the presence of physiologic need and diminished water conservation by the kidneys is a predisposing factor for dehydration in the elderly.(166)

Water intake is mainly stimulated by thirst, and since the thirst sensation decreases with aging, risk factors for dehydration are those that lead to a loss of autonomy or a loss of cognitive function that limit the access to beverages.(167) Due to thirst mechanism malfunction, the elderly consume insufficient liquid amounts and they often drink when dehydration has already appeared.(168)

Adequate hydration is necessary for normal saliva function and the prevention of Xerostomia and SGH. Lack of adequate hydration is a major risk factor for new decay and poor oral and systemic health outcomes.(169) The healthy range of water consumption for an adult is 1500mls-3000mls and varies depending on age, physical exertion and temperature.(168)

Hydration is further compromised if the elderly has difficulty swallowing or has a greater level of dependency requiring assistance to place a cup or straw to their mouths or as may occur in people with dementia by forgetting to drink. Reduced fluid intake over time will result in diminished salivary flow and salivary function.

Nurses were advised participants had to ingest a minimum of 1600mls of water a day unless they were for medical reasons for water restrictions.(169, 170)

However, caution needs to be taken before recommending increased water intake if the patient is on a water or fluid restricted diet due to a medical condition in which case it is prudent to discuss this matter with the person's medical practitioner.

In this study, the participants were too mobile and independent to monitor water intake. Monitoring hydration in a RACF requires maintaining a log of all fluid ingested from all sources and is not practical to monitor independent mobile residents even when they have early dementia. Monitoring water and total fluid intake may be better suited to high care nursing where RACF residents are more dependent and likely to be confined to their rooms.

Hydration was included in the care plan as a reminder to nurses of the importance of adequate liquid intake but not monitored for this study.

## Artificial Saliva - Saliva Lubricant

Product:  OralSeven (Oral7)™ Moisturising Mouth Gel (Auspharm)

Oral7 gel was chosen for this study due to its high pH (pH 6.1) compared to other moisturising gels.(171)  Oral7 also contains calcium, xylitol and fluoride as well as containing anti-microbial agents, lactoperoxidase, lactoferrin and lysozyme.(172)

However, a study investigating anti-microbials concluded that the utility of oral hygiene products with antimicrobial proteins and substitutes of the salivary peroxidase enzyme system yielded no positive results, at least in elderly individuals(173) This study did not investigate Oral7 gel.

In people with medication induced xerostomia and SGH, management of dry mouth symptoms is mostly palliative and consists largely of topical therapies. Management is aimed at symptomatic relief through the use of oral lubricants/moisturisers to act as saliva substitutes. More complex saliva substitutes attempt to mimic the protective properties of saliva through the addition of re-mineralizing and antimicrobial agents.(171) The introduction of this product into the mouth multiple times is likely to raise a low mouth pH environment directly as well by simply stimulating the mouth.

A number of products on the market place could have been suitable for this study. The pH of oral lubricants may be important as frequent use of a low pH oral lubricants may contribute to maintaining an acidic oral environment.
The pH values of commonly available oral lubricants are listed in the table below. Biotene was not recommended for use due to its low pH.

Table 30  Preventive product pH values

| Product | pH |
|---|---|
| OralSeven™ Moisturising Mouth Gel | 6.1 |
| Colgate Dry Mouth Gel(174) | 6.0 |
| GC Dry Mouth Gel (175) | 6.0 |
| Colgate Dry Mouth relief Fluoride Mouthwash (174) | 5.8 |
| Biotene* (176) | 4.7 |

Adapted from Dost  and Farah 2013 (171)

Artificial saliva is a misnomer as no current product can truly replicate all the functions of saliva.  A more apt descriptor would be artificial oral lubricants or moisturisers and not artificial saliva.

A high pH saliva lubricant is recommended for use in future studies.

## Salivary Gland Stimulation

Product: Miradent Xylitol Chewing Gum (Hager and Werken GMBH and Co.
1 gm tablet contains 0.72gm Xylitol

Where residual salivary gland function remains, saliva stimulants may also be considered an important intervention.(171)  Simple chewing, particularly hard foods is considered a saliva stimulant and encourages salivary gland function.
Nurses found issuing gum to participants an easy intervention able to be easily integrated into the nursing home routines similar to issuing medications.

Nurses understood the benefits of chewing and its effects on saliva function through their training. Without this understanding, nurses would be less likely to encourage chewing or schedule chewing gum into NSCOCPs to help maintain salivary gland function. Nurse class room education was re-enforced during saliva testing when nurses recorded higher pH values for stimulated saliva through chewing to naturally neutralise mouth acids.

Nurses learnt that saliva gland function in the elderly may deteriorate simply through lack of chewing and could be expected to worsen further when RACF residents are subjected to poly-pharmacy.


### Chewing Gum With and Without Xylitol

Most studies report an improvement of oral health from increased chewing of sugar free gum.

A study of people 18-65 years, stratified by age group, found despite resting flow rates decreasing with increasing age, saliva pH rose with chewing gum and increased days of chewing sugarless gum was associated with decreased severity of caries.(177)

Chewing sugar-free gum elevates plaque pH and thus favours mineralization.(68)
In people with SGH where residual saliva function remains, chewing will elevate saliva pH, saliva flow rates and calcium and phosphates in saliva favouring re-mineralisation.

Although the critical pH of dental enamel is often reported as a fixed value of pH5.5, the actual critical pH of enamel varies over a wide range depending on calcium and phosphate concentrations in saliva.(79)  Similarly the critical pH of dentine varies with active carious lesions at or below pH5.8 and arrested lesions at or above pH6.3, also dependant on calcium and phosphate concentrations. (130, 178)

Where SGH exists due to polypharmacy or systemic diseases, the calcium and phosphate concentrations in saliva are greatly diminished creating an oral

environment where tooth structure will dissolve in a less acidic oral environment due to the lack of minerals. Chewing raises the critical pH of enamel and dentine by increasing calcium and phosphates concentrations in saliva as well as the pH of the mouth promoting mineralisation to help retard tooth decay.

A literature review concluded that chewing gums appear to increase saliva production in those with residual secretory capacity and may be preferred by patients, but this study found no evidence that gum is better or worse than saliva substitutes for Xerostomia relief.(179)

A one year controlled double blind study of RACF residents compared Chlorhexidene/Xylitol gum, Xylitol gum and a no gum control group, found better oral health with significant improvements in saliva flow rates, reduction in plaque and debris indices as compared to baseline and controls. Both chlorhexidene/xylitol gum and Xylitol gum had reductions in denture stomatitis and angular cheilitis with the chlorhexidene/xylitol gum having a greater effect.(180)  A randomised controlled trial found prescription of sugar-free chewing gum with xylitol to dentate older people living in the community and attending routine dental services was not associated with a significant increase in stimulated saliva flow. This study found significant improvements in Plaque and Gingival Index scores, and in self-perceived oral health.(181)

A Cochrane review found there was low to very low quality studies and there is insufficient findings to determine whether any other xylitol-containing products can prevent caries in infants, older children, or adults.(182).  However, this article did not review xylitol containing chewing gum in adults. All but one of the articles examined were on children and adolescents with normal salivary function and only one article on adults was included.

A 3 year study of adults aged between 21-80 years (mean c:47 years) found daily use of xylitol lozenges did not result in a statistically or clinically significant reduction in 33-month caries increment among adults at an elevated risk of developing caries.(183)  However, this study did not record salivary gland function.

Re-examination of the data above in a later article by the same researchers found that xylitol appears to have a caries-preventive effect on root surface caries among caries-active adults, but less so for coronal surface caries due to differences in structure and critical pH of root and coronal surfaces, composition and virulence of root and coronal biofilms and greater root surface biofilm stagnation. The results of their secondary analysis showed a statistically significant, 40% reduction in root surface caries per year.(184)

Similar studies suggest that xylitol may inhibit plaque formation and thus exert an active caries preventive effect although in the case of xylitol-containing chewing

gums the caries preventive effect may be due largely to salivary stimulation rather than from the xylitol released from the gum.

This feasibility study found that some participants did not like chewing gum or began to use chewing gum enthusiastically at the beginning if the study but then used less over time. Additionally, some participants liked one flavour of gum over another and not chewing gum was enough of a reason to stop chewing if their favourite gum was not available.

Part of the design of this study was that participants and nurses had choices. Those who did not like chewing gum had alternative preventive products available that nurses could recommend.

About half the participants found chewing gum a great benefit and continued to ask for gum after the study had finished.

Establishing a gum chewing habit early when approaching old age may be important. Many older elders do not consider the practice of chewing gum favourably. A chewing habit may be easier to acquire if gum is introduced at age 65 years when people are more likely to understand the benefits of chewing than much later in life when cognitive decline together with the increased incidence of chronic diseases and poly-pharmacy are more likely to result in poorer salivary function adversely affects oral health.

Chewing gum may not be suitable for people wearing full and part dentures. Chewing gum is recommended even when there is limited number of functioning pairs of teeth in which case early dementia elderly may have to be reminded to remove their part dentures.

In summary, chewing sugarless gum, preferably with xylitol, is important to help maintain masticatory and saliva function and should be considered an adjunct to other oral hygiene procedures in older people.(180)

**Acid Neutralising Toothpaste to Neutralise Mouth Acids After Meals**

Product: Colgate Acid Neutraliser Toothpaste: Colgate-Palmolive Co.

Colgate Acid Neutraliser toothpaste was chosen as it contained sodium bicarbonate arginine, calcium and sodium carbonate. This toothpaste has a higher concentration fluoride (1450 ppm F) than most other toothpastes available in the market place.

The importance of maintaining a higher pH and neutralising mouth acids after eating was stressed during nurse education sessions. Nurse saliva testing allowed nurses to see the rapid rise in saliva pH after a small increment of sodium bicarbonate toothpaste was introduced into the mouth. Nurses understood the significance of neutralising mouth acids after eating in dementia residents who were unable or unwilling to chew gum, who had a swallowing risk or were denture wearers unable to chew gum.

This early dementia feasibility study used pea size increments of sodium bicarbonate toothpaste administered into the mouth 4-6 times a day, preferably soon after meals and in an alternating combination with chewing gum. Anecdotally, nurses commented on some participants having a noticeable improvement in participant's oral malodour. Nurses monitored gastric symptoms and were advised to stop the use of any product causing bloating, gastric or bowel problems. No gastric or abdominal problems were found during the 10 week study period.

However, the taste of sodium bicarbonate dentifrices may be unpleasant to some people. Increasing the concentration of sodium bicarbonate increases the saltiness and likelihood of resistance to the toothpaste. Colgate Acid Neutraliser toothpaste also contains sodium lauryl sulphate and can be quite tangy and may have a stinging sensation when put onto the tongue. In people with SGH, wetting the toothpaste helps reduce discomfort. A recently released, less tangy children's version of this toothpaste by the same manufacturer was not available at the time this study commenced. The children's toothpaste may be more palatable for older people. There has not been a product especially formulated to help neutralise mouth acids for aged care.

A review of 5 independent randomised controlled, blinded cross over study found sodium bicarbonate (between 20%-65%) toothpaste significantly enhanced plaque removal compared to non sodium bicarbonate toothpastes. The greater the concentration of sodium bicarbonate the greater was the plaque reduction effect.(185)

Sodium bicarbonate has a profound alkalinizing effect on saliva, can be used to increase saliva pH and buffering capacity, facilitate mineralization in patients with caries or dental erosion, suppress aciduric micro-organisms, improve or normalize

taste function in subjects with xerostomia-related taste dysfunction and neutralize acids to prevent erosion caused by episodes of prolonged exposure to weak acids or short-term exposure to strong acids (reflux).(68)

Baking soda may dissolves in plaque fluid and due to its high pH (pH8.2) has a physical effect on the structure of plaque, reducing its viscosity, adhesiveness and cohesiveness making it easier to remove by brushing.(185)  Sodium Bicarbonate toothpastes have a direct anti-bacterial cleaning effect and reduces the pathogenicity of the oral micro-flora by raising the pH and may reduce the numbers of acid loving bacteria in the mouth, although this effect lasts only as long as the mouth stays alkaline.(186)

A study comparing 6 dentifrices found as sodium bicarbonate dentifrice was more effective in reducing Candida strains than 5 other dentifrices.(186)

Dentifrices containing 20% or more  baking soda  can confer a significant odour reducing benefit for time periods up to three hours.(187)
The mechanisms whereby baking soda inhibits oral malodour might be related to its bactericidal effects and its transformation of volatile sulphide compounds to a non-volatile state.(188)

Sodium Bicarbonate can be delivered in toothpastes, rinses, swabs or sprays. The use of a sodium bicarbonate muco-adhesive spray (Cariex) on the mucosa was shown to reduce the time mouth pH remained lower than 6.0 and was shown to enable a faster continual rise of salivary pH as compared to controls after a glucose challenge. This study concluded that sodium bicarbonate spray helps to control the lowering of salivary  pH  following carbohydrate consumption and might therefore add to the prevention of caries and dental erosion.(189)

No adverse events were found when relatively much larger oral doses of sodium bicarbonate (4gms) were administered 3 times a day to healthy adults.(190) Patients suffering from chronic kidney disease who were administered higher doses of sodium bicarbonate were found not to have any adverse results.(191)

Adverse events are more likely to occur if sodium bicarbonate rinses are swallowed (68) than from several small increments of toothpaste taken throughout the day. Adverse events include gastrointestinal symptoms such as nausea, vomiting, belching, and flatulence from oral exposures and mild electrolyte abnormalities (hypokalemia, hypocalcemia, hypernatremia) and metabolic alkalosis. Mild toxicity is highly unlikely as studies with ingestion of high dosages of sodium bicarbonate do not show any adverse health outcomes.

In this study, the sodium bicarbonate toothpaste used to neutralise mouth acid also contains arginine which can play a significant role in stabilizing the oral microbiome, reduce the risk for pH mediated oral conditions and diseases and potentially reverse early stages of demineralization.(192)

Many organisms associated with dental health are able to use arginine or urea to generate ammonia via the arginine deiminase system or urease enzymes. Alkali production by these bacteria can positively affect the balance between remineralization and demineralization of the tooth and may also help to prevent the emergence of a cariogenic microflora resulting in an inhibitory effect on the initiation and progression of dental caries.(193)

In a double randomised study to evaluate the clinical effect on plaque metabolism of a dentifrice containing 1.5% arginine and 1,450 ppm F compared to a commercially available dentifrice containing 1,450 ppm F found the arginine containing toothpaste had significantly higher plaque pH values before and after a sucrose challenge than those using the commercially available control dentifrice. Subjects using the test dentifrice also produced higher levels of ammonia and lower levels of lactic acid compared to subjects using the control dentifrice.(194)

The study above was on younger people recruited from the company making the 1.5% arginine and 1,450 ppm F product. Recently the company's research methods (excluding the study above) and the commercialisation of their product has been criticised for having bias.(195)  A systematic review and meta-analysis demonstrated a synergistic effect of arginine when used in conjunction with fluoride on early coronal and root caries compared with placebo or fluoride alone. However, the reviewers also were concerned about issues of bias.(196)

This study used 3 preventive products (mouth lubricant/moisturiser, sodium bicarbonate toothpaste and chewing gum) to neutralise mouth acids and raise mouth pH to a healthier state. Other preventive products and procedures may prove effective in alkalising both saliva and dental plaque and be able to maintain the mouth in a healthier state. Additional interventions and procedures, beyond the scope of this study, are able to raise mouth pH and could be incorporated into the mix of multi-component interventions in care plans to suit the individual in future studies. Other interventions able to alkalise mouth and dental plaque acids are:- Alkaline water (168), (197), carbamide peroxide (198, 199), antacid tablets (200), Gum of Arabic(200), probiotics (201) (202) and through diet by ingesting high pH foods and relatively unsweetened biscuits high in baking soda instead of sweetened low pH foods.(203)

In summary, the ability to alkalise saliva by scheduling multiple applications of toothpastes throughout the day, particularly after snacks or meals to alter an unhealthy oral environment to a healthier oral environment is an important preventive intervention in oral care plans. The use of small pea size increments of sodium bicarbonate toothpaste to help retard acidification of the mouth by neutralising mouth and food acids after eating is recommended by the author for the elderly with poor salivary function, poor plaque control, who have a high risk of oral disease and are dependent on others to perform basic oral care tasks.

## Anti-Microbial Toothpastes or Gels

Product: Curascept Toothpaste 0.12% Chlorhexidene (Curaden Swiss, Australia) Contains xylitol and is sodium lauryl sulphate free.

Previous studies have shown that 0.12% Chlorhexidene (CHX) is an excellent broad-spectrum antimicrobial agent that can significantly reduce the number of both facultative and obligate anaerobes in plaque.(204)

In gingivitis patients, CHX mouth rinses together with oral hygiene versus placebo, or a control mouth rinse provides significant reductions in plaque and gingivitis scores, but with a significant increase in staining score and altered taste perception.(204, 205)

More recently CHX containing products, many of which contain chelated zinc, have been produced that stain teeth less than the earlier products.(206)  Chlorhexidene oral products can come with or without anti-discolouring systems. There may be some doubt as to the clinical efficacy of chlorhexidene with an anti-discolouration system as some studies show them to be less effective than chlorhexidine products without an anti-discolouration system.(206, 207)  Curascept was chosen for use in this study as the manufacturer claimed their paste did not stain teeth. No staining was noticed in this study.

Chlorhexidine is de-activated by fluoride and sodium lauryl sulphates in toothpastes. To optimize the anti-plaque effect of CHX, the interval between tooth brushing and use of CHX should be more than 30 minutes and cautiously close to 2 hours after brushing.(208)

CHX is the most widely accepted and most widely used chemo-prophylactic agent, because of its substantiveness in the oral cavity and low toxicity as it is poorly absorbed by the gastrointestinal tract.(32)

Numerous studies have confirmed the beneficial effects of CHX in reducing of plaque accumulation, in tooth caries, gingivitis, periodontitis and in alveolar osteitis.(209)

Chlorhexidine also binds to the different surfaces within the mouth (teeth and mucosa) and also to tooth surface pellicle and saliva. After a single rinse with chlorhexidine, the saliva itself exhibits antibacterial activity between 2-5 hours(210) and persistence of CHX on oral surfaces has been shown to suppress salivary bacterial counts for over 12 hours. At a clean tooth surface a small amount of chlorhexidine (relative to the total amount orally) can bind to the pellicle and enamel. Low dose CHX can remain for several hours resulting in a persistent bacteriostatic effect. Plaque is prevented from forming because the bacteria attaching to the tooth surface cannot multiply.(204)

However, CHX activity is dependent on the pH of the environment with an optimal range between pH5.5-7.0. Activity is reduced in the presence of serum, blood, pus and other organic matter. CHX, as a result may not be as effective in a highly acidic oral environment or where there is organic matter and thick dental plaque commonly found in the elderly with poor oral hygiene and SGH. CHX may be more suited to thin biofilms, newly cleaned tooth surfaces and an pH oral environment above pH 5.5.(209)

The effectiveness of CHX under different oral conditions may help explain results of systematic reviews of the literature that are unable to establish definitive conclusions regarding the effectiveness of other adjunct therapies using CHX in dental caries prevention.(211)

In very high risk individuals, Chlorhexidine gluconate gel (0.5 %) is more effective than rinses and is the agent of choice for chemical plaque control in patients with salivary dysfunction since this agent possesses proven anti-plaque, anti-gingivitis, and anti-caries activity. It causes profound inhibition of cariogenic mutans streptococci.(64) The gel formulation is preferred as this is alcohol-free. The alcohol content of some chlorhexidine rinses may be problematic because of mucosal burning.(64)

Oral risk assessment plays a factor in selecting the concentration of CHX to be used and the delivery system. The antimicrobial effect of chlorhexidine is dose dependent. Chlorhexidine at low concentrations (0.02%-0.06%) has bacteriostatic activity, whereas at higher concentrations (> 0.12%) CHX is bactericidal and is active against bacteria, fungi and viruses.(204, 212)

In this early dementia study, Curadent toothpaste containing 0.12% CHX (bactericidal) was selected and the toothpaste was used once only in the evenings in participants assessed as having a high risk oral disease.

CHX concentration could be varied depending on a participant's risk assessment. In the Crurascept range chlorhexidine can be delivered in toothpaste (0.05%, 0.12%), rinses (0.05, 0.12%, 2.0%) and gel (0.5%) with greater concentrations used for higher risk individuals.

CHX is also available as oral rinses (without alcohol is recommended in aged care), aerosols and spray formulations (0.12-0.2%), gels (0.12-1%) and dental varnishes (1%, 10%, 40%).

Despite inconclusive evidence that chlorhexidene is effective in reducing decay when applied topically by toothpastes or rinses, its use is still recommended in high risk elderly and those with dementia for the reduction of microorganisms related to dental caries, plaque accumulation, periodontal diseases (32) and to reduce the overall oral pathogenic biofilm to possibly reduce aspirational respiratory infections.

Spray formulations or small increments of CHX toothpastes delivered by a nurse using an applicator and a bent toothbrush by may be more suited to delivering CHX where there are resistive behaviours.

## Assisted Brushing and Denture Brushing

The wearing of a partial denture is a risk factor for decay. Physical scrubbing of dentures in soap and water is the primary cleaning method with additional disinfection of dentures placed in water with a 'denture soaking tablet'.(37)

Adequately brushing another person's teeth, even when that person is fully co-operative, requires training. When co-operation is lacking or resistive behaviours are encountered, as with those suffering dementia, a relatively simple task can become very difficult. Strategies such as Rescuing, Distraction, Bridging, Hand over Hand, Chaining, busy boards and a familiar face can help manage older patients with cognitive impairment, anxiety-related conditions or resistive behaviours when attempting dental interventions.(37, 42)

Threat reduction strategies are important in the management of resistant behaviours and have been shown to be effective in reducing care resistant behaviours during oral hygiene procedures in moderate to severe dementia sufferers within a 14 day trial period.(213)  However, these strategies are more suited to preventive interventions, such as assisted tooth brushing able to be stopped at any time without the likelihood of causing harm than procedures requiring active treatment.(15)

Whenever possible, unassisted brushing was encouraged to help maintain a level of independence as long as possible. Nurses would plan to remind those residents who could complete these tasks but had problems remembering. In practice there was a mix of assisted and unassisted brushing by nurses.

Assisted brushing and oral hygiene programs in RACF are difficult to implement, to maintain in the long term and have satisfactory results.(38, 44, 48, 60)

Residents who exhibit resistance to mouth care tended not to receive regular care, while issues such as time, increased workload, limited staff, and the lack of an accountability structure are disenabling factors for provision of daily mouth care. Results suggest that the impact of educational interventions is affected by the quality of in-service education, an absence of identified predisposing, reinforcing, and enabling factors, and a strong commitment among staff to the provision of daily mouth care for frail elders.(47)

A 5 year longitudinal study investigating the implementation of an oral hygiene protocol in 14 nursing homes involving 1393 residents, resulted in less dental and denture plaque, but the obtained plaque levels were statistically and clinically insignificant.(147)

Daily care is delivered by nurses, carers, volunteers and allied health workforce who often come from different socio-demographic backgrounds, may have different educational levels, training and attitudes to oral health.

Additionally there is considerable mobility of nursing staff within the industry through migration within and out of the industry resulting in the high use of temporary staff and the loss of trained personnel.(62)  Loss of nursing oral hygiene skills through staff mobility further complicates the delivery of oral care within RACFs.

From experience gained by the author and the oral health therapist (also involved in this study), over 5 years in implementing other oral health programs in Montefiore Nursing Home ( and not part of this study), an OHT needs to offer ongoing continuing periodic education sessions to RACF nursing staff. To institute staff education and training sessions on a regular basis requires the active support of nursing home managers. To achieve the support of nursing home managers, requires dental professionals to engage in unique public relations exercises to convince nursing home managers of the importance of oral health, explaining implementation of oral health programs and often involves developing business plans to justify the costs of introducing these endeavours.

An additional and very important role provided an OHT, is their ability to alter the culture of a nursing home and raise the profile and importance of oral health more effectively from within the organisation than trying to introduce or imposing oral health programs by dental professionals working outside a RACF.

Much effort has been spent training dementia nurses in oral care and introducing assisted brushing programs in Montefiore Aged Care Facilities. Assisted brushing is now accepted as an important part of resident's care by Montefiore managers and senior nursing staff. As a result, dementia nurses perform assisted brushing on a daily basis on dementia residents in the home. Despite the acceptance of the importance of assisted brushing, the Montefiore Dementia Executive Care Manager has informed the author that no attempt is made at interproximal cleaning as this task is considered too difficult in high care dementia.

In practical terms, it is more likely nurses are able to clean buccal tooth surfaces better than lingual surfaces and probably clean interproximal surfaces poorly or not at all. As buccal and occlusal surfaces may be better cleaned, the overall bioburden of the mouth may be reduced and may even show as an improvement in plaque scores. However, the obvious implication is that the oral bio-burden between the teeth may not alter or may become more pathogenic over time and the associated

interproximal and lingual caries increments may rise despite a decrease in plaque scores.

Studies on older adults are often related to single intervention approaches.(214) Although caries increments in nursing homes have been investigated (8, 215),  there is a lack of adequate studies of caries increments after implementation of a comprehensive oral health programs using a scheduled multi-combination therapy approach.

The author suggests that the determinant in the improvement in oral health may likely be the decrease in the incremental rate of new coronal and root caries in general but particularly interproximal root caries and respiratory infections and not necessarily in the reduction in plaques scores through assisted brushing. This hypothesis needs to be determined in a larger trial.

This study and previous studies strongly suggest that assisted brushing is very important, however relying on assisted brushing as the sole or predominant preventive intervention may prove unsuccessful unless accompanied by scheduled multiple preventive interventions to deliver compound preventive therapies to alter an unhealthy oral environment through NSCOCPs to become a healthier oral environment.

# CHAPTER 5- CONCLUSIONS

The goal of this project was to develop a method whereby trained nurses could assess early dementia RACF residents and implement individualised intensive multi-component preventive interventions through scheduled comprehensive oral care plans (NSCOCPs) as part of the scope of nurse duties within the normal daily routine of a nursing home.  The advantage of such a system would be that residents could be assessed and commence a preventive oral health program soon after entry into a nursing home and be re-assessed periodically. This is particularly important when timely visits to RACFs by dental professionals to examine residents and prescribe preventive interventions are unlikely.

A highly advanced 12 hour nurse education training program was developed for RACF nurses to perform accurate oral assessments and create care plans. The feasibility of this proposition was assessed by comparing nurse assessments and nurse created daily oral care plans with OHT assessments and care plans and dentist clinical examination on the same cohort of early dementia test participants.

The nurses selected for this program were initially "untrained" in oral health preventive interventions and the implementation of oral care plans.

Research questions were posed around the feasibility of nurses being able to understand oral assessments, saliva testing, create individualised oral care plans and be responsible for and monitor oral care plans for compliance within their normal RACF work practices.

1.) Can the training of aged care nurses to assess oral health risk of early dementia RACF residents be established effectively and be incorporated into RACF activities?
This study found such a program was acceptable to incorporate into RACF institutions.

2.) Can nurses trained through such a program introduce preventive products and strategies through individualised NSCOCPs at an acceptable level of clinical acceptability?
This study found a high level of agreement between trained NSCOCPs and care plans made by OHTs.

3.) Can NSCOCPs established by nurses be complied with over a time period?
This study found NSCOCPs could be effectively monitored with a high level of compliance over a 10 week study period.

The main limitation of this study was the small sample size of Participants and nurses. Future studies should be conducted on a larger scale across different RACFs from different socio-economic and cultural areas.

Results from a raft of questionnaires, assessment tools and saliva tests of participants enabled nurses to estimate the individual risk of poor oral health and salivary function and allowed nurses to select suitable preventive products (toothpastes, gels, gum, saliva lubricants) to be scheduled multiple times into care plans and be delivered by untrained staff over a 24 hour period tailored to the test participant.

The results from this study also suggest a large scale randomised trial of establishing advanced oral health education and training of RACF nurses to formulate NSCOCPs should be conducted with the aim of assessing the relationship between NSCOCPs and long term oral health status as well as medical risk consequences of those with dementia and/or cognitive impairment.

The advantages and disadvantages of specific questionnaires, assessment tools testing procedures, preventive interventions and products were also assessed as part of this feasibility study and suggestions are made to modify and improve possible shortcomings for subsequent studies as these modifications would impact on the success of a major clinical trial.

Success of a major clinical trial would be dependent on:-
1.) Ensuring a close partnership exists between RACF managers, nursing staff, medical officers, dental professionals and allied health professionals involved in the care of residents.

2) Ensuring all clinical assessment personnel are trained, standardised and calibrated in the use of intra-oral assessments and the use of procedures. A clear and extensive protocol for mouth assessments and procedures must be in place prior to the commencement of any large-scale trial.

3.) Ensuring that clinical professional interventions are based on a minimal intervention philosophy and pathways that are integrated into the daily NSCOCP management programs of residents.

4.) The Oral Health Assessment Tool (OHAT) to be modified to improve its sensitivity and applicability.

5.) Two additional criteria to be incorporated into saliva consistency estimates.

6.) A method is shown whereby Intensive scheduled multi-component preventive interventions can be delivered by untrained RACF nurses throughout a 24 hour period using NSCOCPs that may have the potential to alter an unhealthy oral

environment to a healthier oral environment. These oral care plans can be effectively monitored for compliance.

7.) Actively alkalising saliva may provide a new treatment strategy in people who have SGH, acidified mouths and slower salivary clearance. The ability to initially assess and then maintain an appropriate healthy mouth pH by using multiple preventive products would be a significant element in achieving a successful outcome. This approach should be given the equivalent emphasise as re-mineralising teeth and assisted brushing in care plans. Further studies are needed to determine the effectiveness of this strategy.

This study did not attempt to determine if one or more products used alone or in combination was more effective than other commercially available products in achieving this strategy. Other alkalising products and procedures, such as oro-muscular exercises and drinking alkalised water (beyond the scope of this study) may prove helpful and could be incorporated into the mix of possible interventions.

8.) As poor oral health is multi-factorial, study designs and models of care delivering multi-factor preventive interventions need to be investigated. Comprehensive scheduled multi-component oral care plans in RACFs act as a form of compound therapy and is likely to be more effective than care plans focusing on single or limited preventive interventions.

9.) The concept of a theoretical Total Oral Bio-burden Tool (TOBI) based on total oral surface area may be useful but needs further investigation. A Dental Bio-burden and Denture Bio-burden Index, which are components of the TOBI, is practical to use within RACFs and would be useful in both defining oral health risk and monitoring effectiveness of preventive interventions.

10.) The use of colour coding systems to summarise oral health assessments and saliva testing is a useful adjunct for nurses in their monitoring and implementation of NSCOCPs.

11.) Although not part of this study, the author suggests combining both NSCOCPs with periodic preventive topical applications of silver fluoride followed by stannous fluoride would have a significant effect at reducing the incidence of dental caries and improving the oral health of early dementia RACF residents.

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# Appendix: Documents and Templates: Alan Deutsch MPhil(Dent)

Workflow pattern for documents and templates explaining for whom the material was intended and which party actioned or was responsible to complete the associated task.

## Abbreviation

| D | Dentist | Alan Deutsch (Lead Researcher) |
|---|---|---|
| H | HERC | Concord Human Ethics Committee |
| M | Montefiore Home Managers | |
| OT | Oral Therapist | Jayne Braunsteiner, Deepa Singh |
| Nt | Nurse -Trained | |
| Nu | Nurse -Untrained | |
| P | Participants | |
| RA | Research assistant | Emma Segal |
| V | Volunteers | |

| No. | Documents and Templates | For | Actioned by |
|---|---|---|---|
| **Correspondence with and submissions to Concord HERC** | | | Alan Deutsch |
| 1. | Study Protocols Dementia Oral Health Pilot Study | | Concord HERC |
| 2. | National Ethics Application Form (NEAF) | | |
| 3. | HERC Supplementary Questions | | |
| 4. | Letter of Reply to Concord HERC Supplementary Questions | | |
| 5. | Ethics Approval From Concord HERC 3 Oct 2014 | | |
| **NSCOCP study: Documentation, Forms and Templates** | | | |
| 6. | Participant Information for Residents | P, M | RA |
| 7. | Participant Resident Consent Form | P, M | RA |
| 8. | Information for Next Kin Sheet | P, M | RA |
| 9. | Participation information for Volunteers | V | RA |
| 10. | Volunteer Consent Form | V | RA |
| 11. | Findings -Clinical Examinations and Assessments | P, M | D |
| 12. | Nurse Training–Assisted Brushing | Nt | D, OT |
| 13. | Nurse Training- Saliva Testing and Advanced Care Plans | Nt | D, OT |
| 14. | Short Xerostomia Questionnaire (SXD-I) Dutch Short Version | P, V | Nt |
| 15. | OHIP14 | P, V | Nt |
| 16. | Oral Health assessment Tool (OHAT) | P, V | Nt, OT |
| 17. | Saliva Test Worksheet | P, V | Nt, OT |
| 18. | Plaque Scores – Greene and Vermilion | P | D, OT |
| 19. | Anti-cholinergic Index -St Vincent's Pharmacy Dept. | P | D, RA |
| 20. | Participant Medical Drug History | P | D, RA |
| 21. | Nurse NSCOCP Template Forms | P,V | Nt, Nu |
| 22. | Nurse Education and YouTube Education Material | Nt | OT,D |
| 23. | Nurse OHAT Survey | Nt | D, RA |
| 24. | Nurse NSCOCP Survey | Nt | D, RA |
| 25. | Nurse Focus Group Transcript | Nt, Nu | D, RA |
| 26. | Montefiore Resident Staff Ratios | | D, M |

# Appendices

# CORRESPONDENCE WITH CONCORD HERC PRIOR STUDY APPROVAL

## Appendix 1: - Study Protocols: Alan Deutsch (Lead Researcher) Letter to HERC Concord

1 October 2014

C/o Virginia Turner, Executive Officer
Sydney Local Health District (SCHD)
Human Research Ethics Committee CRGH, Concord Repatriation General Hospital
Building 75, Hospital Road. NSW 2139

Dear Ms Turner

**(Short Title) Role of RACF nurses and oral assessment and care.
CH62/6/2014-107-A. Deutsch
LNR/14/CRGH/133**
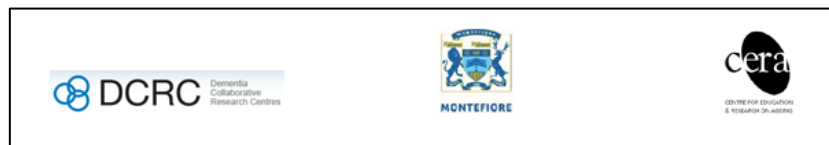


**PROTOCOL FRONT PAGE= Montefiore RN Study**

**PROJECT TITLE**: Establishing the feasibility for the prevention of Rampant Dental Decay associated with Dry Mouth to be prevented by early interventions by Residential Aged Care Facility (RACF) nurses using oral and salivary diagnostic tests to determine risk of Salivary Gland Hypofunctoin (SGH) : A pilot study

**SHORT TITLE:**
Can Residential Aged Care Nurses improve the oral health of Residents through oral assessments?

**Co-ordinating Investigator**: Dr Alan Deutsch (AD), Visiting Dental Officer, Montefiore Aged Care Randwick, CERA Oral Health Geriatric Dentistry Advisory Committee, Concord

**Associate Investigator**: Dr Peter Foltyn (PF), Conjoint Senior Lecturer UNSW, Dental Department, St Vincent's Hospital Darlinghurst, Visiting Dental Officer Montefiore Aged Care Facility, CERA Oral Health Geriatric Dentistry Advisory Committee

**Associate Investigator:** Ms Jayne Braunsteiner (JB), Oral Health Therapist, Montefiore


**Consultant Investigators:**

Professor Clive Wright (CW), Associate Director (Oral Health) Centre for Education & Research on Ageing, Concord Clinical School, University of Sydney;

Associate Professor Vasi Naganathan (VN), Consultant Geriatrician, Concord Hospital & Centre for Education & Research on Ageing, Academic Sydney Medical School, University of Sydney;

Professor Henry Brodaty (HB), Director, Dementia Collaborative Research Centre, The University of New South Wales.

**Responsible Institute:** Centre for Education & Research on Ageing, Concord Clinical School, University of Sydney & Department of Aged Care and Rehabilitation, Concord RGH.

## RATIONAL, BACKGROUND AND SIGNIFICANCE

Dental management of frail and elderly people, especially those suffering dementia, in general dental practice and in residential aged care facilities (RACF), is a relatively new field in dentistry and is not well managed or researched. Conventional dental treatment for frail older people, especially those with dementia is often unsuccessful, places the patient at increased risk of systemic health consequences and leads to a deteriorating quality of life.  The main factors contributing to poor quality dental outcomes in these circumstances are:

1.Salivary Gland Hypofunction (SGH) which causes dry mouth (xerostomia)- where low saliva rates potentiate dental decay and periodontal (gum) disease. Normal saliva flow varies in both Circadian and anticipatory patterns. Resting Saliva (during normal daily time) has an average flow rate of 0.4ml/min, whereas Stimulated Saliva (anticipating or associated with eating) has an increased rate on average of 1-2ml/min.  Saliva contains a supersaturated solution of calcium and phosphate ions, multiple buffers, antibacterial agents, lubricants & digestive enzymes.  These are essential components for good oral health, swallowing and systemic health[1,2,3,4].

Polypharmacy (taking of multiple medications) is a well documented cause of xerostomia and SGH where Resting Saliva rates may drop to<0.1ml.min, and Stimulated Saliva rates to<0.5ml/min). It is not unusual in the resulting dry mouth for multiple teeth to decay rapidly to the gum line for patients subjected to polypharmacy.

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Inadequate Resting Saliva results in loss of the protective/lubricating coating over teeth and soft tissues increasing decay, physical damage to soft tissues and bacterial infections. Dry Mouth patients have difficulty chewing, swallowing, wearing dentures and speaking often resulting in inadequate nutrition, bad breath and social withdrawal. Mucins and agglutins in Resting Saliva allow agglutination and de-activation of oral pathogenic micro-organisms which aids swallowing these organisms - where they are destroyed in the gut. In Dry Mouth patients pathogenic organisms remain in the mouth longer as they cannot be readily cleared[5,6,7] and consequently enhance deterioration of teeth and soft tissues within the mouth.

Stimulated Saliva flushes out the mouth enabling food clearance, glucose clearance, dilution of both dental plaque acids and food acids allowing the mouth to return to a normal environment and pH. The loss of adequate Stimulated Saliva flow and volume results in loss of buffering capacity, insufficient calcium and phosphate ions to re-mineralise teeth and causes a prolonged or permanent drop in mouth pH.[1,8] Pathogenic biofilms are encouraged to grow as the mouth acidifies leading not only to rampant decay and gum disease but also the possibility of other infections and aspiration pneumonia.  Death rates from aspiration pneumonia can be mitigated by intensive oral cleaning by dental health workers[9].

2.  Compromised physical and cognitive abilities of frail elderly. Deteriorating physical and mental capacity in frail older people reduce or prevent the individual from being able to maintain their own oral health on a daily activity basis.  Such frail older people are dependent on carers to perform these daily oral health maintenance tasks for them. Most RACFs do not have sufficient resources, or a systematic educational and training approach, to provide staff with the necessary motives and skills required to maintain the oral health of residents dependent on another person to do these relatively simple tasks.

3) Conventional dental interventions require patient co-operation. With advancing dementia, the loss of co-operation and challenging behaviours may make even simple dental interventions impossible[10].

4)  The adverse oral effects of food management are not well understood in the aged care Industry. Food management is the non-nutritious use of food to manage behaviours and the taking of medicines. The offering of frequent small snacks (often sweet and sticky) to SGH residents with poor oral hygiene results in a mouth that remains acidified for extended periods of time. This is often a common practice in RACF.

Saliva pH drops after each meal or snack. Normally saliva pH returns to resting pH values within 30-60 minutes due to the buffering capacity of Stimulated Saliva. People with poor oral hygiene have lower resting Saliva pH values and suffer higher caries rates due to a greater and a prolonged pH drop after meals. Enamel caries occurs around pH 5.5 and root caries around pH 6 depending on salivary calcium

and phosphate concentrations. In SGH patients, the pH remains well below 5.5 for over an hour or may never return to safe values depending on the frequency of meals and snacks.

5) Previous generations of older people entered RACFs with many missing teeth and dentures that were easily cleaned. The current "baby boomer" generation has invested in restorative and rehabilitative dental care which has included extensive amalgam fillings, crowns, bridges and increasingly implants and partial dentures. Future generations will enter RACFs with substantially intact dentitions and consequently a far higher need for more sophisticated daily maintenance of their mouths to prevent late-onset dental diseases. The greater the number of teeth that cannot be maintained the greater the pathological bio-burden originating from the mouth. Further, each broken down tooth is a source of pain and infection in the body. Behaviour of dementia patients may improve once decayed teeth are treated or removed[11].

Most frail older residents in RACF, and those housebound, lack the mobility to attend a dental surgery to have regular preventive and restorative treatment when needed. As daily oral health maintenance of an intact dentition with implants, crowns, bridges and partial dentures becomes increasingly prevalent in an ageing Australian population – it is critical that education and research in dentistry move to focus on the needs and outcomes of the most at risk and vulnerable.

*The combination of poly-pharmacy causing SGH, the inability to maintain one's own oral health, poor oral hygiene, lack of co-operation and food management issues with RACF – currently and increasingly these factors will result in rapidly progressive oral disease, in particular rampant decay. An understanding and elucidation of the role of oral and salivary markers in older residents in RACF will potentially allow early advanced preventive interventions and strategies to be instituted in the early stages of dementia thus reducing the potentially serious consequences.*

The proposed pilot study will provide data that will be used to design large intervention studies in RACFs. In addition, it will provide useful information about the practicalities of assessing and managing oral health in RACF. This study will complement studies currently being undertaken within acute aged care wards at Concord and Nepean (see Gibney et al 2014 HERC Application) and the Concord Health and Ageing in Men Project (see Cumming et al 2014 HERC Application).

**AIM**

1. To determine whether RACF nurse oral health assessment and saliva testing is a valid, reliable and efficient assessment of oral health risk by comparing RACF nurse test screening results with those of a dental professional.
2. To ascertain if a saliva marker screening test, conducted by RACF nursing staff, are practically feasible within their scopes of practice and current duties.
3. Oral care plans based on their risk assessments from saliva and oral screening.
4. To determine if oral health preventive management plans and intervention result in measurable changes in oral health markers after 10 weeks

**HYPOTHESES:**

1. That - RACF nurse assessment of oral health risk, including saliva testing will be a valid, reliable and efficient assessment of oral health risk of residents;
2. That - It is feasible and practical for RACF nurses to undertake oral health assessments;
3. To ascertain whether RACF nurses can formulate individualised early preventive interventions into advanced oral care plans through oral assessments;
4. That - Oral care plans based on nursing assessed oral health needs will have improved saliva and oral health markers after 10 weeks;
5. That - RACF nurses will be able to implement appropriate preventive interventions and refer high risk residents for treatment;

**STUDY SITE:** Montefiore Aged Care Facility, Randwick, NSW.

**RESEARCH STRATEGY:** This is a pilot study to assess the feasibility of using RACF nursing staff to perform simple oral health assessment and a wide range of preventive interventions to improve daily oral health maintenance of residents in aged care facilities or those at high risk to dementia and salivary gland hypofunction. Findings from this study will be used to link with a major NHMRC project on dementia care being led by Professor Henry Brodaty and further site-based clinical interventions for those diagnosed with SGH.

The pilot study will be conducted on 20 consenting aged care residents from Montefiore Aged Care Facility and 10 healthy participants (less than 60 years of age, who will act as a test group to train RNs before testing residents and as a possible control group).

**Table - Summary of Experimental Design**

| Research Questions | Methods | Interventions | Measures | Outcomes |
|---|---|---|---|---|
| ? Will additional training of RACN in preventive oral care lead to better oral heath for residents, especially those with dementia and/or SGH | • Convenience sample, <br>• General vs RACF resident <br>• Before/after study <br>• Benchmark against professional standard | • Education & training <br>• OHAT + saliva markers <br>• New Careplans <br>• Availability of products | • Tools can be used at professional standard in risk group <br>• Plans for risk group are complied with <br>• Products used appropriately | • High congruency in assessments & procedures <br>• Strong compliance <br>• Indicators of OH improvement <br>• Recommendation for RCTs |
| | | | | |
| ? Can we use salivary markers better to predict oral & systemic health | • Convenience sample from SGH risk group | • Clinical testing of saliva flows <br>• Laboratory tests for saliva constituents | • pH, dryness, buffer <br>• Calcium, phosphates, glycoproteins, carbonates etc | • Clinical testing feasible & cost-effective <br>• Laboratory analyses show improved protective elements |

## Methods

### Selection of Participants

Residents suitable for this study will first be nominated for selection after consultation with the Nursing Home Managers and the residents themselves. Residents will be excluded from nomination for selection if they acutely unwell or have significant behavioural problems. We will exclude residents who do not understand sufficient spoken and written English. Only those residents will be selected, who in the opinion and assessment by Nursing Home Managers will be co-operative and will not be distressed or upset by testing procedures. Residents with advanced dementia or who are likely to be distressed or non-cooperative will not be selected in the pilot study. Should there be more than 20 residents nominated as potential participants – 20 subjects will be selected randomly. Following this initial selection, Participant Information sheets will be given to the participants (if they have capacity to consent) or their person responsible (if they do not have capacity to consent). Even in people who have capacity to consent we will endeavour to provide the participants family/person responsible with information about the study and ask for their consent. Signed consent forms will be obtained from the participant and/or their person responsible for those who agree to take part in the study.

### Testing Procedures

Both RACF nursing staff and dental professionals will carry out salivary marker testing procedures and oral health assessments, independently and blind, to each other's results. The RACF nursing staff will do a shorter basic assessment using the Oral Health Assessment Tool (OHAT) and perform salivary maker testing. The oral health therapists will undertake a more detailed dental examination and the same salivary marker testing.

**RACF Nurses Assessment and Intervention Plan**

**Oral Health Assessment Tool (OHAT)** (Appendix A)
The OHAT will be carried out by the nursing staff. The assessment tool has been validated in a three-year tri-state Australian trial and was introduced in 2009 as part of the Australian Government's *Better Oral Health in Residential Care Program (BOHRC).*[a,b,c,d,e] The BOHRC Program involves four key processes: oral health assessment; oral health care planning; daily oral hygiene; referral for dental treatment. The BOHR Program is currently an integral part of nursing education and training at the Montefiore Nursing Home.

*Saliva Assessment*
Saliva will be obtained by the "spit or drool" method, into a suitably labelled and sealed container.

The collected saliva will initially be weighed to assess mouth dryness, volume of saliva, pH and buffering capacity at chair-side. A standard commercial saliva pH and buffering test will be used.
Training for taking simple non invasive testing procedures will be conducted (see below) for the nursing staff by the research clinicians (SD, PF, JB). The tests will measure oral dryness, saliva volume and acidity of the mouth at rest and when stimulated by collecting and testing samples of saliva.

Testing will be carried out between 8:30am and 12:30pm on the 20 participants. Saliva samples will be collected first by nursing staff and within 5-7 days by an oral health therapist.

A final saliva test will be made of the oral health therapists at 10 weeks to ascertain whether there is an improvement in oral and salivary markers.

**Saliva Tests**
Saliva Testing will be performed using a commercially available saliva test kit (GC Saliva-Check Buffer kit).

**Tests and Time Allocated**
**i) Resting pH:** Resting Saliva pH will be assessed by wetting a small sponge applicator placed under the tongue for 5 seconds and using the applicator to wet litmus paper. (Time: 0.5 minute)

**ii) Dryness Test**:
Dryness will be measured by placing tissue paper on the inside aspect of the lower lip for 1 minute and recording how long it takes for beads of saliva to form.
(Time 2 minutes)

**iii) Consistency:** Saliva will be visually assessed and inspected whether saliva adheres to a dental mirror, Saliva will be classified as mucousy, sticky, frothy, watery or clear. (Time 0.5 mins)

**iv) Resting Saliva Test:** Participants will be asked to spit or drool into a container for 3 to 5 minutes depending on co-operation) which will be weighed to assess unstimulated saliva volume and pH recorded using litmus paper. (Saliva weight after 3-5 minutes is inversely proportional to SGH). Re-testing after interventions or de-prescribing should result in more saliva weight and clinical improvement of Dry Mouth). (Time: 5')

**iv) Stimulated Saliva Test After Glucose Challenge:** Participants will rinse with a 20% glucose solution for 1' and rest for 5' after which time saliva pH drop will be recorded using pH paper. Participants will then chew wax gum for 3-5' to collect stimulated saliva. The pH will again be measured after chewing at least once and if possible at 5' intervals for a further 15'-'depending on co-operation, and pH values will be plotted over time. The rate at which saliva pH returns to resting values is dependent on buffering capacity and stimulated saliva volume. Poorer oral health outcomes can be expected when the pH drop is greater and more prolonged. Buffering capacity as per the GC Saliva-Check Buffer kit will be recorded. (Less saliva collected, worse SGH. The slower the pH return to base values the worse the buffering capacity of saliva and more acidified the mouth). Re-testing after interventions or de-prescribing should see an increase in saliva volume and correlate with clinical improvement of Dry Mouth. (Time: 12- 30' depending on co-operation; contact time = 8')

**v) Re-Buffer Test:** A small pea size increment of a commercially available sodium bicarbonate toothpaste (Colgate Acid Neutraliser) will be introduced into the mouth on a cotton bud. The pH will be recorded at least once and if possible at 5' intervals for a further 10' depending on co-operation. This test shows the neutralisation of mouth acid independent of chewing. (Time 0.5' – 15' depending on co-operatio; contact time = 1.5')

**Time Allocated For Tests:**
1 hour will be allocated for saliva testing of each Resident and will be performed once by the RNs and then again by an oral health therapist, at beginning of study, and again after 10 weeks by only the oral health therapist. A total of three saliva tests per Resident will be performed.

Test Appointment consists of 15' "Setup time" and 45' "Total working appointment". Actual patient contact time is between 12-15 minutes with the bulk of time spent waiting between pH tests.

***Nursing Management Intervention Plan***
Based on OHAT and Saliva assessment the nurse will then determine the residents daily oral care plan. This includes formulating an oral health care plan for daily care, advanced preventive interventions and referral.  The incorporation of advanced preventive interventions into Nursing Management Intervention Plans as a routine for high risk older people was not evaluated in the BOHRC Program.

**RACF Nurses Education and Training Procedures**
*Core BOHRC Educational Program and Saliva testing*
The core BOHRC educational program is conducted by JB and supplementary program on saliva testing and preventive interventions will be an additional module conducted by AD and PF.  Participating nurses and unit managers will be given three interactive in-services about oral health and provided with handouts. They will first be trained in the standard BOHRC oral health materials [a,b,c,d,e], how to interpret them and what actions and appropriate daily preventive interventions and care should follow and how these should be documented into the care plan.


*Advanced Prevention Training*
In addition to the core program described above, other, advanced prevention training: will include:1) The role of increased daily water consumption;  2) The use of artificial saliva substitutes; 3) The use of bicarbonate toothpaste or rinses after snack/meals or periodically throughout the day to raise mouth pH. 4) Decreasing foods / snacking – i.e. monitor and record eating behaviours and using sweet foods to take medicines (i.e. Food *Management); 5*) The role and use of sugarless gum, with Xylitol to stimulate saliva glands, and decrease Streptococcus in mouth[12, 16, 17,18,19]. All of these procedures have been recommended within the BOHRC Program but not tested as a basic package of oral health care in those at high risk dependency.

The education and training program will be conducted no more than 10 weeks prior to the commencement of the study and the nurses will complete a "recommended preventive intervention sheet" as part of their Oral Health Care Plan, at their assessment.

The Oral Health Care Plan devised by the RACF nurses for each participant, including the recommended preventive interventions will be assessed by independent clinical researchers for completeness and compliance (AD, PF, JB). *Using or not using the information gathered from the dental professional plan described below*

**Oral Health Therapist Assessment and Intervention Plan**

*Assessment*
The dental professional's mouth assessment process will be based on World Health Organization and Australian Research Centre for Population Oral Health (ARCPOH) diagnostic criteria and standards and conducted by one, clinical investigator (JB) not associated with the provision of dental treatment.
RACF nursing staff will not be involved in clinical examinations and charting.

Data collected during the dental examination will include estimates of: Decayed Missing and Filled Teeth (DMFT); Number of remaining teeth present; Plaque Scores; Periodontal Disease. Residents will be informed and referred for treatment should any new decay or oral disease be found at exam (see Attachment 2).

*Saliva Assessment.*
These tests will be the same as described above with the exception that the one sample per resident of the collected saliva will have more detailed laboratory assessment of constituents. The tests for pH, buffering capacity and weightings will use the same standard commercial materials as described above.

*Intervention Plan.*
One (independent) oral health therapist will be responsible for all dental professional examinations and ensuring appropriate referral for dental treatment (see Attachment 2 "Patient Information Sheet - Findings from the Mouth Examination"). The examiner may be assisted by a further oral health therapist in the collection of saliva.

The professionally assessed examination will be the gold standard for referral to a dentist/dental clinic.

*Advanced Oral Care Plans*
Advanced oral care plans will be formulated by RNs under the supervision of a dental professional. It is expected RNs will need more assistance in the beginning of the study and require progressively less input from dental professionals by the end of the study. (See appendix F)

The RN advanced oral care plan will be entered into a master template page and sticky taped into the inside cover of a folder marked 'Resident Oral Care Plan' to be stored in each participants room. A photocopy of an unfilled template page will be printed for each day of the study and placed adjacent to the master template plan in the folder. Carers and other nursing staff will be instructed to follow the interventions marked on the template page and tick or notate each intervention and time of day to track compliance and acceptance throughout a 24 hour period.

The registered nurse responsible for the plan, dental therapists involved in the study and the research assistant will monitor the plans. The research assistant will record the data from the care plan folder every second day. The folder will allow both daily

follow up with intervention compliance and record any problems associated with implementing each intervention.

**Testing Congruity of Nurses and Professional Assessments**

Three aggregate comparisons will be made between the information collected by the Nurses and that by the Oral Health Therapist:
1. Oral health needs assessment. OHAT cleanliness estimates (Green; Orange; Red: Referral) versus Plaque Index[f] (0-1; 2 & 3); Dental decay severity (Green; Orange; Red; Referral) versus Dental caries severity (1 or more minor reversible lesions; 1 or more shallow/non-active lesions ; 1 or more open lesions; pain abscess etc.) and other pathology (present/absent).

| Nurses Oral Health Assessment | Dental Professional Assessment |
|---|---|
| OHAT cleanliness estimates (Green; Orange; Red: Referral) | Plaque Indexes (0-1; 2 & 3) |
| Dental decay severity (Green; Orange; Red; Referral) | Dental caries severity (1 or more minor reversible lesions; 1 or more shallow/non-active lesions) |
| Saliva Test Result<br>Resting flow rate, stimulated flow rate, pH rest, pH stimulated, pH buffered, consistency | Saliva Test Result<br>Resting flow rate, stimulated flow rate, ph rest, pH stimulated, pH buffered, Consistency |
| Questionnaires – OHIP14, Short Xerostomia Index at beginning of study | Questionnaires - OHIP14, Short Xerostomia Index at end of study |

2. Saliva assessments. Direct comparisons of saliva estimates at the initial visits, including: pH; Buffering capacity and Weights.

3. Oral Health Management Plans. Compliance with recommended daily preventive care and referral processes; including especially cases for recommended advanced preventive interventions (hydration; bicarbonate toothpaste; xylitol chewing gum; saliva substitutes; specific food management interventions.

Kappa values based on nurses v's oral health therapists similarities/differences will be calculated for 1 and 2 above. Kappa values of 0.6 or above will be used to indicate acceptable concordance between the two categorical measures under test. For pH and buffering capacity confidence estimates will be established, and for estimating compliance with preventive regimens a consensus between researchers against a figure of 85% will be used as an acceptable value.

**10 week Follow-up Assessment**

Oral health therapist assessments will be repeated at 10-weeks to measure any changes in OHAT and oral health.

Compliance with implemented oral health care plans will also be assessed by the research team at this time. This will take the form of reviewing the residents daily care record (see above).

A follow-up saliva assessment will be made by the oral health therapist for assessment of the impact of the program on saliva markers and samples sent to the laboratory for comparative analyses between initial and post intervention constituents.

***Laboratory analysis of professionally obtained saliva samples:***

Saliva collected will transported within individual labelled sealed containers to St Vincent's Hospital in secure containers for bio-marker analysis. Only saliva samples obtained by the oral health therapists will be used for future component analyses.

Bio-marker analysis involves general testing for calcium, phosphate, urea, carbonates, sodium and chloride, mucins, glycoprotein concentrations and possibly salivary buffering capacity[5,12,13,14].

Anonymity between personal resident care plan, and the laboratory analysis of saliva will be ensured such that the saliva sample will be numerically coded before transfer to the laboratory. The key will be held by the clinical researchers and broken only following receipt of the analytical findings which may or may not impact on individual care.

**Other data and information (collected from case notes, structured questionnaires and interviews with nursing staff)**
Demographic: age, sex, marital status;
Marital status, next of kin/ person responsible, previous occupation;
General health, medical history and diagnoses, medications;
Nurses' recommended preventive care (this questionnaire will provide responses of the nurses to their perception and recommendation for the level and type of oral health preventive intervention.

**Staffing:** Each Saliva Test per Resident will require a one hour appointment. 20 Residents will be tested at the start of study and at end of study by the Oral Health Therapist and RACF nurses. Each Resident will be tested three times in a 10 week period. Three residents can be tested per day per test. To test 20 Residents, the Oral Therapist will require a minimum of 7 sessions testing 3 Residents per morning. Allow three additional test sessions for contingencies equals a total of ten morning test sessions.

**Risks**: All materials to be used in this study are routinely used in general dental practice and their use would not be considered to have any special risk. Most restorative and surgical procedures routinely performed in general practice carry far greater risks. The risk of swallowing the gauze, cotton buds, and gum used in the study are potential theoretical risks. The intervention will be terminated immediately should any adverse side effects be noted.

**Treatment of Risks**: Only co-operative competent older residents will be selected for the study on the advice of Montefiore Nursing Home Managers.

**Ethics:** Consent will be obtained from the resident only after the study has been explained in person at which time a participant information sheet will be issued and after the participant has had time to read the information sheet and discuss the study with their family and others. We will inform next of kin in a person and through information sheets. The project will be monitored by reporting to a Governance Committee comprising of independent medical and dental scientists drawn from appropriate staff within CERA at Concord Hospital and the research team.

The Montefiore Home where Alan Deutsch and Peter Foltyn provide dental services has agreed to be part of this trial for both this and later stages of the research.

**Time-Line:** Ethics, nursing home approval, 12 weeks; Resident recruitment: 2/wks for 10 wks; Follow-up 2x/wk for 10 wks; Analysis/write-up 12 wks; Contingencies 10 weeks.

**Implications:** If successful, this model of oral health care that could be promulgated more widely in residential aged care facilities. The nursing home participating in this will gain credit from accreditation review and this will be incentive for others to participate. The next step would be a randomised control trial with funding being sought from NHMRC or other funding body.

## Footnotes

a http://www.sadental.sa.gov.au/Portals/57ad7180-c5e7-49f5-b282-c6475cdb7ee7/BOHRC-oh-assesment-tool.pdf

b http://www.health.gov.au/internet/main/publishing.nsf/Content/2E625F7A23ED6F71CA257BF0001B5D73/$File/ProfessionalPortfolio.pdf

c http://www.health.gov.au/internet/main/publishing.nsf/Content/2E625F7A23ED6F71CA257BF0001B5D73/$File/FacilitatorPortfolio.pdf

d http://www.commcarelink.health.gov.au/internet/main/publishing.nsf/Content/ageing-better-oral-health.htm

e http://www.sadental.sa.gov.au/Portals/57ad7180-c5e7-49f5-b282-c6475cdb7ee7/BOHRC-Facilitator-Portfolio-10-2-11.pdf

f Oral Hygiene Index (Greene and Vermilion, 1960) http://www.mah.se/CAPP/Methods-and-Indices/Oral-Hygiene-Indices/

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# Appendix 2: National Ethics Application Form (NEAF)

*Accessible at https://ethicsform.org/au/SignIn.aspx.*

## Human Research Ethics Committee (HREC)

Sydney Local Health District (SCHD), Human Research Ethics Committee CRGH
Concord Repatriation General Hospital

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**Page 1**

Submission Code Date: 09/07/2014 14:09:29    Reference:    Online Form

**Application Form for Ethical and Scientific Review of Low and Negligible Risk Research (N.S 2.1.6–2.1.7, 5.1.8–5.1.23) – New South Wales**

**Purpose of this form**
The purpose of this form is to enable applicants to provide sufficient detail about the research project to allow the Human Research Ethics Committee (HREC) to make an informed decision about the ethical and scientific acceptability of the proposal.

HREC approval and authorisation by the Public Health Organisation are required for all human research projects prior to commencement.

**Use of this form**
This form must be completed by the Co-ordinating Investigator responsible for the conduct of the research project within the NSW public health system.

If you believe that the research project involves only low or negligible risk to participants and may be eligible for expedited ethical and scientific review, it is recommended you read the guidance and discuss the project with an HREC Executive Officer before completing this form.

If the HREC Executive Officer advises that the project is not eligible for expedited review, you must complete an application for full HREC review using the National Ethics Application Form (NEAF) accessible at https://ethicsform.org/au/SignIn.aspx.

The HREC may request a full review using NEAF following assessment of your application for expedited review if it considers the risk to participants to be greater than low risk.

Examples of research with low and negligible risk include, but are not limited to, the following:

- Research involving only questionnaires and general surveys on non-controversial, non-personal issues that also include only basic demographic data and where, in all instances, respondents are not identified;
- Research involving only the use and/or disclosure of information from existing data collections, where the identity of the person cannot reasonably be ascertained from the information to be disclosed to researchers;
- Research involving human tissue where participant consent is not required because broad consent has been provided for use of the tissue in research and specific individuals cannot be identified from specimens used e.g. where specimens have never been labelled with individual identifiers or individual identifiers have been permanently removed; and
- Research requiring access to individual medical records or to information stored electronically, through the site's medical records department or other department/specialty, but where participant consent is not required or where a waiver of consent requirement is being requested because, in all instances, individuals cannot be identified from data extracted or provided.

**How have you confirmed your project is eligible for expedited ethical and scientific review (low and negligible risk project)?**
☑ I have read the guidance; and/or
☐ I have discussed the project with an HREC Executive Officer

**1. Project reference N.S 1.1**

**1.1. Project type**
◉ Single-centre  ○ Multi-centre
◉ Low risk  ○ Negligible risk

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**Page 2**

Submission Code Date: 09/07/2014 14:09:29    Reference:    Online Form

**1.2. Project title**
*State the full title of the project.*
Can oral health be assessed by RACF nurses, and early preventive oral health interventions incorporated into care plans for residents?

**1.2a Project Short title**
*State the short title of the project.*
The role of RACF nurses and oral health assessment and care

**2. Research personnel N.S 5.2.5–5.2.15**

**2.1. Co-ordinating Investigator**

| | |
|---|---|
| Title: | Dr |
| First Name: | Alan |
| Surname: | Deutsch |
| Position: | Dentist |
| Department: | Dental Clinic, |
| Organisation: | Montefiore Aged Care, Randwick |
| Mailing Address: | 603/34 Spring Stret, Bondi Junction |
| Suburb/Town: | Bondi Junction, Sydney |
| State: | NSW |
| Postcode: | 2022 |
| Phone (business): | 02 9693973 |
| Phone (mobile): | 0422872341 |
| Fax: | 02 93899748 |
| E-mail: | alan.deutsch@gmail.com |
| Qualifications, Experience and skills | BDS; general dental practitioner with special interest and skills in geriatric dentistry; Consultant, Montefiore Nursing Homes |
| Role: | Lead researcher and clinician |
| Is this person the nominated contact person for this project? | ◉ Yes  ○ No |
| Is the Co-ordinating Investigator a student? | ◉ Yes  ○ No |

**Supervisor 1 details N.S1.1(e) and Code of Conduct, Section 3**

| | |
|---|---|
| Site: | Centre for Education and Research on Ageing, Concord Hospital |
| Title: | Prof |
| First Name: | Clive |
| Surname: | Wright |
| Position: | Associate Director (Oral Health) & Clinical Professor |
| Department: | Centre for Education and Research on Ageing, Aged Care & Rehabilitation |
| Organisation: | Concord Clinical School and Concord RGH |
| Mailing Address: | Building 18, Concord Hospital |
| Suburb/Town: | CONCORD |
| State: | NSW |
| Postcode: | 2139 |
| Phone (business): | 02 9767 5957 |
| Phone (mobile): | 04 99775603 |
| Fax: | 02 9767 7289 |

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**Page 3**

Submission Code Date: 09/07/2014 14:09:29    Reference:    Online Form

| | |
|---|---|
| E-mail: | fac.wright@sydney.edu.au |
| Qualifications, Experience and skills | BDS, MDS, PhD, MRACDS (DPH). Previous Professor of Preventive & Community Dentistry, University of Melbourne; previous Chief Dental Officer, NSW |

**Supervisor 2 details N.S1.1(e) and Code of Conduct, Section 3**

| | |
|---|---|
| Site: | Centre for Education and Research on Ageing, Concord Clinical School |
| Title: | A/Prof |
| First Name: | Vasi |
| Surname: | Naganathan |
| Position: | Consultant Geriatrician and Academic Sydney Medical School, University of Sydney |
| Department: | Aged Care and Rehabilitation |
| Organisation: | Centre for Education and Research on Ageing |
| Mailing Address: | Building 18, CERA, Concord Hospital |
| Suburb/Town: | CONCORD |
| State: | NSW |
| Postcode: | 2139 |
| Phone (business): | 02 9767 5419 |
| Phone (mobile): | |
| Fax: | 02 9767 7289 |
| E-mail: | vasi.naganathan@sydney.edu.au |
| Qualifications, Experience and skills | MBBS FRACP PhD Grad CERT Med Educ; researcher and geriatric medical consultant |

**2.2. Principal Investigator/s**

**Principal Investigator 1**

| | |
|---|---|
| Site: | Montefiore Aged Care Facility Randwick |
| Title: | Dr |
| First Name: | Alan |
| Surname: | Deutch |
| Position: | Dentist |
| Department: | Dental Department |
| Organisation: | Montefiore Aged Care Randwick |
| Mailing Address: | 603/35 Spring Street, Bondi Junction |
| Suburb/Town: | BONDI JUNCTION, SYDNEY |
| State: | NSW |
| Postcode: | 2022 |
| Phone (business): | 02 969 3973 |
| Phone (mobile): | 0422872341 |
| Fax: | 93899748 |
| E-mail: | alan.deutsch@gmail.com |
| Qualifications, Experience and skills | BDS (Sydney; general dental practitioner with a special interest in geriatric dentistry, Consultant Montefiore Nursing Homes |
| Role: | Lead researcher, clinician |
| Is the Principal Investigator a student? | ◉ Yes  ○ No |

**Supervisor 1 details N.S1.1(e) and Code of Conduct, Section 3**

| | |
|---|---|
| Site: | |
| Title: | |

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**Page 4**

Submission Code Date: 09/07/2014 14:09:29    Reference:    Online Form

| | |
|---|---|
| First Name: | |
| Surname: | |
| Position: | |
| Department: | |
| Organisation: | |
| Mailing Address: | |
| Suburb/Town: | |
| State: | |
| Postcode: | |
| Phone (business): | |
| Phone (mobile): | |
| Fax: | |
| E-mail: | |
| Qualifications, Experience and skills | |

**2.3. Investigator/s**

**Investigator 1**

| | |
|---|---|
| Site: | Centre for Education and Research on Ageing, Concord Clinical School |
| Title: | A/Prof |
| First Name: | Vasi |
| Surname: | Naganathan |
| Position: | Consultant Geriatrician and Academic Sydney Medical School, University of Sydney |
| Department: | Aged Care and Rehabilitation |
| Organisation: | Centre for Education and Research on Ageing |
| Mailing Address: | Centre for Educationa nd Research on Ageing, Concord Hospital |
| Suburb/Town: | CONCORD |
| State: | NSW |
| Postcode: | 2139 |
| Phone (business): | 9767 5419 |
| Phone (mobile): | |
| Fax: | 9767 7289 |
| E-mail: | vasi.naganathan@sydney.edu.au |
| Qualifications, Experience and skills | MBBS FRACP, PhD, Grad CERT Med Educ |
| Role: | Research nd Geriatrics Advisor |
| Is the investigator a student? | ○ Yes  ○ No |

**Investigator 2**

| | |
|---|---|
| Site: | Centre for Education & Research on Ageing, Concord Hospital |
| Title: | Prof |
| First Name: | Clive |
| Surname: | Wright |
| Position: | Associate Director (Oral Health) & Clinical Professor |
| Department: | Centre for Education & Research on Ageing, Aged Care & Rehabilitation |
| Organisation: | Concord Clinical School and Concord GRH |
| Mailing Address: | Building 18, Concord Hospital |

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**Panel 1 (top-left)**

| | |
|---|---|
| Suburb/Town: | CONCORD |
| State: | NSW |
| Postcode: | 2139 |
| Phone (business): | 02 9767 5957 |
| Phone (mobile): | 04 99775603 |
| Fax: | 02 9767 7289 |
| E-mail: | fac.wright@sydney.edu.au |
| Qualifications, Experience and skills | BDS, MDS, PhD, MRACDS (DPH) |
| Role: | Oral Health Research Advisor |
| Is the investigator a student? | ○ Yes  ⊙ No |

**Investigator 3**

| | |
|---|---|
| Site: | Montefiore Aged Care Facility, Randwick |
| Title: | Dr |
| First Name: | Peter |
| Surname: | Foltyn |
| Position: | Senior Dental Officer |
| Department: | Dental Department |
| Organisation: | St Vincent's Hospital |
| Mailing Address: | Victoria Street, Darlinghurst |
| Suburb/Town: | DARLINGHURST, SYDNEY |
| State: | NSW |
| Postcode: | 2010 |
| Phone (business): | 02 8382 3129 |
| Phone (mobile): | 0419406051 |
| Fax: | 02 83822607 |
| E-mail: | p.foltyn@stvincents.com.au |
| Qualifications, Experience and skills | BDS (Sydney); Consultant dentist; Associate University of New South Wales; 35 years expereince with compromised medical patients and geriatric dentistry; consultant, Montefiore Nursing Homes |
| Role: | Associate researcher, clinician |
| Is the investigator a student? | ○ Yes  ⊙ No |

**Investigator 4**

| | |
|---|---|
| Site: | The University of NSW |
| Title: | Prof |
| First Name: | Henry |
| Surname: | Brodaty |
| Position: | Director |
| Department: | Dementia Collaborative Research Centre |
| Organisation: | University of New South Walses |
| Mailing Address: | Level 3, AGSM Building |
| Suburb/Town: | University of NSW |
| State: | NSW |
| Postcode: | 2052 |
| Phone (business): | 02 9385 2585 |
| Phone (mobile): | 0434185939 |
| Fax: | 02 9385 2200 |
| E-mail: | h.brodaty@unsw.edu.au |
| Qualifications, Experience and skills | MBBS (Syd, MD (UNSW), DSc (UNSW), FRACP, FRANZCP |

**Panel 2 (top-right)**

| | |
|---|---|
| Role: | Consultant Research Advisor and Geriatrician |
| Is the investigator a student? | ○ Yes  ⊙ No |

**Investigator 5**

| | |
|---|---|
| Site: | Montefiore Aged Care Facility, Randwick |
| Title: | Ms |
| First Name: | Jayne |
| Surname: | Braunsteiner |
| Position: | Oral Health Therapist/ Dental Hygienist |
| Department: | Dental Department |
| Organisation: | Montefiore Aged Care - Randwick |
| Mailing Address: | 36 Danngar Street Randwick |
| Suburb/Town: | RANDWICK, SYDNEY |
| State: | NSW |
| Postcode: | 2031 |
| Phone (business): | 8345 9232 |
| Phone (mobile): | 0408381236 |
| Fax: | |
| E-mail: | jbraunsteiner@montefiorehome.com.au |
| Qualifications, Experience and skills | BOH, MSc (Dementia) Dip DT |
| Role: | Oral health therapist, associate researcher |
| Is the investigator a student? | ○ Yes  ⊙ No |

**2.4. Other personnel**

How many other personnel are involved in this project? Please provide details (for example study nurses, research assistants)
Nursing staff at the specific aged care facility
Volunteers at the specific aged care facility

**2.5. Nominated Contact for project**

| | |
|---|---|
| Title: | Dr |
| First Name: | Alan |
| Surname: | Deutsch |
| Position: | Dentist |
| Department: | Dental Clinic, |
| Organisation: | Montefiore Aged Care, Randwick |
| Mailing Address: | 603/34 Spring Stret, Bondi Junction |
| Suburb/Town: | Bondi Junction, Sydney |
| State: | NSW |
| Postcode: | 2022 |
| Phone (business): | 02 9693973 |
| Phone (mobile): | 0422872341 |
| Fax: | 02 93899748 |
| E-mail: | alan.deutsch@gmail.com |

**Panel 3 (bottom-left)**

**3. Name/ID of HREC reviewing the project**

*Select the name/ID of the HREC that this application will be submitted to.*
Sydney Local Health District - CRGH (EC00118)

**3.1. Sites involved in this project for which ethical and scientific approval is being sought from this HREC**

*List all number and names of all sites (including those external to NSW Health) involved in the project and indicate the site/s requiring ethical and scientific approval from this HREC.*

a) In how many sites will the project be undertaken?    1
b) Please provide the site details:

| Site name: | Does the site require ethical and scientific approval from this HREC?: |
|---|---|
| Montefiore Aged Care Facility, Randwick, NSW | ○ Yes  ⊙ No |

**3.2. Previous ethical review N.S 5.3**

Is this project being submitted to (or has it previously been submitted to) other ethical review bodies?
○ Yes  ⊙ No

**3.3. Peer review N.S 1.2, Code of Conduct, Section 6**

Has the project been peer-reviewed?
⊙ Yes  ○ No
*If yes, provide details and if available, the peer review report.*
The protocol was reviewed through the DCRC University of NSW process which involved advice from two academic reviewers and a coonsumer review.  Advice from the academic reviewers has been included within the current protocol and the Consumer's Review attached.

**3.4. Funding N.S 1.1(f)**

What is the source of funds available to conduct this project?

*Provide details in the table below.*

| Type of funding | Name of funding organisation/source of funding | Amount $ |
|---|---|---|
| External funding e.g. NHMRC, Foundations etc. | | |
| Internal/Departmental funding | Oral Health Unit - Centre for Education and Research on Ageing | $7,000 |

**3.5. Conflicts of interest N.S 5.4**

Are any 'conflict of interest' issues likely to arise in relation to this research?
○ Yes  ⊙ No

**3.6. Publications and Dissemination of results N.S 1.3 and Code of Conduct, Section 4**

How is it intended to disseminate the results of the research? For example a report, publication or thesis.
Publication in a professional dental journal and reports to the participating institutes and agencies.  Newsletter to staff and residents.

**4. Anticipated start and finish dates**

**4.1. Anticipated start date**

**Panel 4 (bottom-right)**

*State the date on which any study procedure or any part of the protocol is expected to be implemented.*
02/08/2014

**4.2. Anticipated finish date**

*State the date on which data analysis is expected to be completed at all sites involved in the project.*
05/11/2014

**5. Project details N.S 1.1**

**5.1. Project summary**

*Provide an overview of the project in plain language describing the aims, the research design, the methods used to achieve those aims and possible outcomes.*
Dental management of frail and elderly people, especially those suffering dementia, in general dental practice and in residential aged care facilities (RACF), is a relatively new field in dentistry and is not well managed or researched. Conventional dental treatment for frail older people, especially those with dementia is often unsuccessful, places the patient at increased risk of sysThe combination of poly-pharmacy causing SGH, the inability to maintain one's own oral health, poor oral hygiene, lack of co-operation and food management issues with RACF – currently and increasingly these factors will result in rapidly progressive oral disease, in particular rampant decay.  An understanding and elucidation of the role of oral and salivary markers in older residents in RACF will allow early individualised preventive interventions and strategies to be instituted in the early stages of dementia and Salivary Gland Hyopfunction thus reducing the potentially serious consequences. The aims of the study are to test whether RACF nurses suitably suitably trained to recognise oral health problems and test for saliva constituents, can appropriately create and implement individualised oral health preventive management plans within the resident's care plan, and referral processes for residents in RACF.  This is a pilot study to investigate the practicality and feasibility of the wider introduction of such education and referral systems in oral health for persons in RACFs. Duplicate oral health assessments and managements plans for 20 residents and 10 volunteers at Montefiore Aged Care Facility at Randwick will be conducted on consenting participates. Nurses within the RACF will be trained in an assessment process based on current best practice, and their assessments compared with professional oral health assessments carried out by registered oral health practitioners.

**5.2. Research aims and significance**

*Briefly state the aims, research objectives, key research questions and/or the hypothesis to be tested, where appropriate.*
AIMS
1. To determine whether RACF nurse oral health assessment including saliva testing is a valid assessment of oral health risk by comparing RACF nurse test screening results with those of a dental professional
2. To determine if it is feasible and practical for RACF nurses to undertake oral health assessments
3. To determine if RACF nurses provide appropriate advanced oral care plans?
4. To determine if oral care plans based on nursing assessed oral health needs will lead to improved saliva and oral health markers after 10 weeks
5. What are the results of saliva tests and saliva composition tests in a RACF population and do they improve with better oral health care?

HYPOTHESES:
1. That - RACF nurse assessment of oral health risk, including saliva testing will be a valid, reliable and efficient assessment of oral health risk of residents;
2. That - it is feasible and practical for RACF nurses to undertake oral health assessments;
3. That - Assessment by RACF nurses leads to appropriate advanced oral care plans;
4. That - Oral care plans based on nursing assessed oral health needs will have improved saliva and oral health markers after 10 weeks;
5. That - RACF nurses will be able to implement appropriate preventive interventions and refer high risk residents for treatment;
6. That there is a correlation between poor oral health and results of saliva testing and saliva composition testing

**5.3. Research methodology  N.S 1.1(a-d)**

*Provide details of the proposed method to achieve the aims, including project design, data collection techniques, data to be collected, number of participants, tasks participants will be asked to complete, recruitment of participants and analysis of results. Provide a justification of the proposed sample size, including details of statistical power of the sample, where appropriate.*

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The study will be conducted on 20 consenting aged care residents from Montefiore Aged Care Facility and 10 healthy participants (less than 60 years of age, who will act as control participants).

**Testing Procedures**
Both RACF nursing staff and dental professionals will carry out salivary marker testing procedures and assessments, independently and blind, to each other's results.

The dental professional's mouth assessment process will be based on World Health Organization and Australian Research Centre for Population Oral Health (ARCPOH) diagnostic criteria and standards.  Examiners (AD, PF, &JB) will be calibrated to the national assessment standards.

**Training Procedures**
The education and training program for nursing staff will build upon the existing Better Oral Health in Residential Care Program (BOHRC) instituted by the Australian Government in 2009.  This includes the use of the Oral Health Assessment Tool (OHAT) to assess the general oral health status of the mouth and referral pathway for dental treatment (See Protocol Attachment A). The core educational program is conducted by JB and supplementary program on saliva testing and preventive interventions will be an additional module conducted by AD and PF. Participating nurses and unit managers will be given two interactive in services about oral health and provided with handouts. They will be trained in doing oral health measurements using Australian Government materials (See references in the Protocol a,b,c,d) and how to interpret these finding and the recommended actions and appropriate preventive interventions whic follow such an assessment. Other training: will include:1) The role of increased daily water consumption (dry mouth and dehydration); 2) The role and protocol for using artificial saliva substitutes; 3) The rationale for using bicarbonate toothpaste or rinses  to raise mouth pH. 4) The impact of decreasing foods / snacking behavours using sweet foods to take medicines (ie. Food Management) 6) The role and use of sugarless gum, with Xylitol (to stimulate saliva and decrease Streptococcus in mouth - Protocol for references 12, 16, 17,18,19) The education and training program will be conducted no more than 10 weeks prior to the commencement of the study. At the completion of the training, the nurses will be competent to complete a "recommended preventive intervention sheet" as part of their assessment of the resident's oral health management plan. The validity of this assessment will be compared to the clinical researchers' assessments.

**Selection of Participants (Residents)**
Residents suitable for this study will first be nominated for selection after consultation with the Nursing Home Managers and the residents themselves.  Residents will be excluded from nomination for selection if they have high medical or behavioural risk.  Only those residents will be selected, who in the opinion and assessment by Nursing Home Managers are co-operative and will not be stressed or upset by testing procedures.  Residents with advanced dementia or who are likely to be stressed or non-cooperative will not be selected.  Should there be more than 20 residents nominated as potential participants – 20 subjects will be selected randomly.  Following this initial selection informed Consent forms will be issues to participants and/or their guardians for participation to enter the study.  Additional participants will be added to the request for consent until 20 consenting participants are enrolled.

Selection of Participants (Nurses and Volunteers). Nurses and volunteers will be selected from those currently employed by Montefiroe Homes and willing to donate their time to the study.  No incentives or coersion will be involved in securing nurses/volunteer participants.  The volunteers are included as a cross-check against feasibility and practicality estimates.  If the finding is that saliva and preventive intervention recommendations are not practcal and feasible in residential older people - the question must also be asked as to whether such tests are practical in non-resident older population.  Consequently the need to include this group within the pilot study.

**Saliva Collection:**
1. Saliva collection will be obtained by the spit or drool method into a suitably labelled sealed container.
2. Saliva collected will initially be weighed to assess volume, pH and buffering capacity at chair-side.  Saliva collected will transported within individual labelled sealed containers to St Vincent's Hospital in secure containers for bio-marker analysis.
3. Bio-marker analysis involves general testing for calcium, phosphate, urea, carbonates, sodium and chloride, mucins, glycoprotein concentrations and possibly salivary buffering capacity5,12,13,14.

**Clinical Mouth Assessment and Dental Charting**
Base-line quantitative measurements will be recorded by dental professionals prior to study commencing and will involve a standard WHO based oral examination.  RACF nursing staff will not be involved in clinical examinations and charting. Data collected during the examination: Decayed Missing and Filled Teeth (DMFT) Scores; OHAT Assessment; Number of remaining teeth present; Plaque Scores; Periodontal Disease.  Residents will be informed and referred for treatment should any new decay or oral disease be found at exam.

Other data (from case notes, structured questionnaires and interviews with nursing staff)
Demographic: age, sex...
Marital status, next of kin/ person responsible, previous occupation

---

General health, medical history and diagnoses, medications
Xerostomia Index (questionnaire is a tracking survey for Dry Mouth);
Quality of Life Questions related to oral health (OHIP-14).
Nurses' recommended preventive care (this questionnaire will provide responses of the nurses to their perception and recommendation for the level and type of oral health preventive intervention.
Compliance with the OHAT oral health care plan.

**Oral Health Assessment Tool**
This will be carried out by the nursing staff and be part of the residents' health care management notes. The will be a short "recommend prevention intervention/referral" check sheet which will ask whether the resident's oral care plan should supplemented with: Bicarbonate toothpaste, xylitol chewing gum, artificial saliva, hydration supplement, high fluoride toothpaste and chlorhexidine?

**Saliva Tests**
Simple non-invasive testing procedures will be carried out by the research clinicians (SD,PF, JB) and trained RACF nursing staff.  Tests will measure oral dryness, saliva volume and acidity of the mouth at rest and when stimulated by collecting and testing samples of saliva.  Testing will be carried out between 8:30am and 12:30pm and random researcher/nurse testing on the 20 participants within 5-7 days of each other.

**5.4. Likely benefits of the project for the participants, institution and/or community N.S 2.1**

While we intend that this research study will further medical knowledge and may improve treatment of dry mouth, rampant decay, oral and respiratory infections in the future, it may or may not be of direct benefit to the participant. If it can be successfully demonstrated that its is feasible (high concordance validity between nurses assessments and registered health providers) and practical (tests and assessments can be carried out in a timely fashion), this model of oral health care could be promulgated more widely in residential aged care facilities. The nursing home participating in this will gain credit from accreditation review and this will be incentive for others to participate.

**5.5. Actual or potential risk associated with the project N.S 2.1**

The selection of participants for this pilot study will exclude residents with serious medical and/or neurological and/or behavioural conditions.
No xrays will be taken.  Assessments by the nurses do not require intra-oral interventions other than the collection of saliva. The risk of swallowing the gauze, cotton buds or wafer  used to collect saliva is low and is mitigated in this study by:
• ensuring the gauze and cotton buds will protrude outside the mouth and be easily removed if any sign of gagging is apparent
• The wafer will be held passively on the tongue and the gauze/cotton buds will be tied with floss which will protrude outside the mouth

**6. Consent N.S 2.2,2.3**

**6.1. Will informed consent be obtained from participants?**

⊙ Yes    ○ No

*If 'Yes', describe the consent process including participant identification, how contact will be made, the process by which individuals will be recruited and enrolled into the project, and how consent will be obtained and recorded.*
Consent will be sought from nursing home, resident and resident's family/ guardian (See Protocol for details). An "Information for participants" letter has been developed and initial consent to proceed has been obtained from the Montefiore Aged Care Facility Board of Management. Participants will be free to withdraw from the project at anytime without detriment to the nursing and/or oral health care.  Participants will be provided with a "Findings of Mouth Assessment" and treatment/clinical care arranged either through the Montefiore Dental Clinic or referral to the dental health provider of the participants choice.  The project will be monitored by reporting to a Steering Committee comprising of independent medical and dental scientists drawn from appropriate staff within CERA at AC&R Concord Hospital and the research team.

**7. Data and privacy N.S 3.2**

**7.1. Is there a requirement for the project to collect, use, or disclose individually identifiable or re-identifiable data of a personal nature (including personal health information) about participants from:**

---

Commonwealth departments or agencies?    ○ Yes    ⊙ No

State/Territory departments or agencies?    ⊙ Yes    ○ No

Private sector?    ⊙ Yes    ○ No

*a) Provide details on the nature and source of the data:*
Saliva test samples will be frozen and stored for the proposed 18 month length of the study to be used for bio-analysis. Saliva samples will be de-identifiable to protect privacy with a numeric number code being held by the Principal Investigator.

Only those clinicians involved in direct patient care will have access to research data collected. All demographic and questionnaire data collected will be de-identified with the code broken only when analysis is required Data will be safely stored in a secured file and backed up off site.

*b) Describe how the data will be used:*
Saliva collected will initially be weighed to assess volume and used to assess pH and buffering capacity at chair-side.  Saliva collected will transported in individual labelled sealed containers to St Vincents Hospital in secure containers for bio-marker analysis. Bio-marker analysis involves general testing for calcium, phosphate, urea, carbonates, sodium and chloride, mucins, glycoprotein concentrations and possibly salivary buffering capacity. Saliva samples will be refrigerated or frozen and stored until the completion of the study.
Mouth assessment data will be use to determine the concordance of response between the OHAT nurses assessment and the professionally determined oral health status; to assess the practicality of nurses including saliva and mouth assessments within their daily care routines; to determine if there has been an improvement in salivary markers and symptoms; and to ensure that the sample is generally comparable in terms of oral health status, xerostomia and quality of life issues with older Australians in residental aged care facilities.

**7.2. Is there a requirement for the project to collect, use, or disclose individually identifiable or re-identifiable data of a personal nature (including personal health information) about participants without their consent?**

○ Yes    ⊙ No

**7.3. Storage and security of data**

*Provide this information for each site which requires ethical and scientific approval from this HREC, listed in response to Question 3.1b of this form.*

---

**Declaration by the Co-ordinating Investigator, Principal Investigators, and Investigators**
**(including Supervisors and students where applicable)**

| Project title: | Can oral health be assessed by RACF nurses, and early preventive oral health interventions incorporated into care plans for residents? |
|---|---|

I/we certify that:

1. All information in this form is truthful and as complete as possible.

2. I/we have had access to and read the NHMRC *National Statement on Ethical Conduct in Human Research 2007* (National Statement) and the *Australian Code for the Responsible Conduct of Research 2007* (The Code)

3. The research will be conducted in accordance with the ethical and research arrangements of the organisations involved.

4. I/we have consulted any relevant legislation and regulations, and the project will be conducted in accordance with these.

5. I/we will immediately report to the HREC anything which might warrant review of the ethical and scientific approval of the proposal, including:
   a. Serious or unexpected adverse effects on participants;
   b. Proposed changes in the protocol;
   c. Unforseen events that might affect continued ethical and scientific acceptability of the project.

6. I/we will inform the HREC and the Public Health Organisation, giving reasons, if the research project is discontinued before the expected date of completion.

7. I/we will not continue the research if ethical approval or site authorisation is withdrawn and will comply with any special conditions required by the HREC and the site.

8. I/we understand and agree that study files and documents and research records and data may be subject to inspection by the HREC, Research Governance Officer, the sponsor or an independent body for audit, inspection and monitoring purposes.

9. I/we will adhere to the conditions of approval stipulated by the HREC and will co-operate with HREC monitoring requirements. At a minimum annual progress reports and a final report will be provided to the HREC and the site.

10. I/we will only commence this research project after obtaining approval from the HREC and authorisation from the Public Health Organisation.

| Name | Designation | Signature | Date |
|---|---|---|---|
| Dr Alan Deutsch | Co-ordinating Investigator | | |
| Dr Peter Foltyn | Investigator | | |
| Ms Jayne Braunsteiner | Investigator | | |
| Prof Clive Wright | Supervisor | | |
| A/Prof Vasi Naganathan | Supervisor | | |
| Prof Henry Brodaty | Investigator | | |

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**Declaration by the Head of Department/School/Research organisation**

| Project title: | Can oral health be assessed by RACF nurses, and early preventive oral health interventions incorporated into care plans for residents? |
|---|---|

*Where an investigator for the study is also the head of department, certification must be sought from the person to whom the head of department is responsible. Investigators must not approve their own research on behalf of the department.*

1. I certify that I have read the project application named above.

2. I certify that I have discussed this project and the resource implications for this department with the Co-ordinating/Principal Investigator.

3. I certify that the Co-ordinating/Principal Investigator and other investigators involved in the project have the necessary skills, training and experience to undertake their role, and where necessary, appropriate training and supervision has been arranged.

My signature indicates that I support this project being carried out using the required resources, based on the information provided by the Co-ordinating/Principal Investigator

**Name of department:**            Centre for Education and Research on Ageing

**Name of head of department:**    Professor David Le Couteur

**Signature:** ......................................................................    **Date:**
Comments:

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# Appendix 3: Letter from Concord HERC14 Aug 2014, Additional Questions

**Contact:** Sydney Local Health District (SLHD)
Human Research Ethics Committee – CRGH
Concord Repatriation General Hospital (CRGH)
Building 75, Hospital Road
Concord NSW 2139
Telephone:     (02) 9767 5622
Email:            ethicscrgh@email.cs.nsw.gov.au

**Our Ref:**     (6.1 of 5/08/2014)

CONCORD
REPATRIATION GENERAL
HOSPITAL

14 August 2014

Dr Alan Deutsch
Dental Department
Montefiore Aged Care
603/35 Spring St
BONDI JUNCTION
NSW 2203

Re:     CH62/6/2014-107 – A Deutsch
LNR/14/CRGH/133
*Can oral health be assessed by RACF nurses, and early preventive oral health interventions incorporated into care plans for residents?*

- LNR Application Locked Code AU/6/3B69113
- Study Protocol Final Version dated 3 July 2014
- Consumer Review Form – April 2014

Thank you for submitting the above new research proposal, which was reviewed by the Executive Ethical Review Panel of the SLHD Human Research Ethics Committee – CRGH at its meeting on 5 August 2014.

The Panel made the following comments:

1. The Panel sought confirmation that all prospective participants will be competent to consent. If this is not the case, you are referred to the NSW Guidelines for Low and Negligible Risk Research which exclude research involving participants who are unable to provide informed consent. In this case a National Ethics Application Form (NEAF) would need to be submitted. Please comment.

2. The Panel requested more information about the project as follows;
   - How many patients are in the Montefiore Aged Care Facility and what level of care is provided?
   - Since samples will be analysed at St Vincent's Hospital, please seek the advice of St Vincent Hospital as to whether it should be included as a site.
   - An alternative signature for Head of Department should be provided, since A/Prof Vasi Naganathan is a named investigator.

3. With regards to the study methodology:
   - If the participants are receiving usual care throughout the study, how will this impact on the study results?

4. In relation to the patients:
   - Are there any dietary restrictions (fasting/fluid intake) before the dental assessment?
   - Should patients who are unable to chew for the required amount of time without swallowing the gum be excluded?

5. In relation to the next of kin, or relatives:
   - The Panel noted that there were references in the submission to consenting patients and next of kin together. If the patient is competent to consent, the consent of relatives is not required, although it is appropriate to inform them about the research. However if the patient is non-competent, a separate Participant Information Sheet and Consent Form should be provided for their next of kin (and a NEAF submitted as per point 1).

6. In relation to the healthy volunteers:
   - How are healthy volunteers identified and approached?
   - Are there any potential dependent relationships for the healthy volunteers (eg if staff members are asked to participate) and how will such relationships be managed?
   - Do the healthy volunteers constitute a control group for the study?
   - Are they offered care if a dental problem is identified?
   - A separate Participant Information Sheet and Consent Form should be provided for this group.

7. Please provide the following documentation:
   - Quality of Life tool for oral health OHIP-14
   - Questionnaire for nurses (ref: page 10 LNR form)
   - A data collection form

8. Participant Information Sheet and Consent Form
   - The Participant Information Sheet should be significantly simplified, jargon and repetition removed and typographical errors corrected.
   - Please clarify the total time commitment for participation in the study (The protocol states that the saliva test will take 1 hour 3 times a week, but this does not match the information in the Participant Information Sheet paragraph 5 under What does the study involve?)
   - The Participant Information Sheet and Consent Form should inform patients that there may further intervention or treatment as a result of their participation.
   - The Participant Information Sheet does not mention the glucose challenge test.
   - The Consent Form refers to risks and side-effects, but these are not addressed in the Participant Information Sheet.
   - The Participant Information Sheet and Consent Form should be a stand alone document with version # and date in the footer, and page numbering.
   - The Panel felt it would be important to give Next of Kin information about their relative's involvement in the study. The researchers are asked to comment.

Please respond to the above issues in writing. Please provide the Panel with one copy of revised documents, with changes underlined, and a new version number and date for patient documents (as appropriate).

Your response to the above matter will be referred to the Chair and the reviewer to make a final decision on behalf of the SLHD Human Research Ethics Committee – CRGH.

Please note that if the requested information is not received within three (3) months the project will be dismissed and you will be required to re-submit the project at a later date.

*Please quote the above Concord Hospital File No. in all correspondence.*

Yours sincerely,

**Virginia Turner**
*Executive Officer*
*Sydney Local Health District Human Research Ethics Committee -*
Concord Repatriation General Hospital

# Appendix 4: Alan Deutsch Letter of Reply to Concord HERC

C/o Virginia Turner, Executive Officer
Sydney Local Health District (SCHD)
Human Research Ethics Committee CRGH
Concord Repatriation General Hospital
Building 75, Hospital Road. NSW 2139

Your Ref 6.1 of 5/08/2014

6 September 2014

Dear Ms Turner

**RE: Your Letter dated 14 August 2014**
   **(Short Title) Role of RACF nurses and oral assessment and care.**
**CH62/6/2014-107-A. Deutsch**
**LNR/14/CRGH/133**
**LNR Study Application Locked Code AU/6/3B69113**
**Consumer Review Form April 2014**

Thank you for your letter dated 14 Aug 2014 requesting further information and clarification of study protocols and procedures for Concord HERC.

Below are answers to questions raised by Concord HERC Committee.

**Q1 –Consent by Resident and Part Q 5 Relatives/Guardians**

**Selection of Participants and Consent**
Residents suitable for this study will first be nominated for selection after consultation with the Nursing Home Managers, residents and relatives or person responsible to ensure their competence to participate. Residents will be excluded from nomination for selection if they are acutely unwell or have significant behavioural problems. We will exclude residents who do not understand sufficient spoken and written English. Only those residents will be selected, who in the opinion and assessment by Nursing Home Managers and/or their guardians will be co-operative and will not be distressed or upset by testing procedures and can follow instructions.
Residents with advanced dementia or who are likely to be distressed or non-cooperative will not be selected in the pilot study. Should there be more than 20 residents nominated as potential participants – 20 subjects will be selected randomly.

Following this initial selection, an information sheet will be issued and its contents outlining the resident's participation and study objectives will be explained in person to both the resident, their family or person responsible.
The Participant Information sheet will be issued prior to obtaining consent outlining the participant's time commitment and study protocols involved.
See answer to Q 8 for more detail.

**2.1 Resident Numbers at Montefiore and Level of Care**:
Montefiore Jewish Nursing Home organisation manages 4 facilities with campuses at Randwick, Hunters Hill, Woollahra and Maroubra. The Montefiore Dental Clinic is situated at the Randwick where the study will take place.
Montefiore residents:

| | | |
|---|---|---|
| Total of 75 High care dementia | ( 30 | Randwick campus) |
| 52 Low care dementia | ( 30 | Randwick campus) |
| 260 Hostel- low care nursing | (107 | Randwick campus) |
| 339 Nursing- high care nursing | (109 | Randwick campus) |
| Totals 726 | (266 | Randwick campus) |

http://www.montefiorehome.com.au/


**2.2 St Vincents SydPath:** The relationship of the study to SydPath will be that of a pathology laboratory processing the specimens on a commercial basis.
We have had an offer of technical assistance and help from St Vincent's SydPath pathology laboratory with respect to salivary bio-chemical collection and analysis to validate against the clinical saliva testing (see below) and explore potential additional salivary markers.

SydPath saliva laboratory analysis results are not core for this study. The training of RNS to carry out saliva testing and care plan development are the main aims of this study not dependant on biochemical testing.

A chairside commercially available saliva testing kit (GC- Saliva Check Buffer Test Kit), commonly used in general dental practice, is suitable for this study and will be used by RNs and dental professionals. The kit allows measurements of pH, resting and stimulated saliva flow rates and buffering capacity and is core to the study and not dependent on laboratory testing.

**2.3 Head of Department:** The final document has been signed off by
Professor David Le Couteur.

**3.0 Study Methodology and Usual Care**. The following interventions can be considered to be usual care and are routinely recommended or prescribed by the Montefiore Dental Clinic:-

- Assisted brushing
- 3-4 monthly examination and cleaning with the oral therapist
- Oral7 artificial saliva substitute, administered by the resident, RNs as needed
- Use of re-mineralising agents, prescribed on an individual needs basis.
- Chlorhexidine toothpastes, prescribed on an individual needs basis.
- High Fluoride toothpaste

The use of these products and recommendations are not monitored and we have found compliance to be variable or poor. Currently an understanding of how, when and why these interventions are used is not understood by RNs or the Aged Care industry as a whole. Although assisted brushing programs have been introduced at Montefiore a number of times, in our experience, assisted brushing is difficult to maintain long term and seldom routinely carried out.

**4.1 Dietary Restrictions**

Saliva testing will be standardised and performed in the mornings one hour after eating and drinking between the hours of 8:30am and 1:00pm. Testing of residents in an ACF may have to fit in with the ACF routine. There may be a need for some flexibility with respect to when testing can begin after breakfast and before lunch as well as the availability of staff to assist in testing if needed. Saliva tests will be delayed by 30 minutes where a subject has recently eaten or has had a drink.  The saliva test data collection will record when the subject last ate or had a drink.

Part of the study will look at the frequency of eating foods and snacking. The aim of this study is not to restrict foods and snacking but to make nurses aware that a high frequency of eating sweet foods and snacking has an adverse effect on oral health and that these adverse effects can be mitigated by chewing gum and using small increments of bicarbonate toothpastes to neutralise mouth acids.

**4.2  Chewing Wax and Swallowing:** Only co-operative early dementia residents, who on the advice of nursing home managers and nursing staff, will not be stressed by testing procedures, can follow instructions and are not likely to swallow the gum will be selected for this study.

Testing will be abandoned should patients be stressed or unable to chew for the minimum allotted 3 minutes. Should the chewing test be abandoned part way through the test then the time chewed will be recorded.

The use of saliva test to create advanced oral care plans will not be invalidated should the participant not be able to chew.
Chewing after a glucose challenge will cause a rise in pH provided test subjects have some residual salivary function. The better the salivary function the greater the rise in pH. However, where there is poor salivary function or where the test subject is unable to chew the pH should rise more slowly or not at all.

A small increment of a commercially available sodium bicarbonate toothpaste (Colgate Acid Neutraliser) will be introduced into the mouth in a later stage of the testing. The paste will cause a rapid rise of pH to pH8 where it is expected to remain for a prolonged period of time irrespective of salivary function or ability to chew.
Again this part of the saliva test will show the benefits using sodium bicarbonate toothpaste in care plans to neutralise mouth acids independent of chewing.

**5.1  Can Give Consent. Next of Kin:** If the participant is competent and able to give consent:-the next of kin or person responsible will be informed of the research.
(See also answer to Q1.)

**5.2  Cannot Give Consent. Next of Kin:** If the participant is not competent, that is have advanced dementia or other condition, they will not be included within this study
(See response to Q1):

**6.1  Healthy Volunteers Selection**: Healthy volunteers will be self-selected mainly from staff within Montefiore Nursing Home or may be sourced from outside the home. The

Nursing home will advertise for volunteers through internal electronic notices, notice boards and word of mouth.

**6.2  Dependant Relationships:** There will be no dependant relationships with respect to staff volunteers undergoing saliva testing. There will be no adverse repercussions to staff should they wish not to participate. Volunteers will undergo a saliva test only once.

**6.3  Control Group:** Volunteer saliva testing will be used as a teaching tool for RNs and not primarily to establish a control group. The purpose of testing healthy volunteers is to teach nursing staff how to perform saliva tests prior to testing residents. Although saliva tests are not difficult, these tests need to be well practiced before testing residents.

A key aim of this study is to determine whether RN saliva testing of residents is reliable and accurate by verifying the results with dental professional testing.
Should saliva testing of volunteers by RNs prove to be reliable from the outset, the volunteer test results may be used as a control group even if it is not a primary aim of the study.

It should be noted that tests results from a healthy volunteer group, even if they are taking medications, may be very different from residents who may be taking medication with stronger anti-cholinergic effects.  The dental/medical literature has established values for normal saliva function in healthy adults.

**6.4  Volunteer Dental Care:** No clinical examination of volunteers will be performed by a dental professional. The volunteer will be advised to seek dental treatment and will be referred to their dental practitioner should any dental problem be discovered during the saliva testing procedure**.**

**6.5  Participation Information Sheet and Consent:** A separate Volunteer Participation Information Sheet outlining the testing procedure will be issued and explained and a signed informed consent form will be obtained.

**7.1  Quality of Life Tool (OHAP14):**
(See attachment)

**7.2  Questionnaire for nurse:** Separate RN and oral therapist questionnaires to assess the ease or difficulty of the different aspects of the study have been formulated.
(See attachments)

**7.3  Data Collection:** The study will be divided into separate components each with its own data collection forms:
(See attachments)

**8.1  Participation Information Sheet:** Separate Volunteer and Resident Participant Information sheets will be issued prior to obtaining consent outlining the participant's time commitment and study protocols.
(See attachment: Residents Participation Information Form (including participants with mild dementia)
(See attachment: Volunteers Participation Form)

## 8.2 TOTAL TIME COMMITMENT OF RESIDENTS AND VOLUNTEERS

**RN OHAT Assessment:** OHAT will be performed by RNs prior to saliva testing.
Time allocated15-20 minutes.

**RN OHIP14 and Short Xerostomia Questionnaire**
OHIP 14 and a Short Saliva Questionnaire will be performed by RN prior to saliva testing.
Time allocated 15-20 minutes

**Saliva Tests and Time Commitment**
One hour is allocated per examiner for each saliva test including setup time. All active testing will cease after 50 minutes, or earlier, to allow for writing up test results. Actual contact time, (time when something is happening to the test subject) is between 10-15 minutes. The bulk of the time is spent waiting to take the next pH measurement and talking to the resident. A minimum of one pH measurement is required per testing procedure. Tests are standardised to take place between 8:30am and 1:00pm, one hour after eating or drinking.
(See data collection sheet attached)

It is likely that one examiner is likely to test no more than 3 test subjects in one morning because of the morning routines and time constraints in an ACF.

**Volunteers:** Volunteers will undergo one saliva test either by an RN or an oral therapists.

**Residents:** Resident participants will undergo 3 saliva tests:-
    1) Saliva test by an RN at 0 weeks.
    2) A second saliva test by a dental professional within 1 week of their first saliva RN test to verify RN testing.
    3) A third saliva test by a dental professional at 10 weeks.

**Summary of Saliva Test Adapted from the GC Saliva-Check Buffer Test Kit**
**Tests and Time Allocated**
**i) Resting pH:** Resting saliva pH will be assessed by wetting a small sponge applicator placed under the tongue for 5 seconds then wetting litmus paper.
(Time allocated to complete this test: 0.5 minute)
**ii) Dryness Test**: Tissue paper is placed over the inside surface of the lower lip for 1 minute and the time noted when beads of saliva first forms on the tissue paper.
(Time allocated to complete this test: 2 minutes)
**iii) Resting Saliva Test:** Participants will be asked to spit or drool into a container for 3 (up to 5) minutes which will be weighed to assess unstimulated saliva volume and pH recorded using litmus paper. Saliva will be aspirated into a collection test tube, labelled, stored and sent for biochemical analysis. (Time allocated: 6 minutes)
**iv) Glucose Challenge:** Participants will rinse with a 20% glucose solution for 1 minute and rest for 5 minutes after which time saliva pH drop will be recorded using pH paper.
(Time allocated: 7 minutes)
**v) Stimulated Saliva-Chewing wax:** Participants will then chew wax gum for 3 (up to 5) minutes to collect stimulated saliva which will be weighed to assess volume, the pH will again be measured after chewing and depending on resident co-operation pH will be measured periodically every 5 minutes for a further 10 or 15 minutes and pH values plotted over time. Note a single pH measurement will be adequate to show improvement in mouth

pH from chewing. Stimulated saliva will be aspirated into a collection test tube, labelled, stored and sent for biochemical analysis.
(Time allocated: 15-20 minutes)

**vi) Buffering Capacity:** Buffering capacity as per the GC Saliva-Check Buffer kit will be recorded during the above waiting time.

**ii) Sodium Bicarbonate toothpaste:** A small increment of a commercially available toothpaste containing sodium bicarbonate will be placed in the mouth and the pH noted with additional pH recordings at 5 minute intervals for a further 10-15 minutes depending on resident co-operation. Again a single pH measurement will be adequate to show improvement in mouth pH from sodium bicarbonate toothpaste.
(Time allocated: 10-15 minutes)

The rate at which saliva pH returns to resting values is dependent on buffering capacity and stimulated saliva volume bought about by chewing. The bicarbonate toothpaste will cause a rapid rise of pH irrespective of salivary function or ability to chew. Poorer oral health outcomes can be expected when the pH drop is greater and more prolonged. (Less saliva collected, worse SGH. The slower the pH return to base values the worse the buffering capacity of saliva and more acidified the mouth).

Re-testing after interventions or any de-prescribing over this time should see an increase in saliva volume and correlate with clinical improvement of Dry Mouth.
(Total test time: 60 minutes, Time with Resident: 30-45 minutes; Actual contact time = 10-15 minutes')

**Clinical examination and OHAT assessment by a dental professional:**
A clinical examination involving charting, plaques scores and OHAT assessment will be performed by a dental professional prior to saliva testing**.**
This is considered part of normal regular care at Montefiore.
Time allocated 20-30 minutes.

A hard copy of this letter can be provided if required.
Yours Faithfully

Alan Deutsch
Montefiore Dental Clinic
603/35 Spring St, Bondi Junction
NSW 2022
P: 9369 3973
E: alan.deutsch@gmail.com

# Appendix 5: Ethics Approval From Concord HERC 3 Oct 2014

**Contact:** Sydney Local Health District Human Research Ethics Committee – CRGH
Concord Repatriation General Hospital (CRGH)
Concord NSW 2139
Telephone: (02) 9767 5622
Email: ethicscrgh@email.cs.nsw.gov.au

**Our Ref:**

CONCORD
REPATRIATION GENERAL
HOSPITAL

3 October 2014

Dr Alan Deutsch
Dental Department
Montefiore Aged Care
603/35 Spring Street
BONDI JUNCTION
NSW 2203

Dear Dr Deutsch,

Re: LNR/14/CRGH/133    (CH62/6/2014-107)
Can oral health be assessed by RACF nurses, and early preventive oral health interventions incorporated into care plans for residents?

Thank you for submitting the above project for single ethical and scientific review. This project was first considered by the Executive Ethical Review Panel of the Sydney Local Health District Human Research Ethics Committee – CRGH at its meeting held on 5 August 2014. This Human Research Ethics Committee (HREC) has been accredited by the NSW Ministry of Health as a lead HREC under the model for single ethical and scientific review.

This lead HREC is constituted and operates in accordance with the National Health and Medical Research Council's *National Statement on Ethical Conduct in Human Research* and the *CPMP/ICH Note for Guidance on Good Clinical Practice.*

I am pleased to advise that the Committee has granted ethical approval of this research project.

The documents reviewed and approved include:

- **LNR Application Locked Code AU/6/3B69113**
- **Study Protocol**
- **Participant Information for Residents version 2 dated 1 September 2014**
- **Participant Information for Volunteers version 2 dated 1 September 2014**
- **Participant Information for Next of Kin version 2 dated 1 September 2014**

The HREC has provided ethical and scientific approval for the following site:
1. Sir Moses Montefiore Jewish Nursing Home

Please note the following conditions of approval:

1. You will immediately report anything which might warrant review of ethical approval of the project in the specified format, including unforeseen events that might affect continued ethical acceptability of the project, (including Serious Adverse Events).

2. Proposed changes to the research protocol, conduct of the research, or length of HREC approval will be provided to the HREC for review in the specified format.

*Final Approval LNR 2014-107*                    *Page 1*

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3. You will notify the HREC, giving reasons, if the project is discontinued at a site before the expected date of completion.

4. You will provide an annual report to the HREC, and at completion of the study in the specified format.

5. You will adhere to the study protocol at all times.

HREC approval is valid for five (5) years subject to the supply of an annual progress report. The first report should be sent to the Concord Hospital Research Office by **31/10/2015.**

Should you have any queries about the HREC's consideration of your project please contact the Executive Officer - (02) 9767-5622. The HREC Terms of Reference, Standard Operating Procedures, membership and standard forms are available from the website: www.sswahs.nsw.gov.au/concord/ethics .

We wish you every success in your research.

*Please quote the above file number in all correspondence.*

Yours sincerely,

Professor Andrew McLachlan
*Chairman*
SLHD Human Research Ethics Committee – CRGH

**Please complete the boxes below and return a copy of this page to the Concord Hospital Research Office:**

| ☐ | *I acknowledge and accept the Conditions of Ethical Approval.* |
|---|---|

| ☐ | *I will not commence this project at any site until separate written authorisation from the Chief Executive or delegate of that site has been obtained* |
|---|---|

Printed Name                Signature            Date
Chief Investigator

*Final Approval LNR 2014-107*                    *Page 2*

# NSCOCP ORAL HEALTH STUDY:- FORMS and EDUCATION MATERIAL

## Appendix 6: Participant Information for Residents

Participant Information: For a study to improve your health by preventing oral infections, disease and decay in Montefiore Aged Care Nursing Home

**Title: Can Residential Aged Care Nurses improve the oral health of Residents through oral assessments?**

You are invited to take part in a research study into whether saliva and oral examinations can predict the likelihood of having an increased risk of dental decay or oral disease. Individualised advanced oral care plans will be designed to improve your oral health and minimise the likelihood of future disease.

This Participant Information Sheet will tell you what is involved in the study and help you decide whether or not to participate. Please read this information carefully and feel free to ask more questions and seek further information about this study. It is advisable you talk things over with a relative, friend or your own doctor or dentist before you make a decision.

*Why have you been invited to take part and why is good Oral Health important*
Older people often suffer accelerated tooth decay , gum disease, dental abscess formation and, sometimes, respiratory infections from bacteria living in the mouth. In older adults these conditions are made worse due to difficulty in maintaining one's own oral care, medical problems and the taking of multiple medicines that may cause dry mouth. Oral health directly impacts on general health and quality of life. Oral infections, pain and discomfort can have devastating effects and compound psychological and social problems that affect a patient, family and carers. Maintaining good teeth and oral health throughout life benefits general health, social wellbeing, nutrition and quality of life.

*What is the purpose of this study?*
We are conducting a research study at Montefiore Aged Care Home to see whether oral examinations performed by nursing staff in aged care facilities , under dental professional supervision, can create 'advanced oral care plans' and whether these care plans can help improve oral health.

***How the project intends to fill the gap in current knowledge***
There is little research on normal and abnormal saliva and oral markers in older adults living at home or in Aged Care Facilities and how these markers relate to oral health, disease and the quality of life.

***How it may contribute to care or education or future research***
This study may help other older people living at home or in aged care facilities should simple interventions delivered by nurses and carers through advanced oral care plans prove to be effective in preventing disease and improving oral health.

***Can I withdraw from the study?***
Taking part in any research is entirely voluntary.  If you do decide to take part you can withdraw at any time without having to give a reason.  Please be assured that, whatever your decision, it will not affect your medical or dental treatment or your relationship with dental or Montefiore nursing staff.

***Consent Form***
The consent form must be signed by you prior to any assessments being performed.

***What are the benefits if I join the study?***
Your oral health will be more closely monitored over the course of the 10-12 weeks study period and existing oral problems will be detected early. Earlier management of dental problems will avoid pain and possibly more complex treatment in the future.
Advanced oral care plans should have a positive effect in improving your oral and general health and decrease the risk of future disease.

***Results***
At the completion of your dental assessment by the dentist/hygienist you will be provided with a report to take to your regular dentist – see attached form - (this may be taken to the dental clinic at Montefiore or elsewhere).

***What does the study involve?***
*Medical history and medication list:*
Older people tend to suffer more medical problems and take medications that directly affect the quality of saliva and often cause the mouth to become very dry. The study will collect information about your general medical condition and the medicines you are taking to see if there is a relationship between the quality of your saliva and your risk of oral disease.

### Study Summary

| Nurses Oral Health Assessment | When | Dental Professional Assessment | When |
|---|---|---|---|
| Questionnaires  15 mins | Beginning | | |
| Oral Health Assessment Inspection 15-20 mins | Beginning | Oral Health Assessment and Clinical Examination  30 min Results of examinations explained | Beginning |
| Saliva Test 15 min contact time (50min over-all) | Beginning | Saliva Test 15 min. contact time(50min over-all) | 1 week later |
| Advanced oral care plans developed by RN, implemented and monitored | 1 to 10 weeks | Supervision and monitoring of Advanced oral care plans | 1-10 weeks |
| | | Saliva Test 15 min. contact time(50min over-all) | End of study |

*Questionnaires:*
You will be asked to fill out two short questionnaires on how dry your mouth is and how the state of your mouth and teeth affect the quality of your life.  Some people may need family or carers to help them fill out these questionnaires which take about 15-20 minutes to complete.

*Oral Health Assessment Tool (OHAT):*
OHAT is a Commonwealth Government validated standardised assessment tool used to assess oral health on entry into an aged care facility. The Montefiore Dental Clinic perform OHATs as part of a resident's routine periodic dental check-up.  The OHAT involves inspecting lips, tongue, gums, saliva, teeth, oral cleanliness and assessing dental pain to detect oral problems and to refer to a dentist for treatment if needed.  An OHAT assessment takes about 10-20 minutes to complete. The OHAT will be performed twice, firstly by a registered nurse who will use a light and mirror only, followed by a dental professional. Their results will be compared.

*Dental Examination by a Dentist or Oral Therapist:*
A dental professional will perform an OHAT exam and  a detailed clinical examination  using a mirror, small round ended probe and air to dry your teeth. This will take about 30 minutes No X-rays will be taken

*Saliva Tests:*
Simple saliva tests to assess saliva quality and mouth dryness will be performed by both a specially trained registered nurse and a dental professional to see if they get the same results.

You will have 3 saliva tests over a 10 (up to 12) week period. The first saliva test will be by a nurse at the start of the study. The same test will repeated within the first week by a dental professional. The last test will be performed a dental professional at the end of the study to see if there has been any improvement through nurse care plans involving preventive interventions.

***Summary of Saliva Test Procedures***
The acidity of your saliva will be measured by wetting a small sponge applicator under your tongue for 2-5 seconds and applying the applicator to litmus paper to measure acidity (pH). Dryness will be measured by placing tissue paper on your lip for 1 minute and seeing how long it takes for beads of saliva to form.
You will be asked to spit into a plastic cup for 3-5 minutes to assess how much saliva you have at rest.  You will then rinse with a 20% glucose solution for 1 minute. The acidity of your saliva will again be measured after 5 minutes. This test replicates eating or drinking something sweet without chewing.
You will be asked to chew wax gum for 3-5 minutes and your saliva will be collected into a cup to measure how much saliva you can produce and your saliva's ability to neutralise acids. Saliva acidity will again be measured every 5 minutes for 10-15 minutes to see how long it takes before your saliva starts to return to a normal.

Finally, a small amount of a commercially available toothpaste (Colgate Acid Neutraliser) containing sodium bicarbonate will be placed in your mouth to see if the paste neutralises mouth acid without having to chew by measuring pH every 5 minutes for 10-15 minutes.

Your actual time of involvement when you have to do something during the test is about 10-12 minutes. The majority of the time is spent waiting to take the next 5 minute saliva acid measurement over a 30- 45 minutes period during which time you will be chatting to the people doing the tests.

*Saliva analysis*
Saliva collected may be sent to a commercial bio-chemical laboratory for analysis.

***Advance Oral Care Plans***
Based on all your assessments the registered nurse, under dental professional supervision, will create advanced oral care plans individualised to your needs. This care plan will be followed by all nursing staff for the 10 (up to 12) week period of the study.
The care plans will include some or all of the following preventive interventions:-
*Hydration:* How much you drink will be recorded to see if you maintain adequate hydration
*Remineralisation of teeth:* High fluoride, calcium and phosphate toothpastes will be used mornings to harden teeth and decrease decay.
*Xylitol chewing gum:* Chewing gum stimulates saliva gland production to produce saliva that can neutralise acid.  The xylitol also acts against bacteria that can cause decay.

*Artificial saliva substitute (Oral7):* Oral 7 topical gel or rinse is used to keep the mouth moist and lubricated and prevent the mouth from drying out.  A dry mouth is more acidic and may have more aggressive bacteria.

*Sodium Bicarbonate toothpastes:* The introduction of small amounts of this toothpaste after eating can rapidly neutralise mouth acids without brushing or chewing.

*Chlorhexidene (Curascept) Toothpaste:* This toothpaste will be used in the evenings to reduce the overall amount of bacteria living in the mouth.

*Assisted brushing*: Where required, nursing staff will assist you in brushing your teeth and dentures.

### *Are there any Risks*

The risk of injury is extremely low. Nurses will use a mirror and light while the dental therapists will use rounded probes, mirror and dry air. It is highly unlikely that injury may be caused during any examination or testing procedure.  A risk of accidentally swallowing chewing gum is possible but even this is well tolerated by the gut.

### *Privacy*

All information will be strictly confidential and restricted to the researchers. Statistical results of the research may be described in local and international scientific meetings of doctors and scientists and published in scientific journals.  No identifiable information will be given to an outside party.

### *Who is organising the study*

This is a collaborative study between the Dementia Collaborative Research Centre -DCRC, Centre for Healthy Brain Ageing -CHeBA, University of NSW, Centre for Education in Ageing - CERA, (Concord Hospital), Sydney University and the Montefiore Dental Clinic.  The study is funded through research grants.

### *Further information*

When you have read this information, Alan Deutsch, Peter Foltyn and Jayne Braunsteiner will discuss it with you further and answer any questions you may have.  If you would like to know more at any stage, please feel free to contact:

Jayne Braunsteiner -   Oral Therapist Montefiore Dental Clinic, Ph: 8345 9232

Alan Deutsch -         Consultant Montefiore Dental Clinic Ph: 9369 3973

Dr Peter Foltyn -      Consultant Montefiore Dental Clinic, Ph: 8382 3129

This study has been approved by the Sydney Local Health District Human Research Ethics

Committee- Concord Repatriation General Hospital. If you have any concerns or complaints

about the conduct of the research study, you may contact the Executive Officer of the Ethics

Committee, on (02) 9767 5622.

## Appendix 7: - Participant Consent Form

**TITLE OF PROJECT**
**Can Residential Aged Care Nurses improve the oral health of Residents through oral assessments?**


I, …………………………………………………….……………[name]


of…………………………………………………………….[address]

have read and understood the Information for Participants for the above named research study and have discussed the study with  ……………………………………………………….

- I have been made aware of the procedures involved in the study, including any known or expected inconvenience, risk, discomfort or potential side effect and of their implications as far as they are currently known by the researchers.

- I understand that, during the course of this study, my medical records may be accessed by the researchers, by regulatory authorities or by the Ethics Committee approving the research in order to verify results and determine that the study is being carried out correctly.

- I freely choose to participate in this study and understand that I can withdraw at any time.

- I also understand that the research study is strictly confidential.

- I hereby agree to participate in this research study.


**Name (Please Print):** …………………………………………………………………………………..


**Signature:**………………………………………….	**Date:** …………………………………………

**Name of Person who conducted informed consent discussion (Please Print):**

………………………………………………………………………………

**Signature of Person who conducted informed consent discussion:**

………………………………………………………………………………….

# Appendix 8: - Information for Next of Kin

**<u>Title:</u> Can Residential Aged Care Nurses improve the oral health of Residents through oral assessments?**

Your relative has been invited to take part in a research study into whether saliva and oral examinations can predict the likelihood of having an increased risk of dental decay, oral disease. Individualised advanced oral care plans will be designed to improve their oral health and minimise the likelihood of future disease.

This Information Sheet will tell you what is involved in the study.

***Why your relative has been invited to take part and why is good Oral Health important***
Older people often suffer accelerated tooth decay , gum disease, dental abscess formation and, sometimes, respiratory infections from bacteria living in the mouth. In older adults these conditions are made worse due to difficulty in maintaining one's own oral care, medical problems and the taking of multiple medicines that may cause dry mouth. Oral health directly impacts on general health and quality of life. Oral infections, pain and discomfort can have devastating effects and compound psychological and social problems that affect a patient, family and carers. Maintaining good teeth and oral health throughout life benefits general health, social wellbeing, nutrition and quality of life.

***What is the purpose of this study?***
We are conducting a research study at Montefiore Aged Care Home to see whether oral examinations performed by nursing staff in aged care facilities under dental professional supervision can create 'advanced oral care plans' and whether these care plans can help improve oral health.

***How the project intends to fill the gap in current knowledge***
There is little research on normal and abnormal saliva and oral markers in older adults living at home or in Aged Care Facilities and how these markers relate to oral health, disease and the quality of life.

***How it may contribute to care or education or future research***
This study may help other older people living at home or in aged care facilities should simple interventions delivered by nurses and carers through advanced oral care plans prove to be effective in preventing disease and improving oral health.

***Can my relative withdraw from the study?***
Taking part in any research is entirely voluntary. If your relative decides to take part they can withdraw at any time without having to give a reason. Please be assured that, whatever

their decision, it will not affect their medical or dental treatment or their relationship with dental or Montefiore nursing staff.

***Consent Form***
The consent form must be signed by your relative prior to any assessments being performed.

***What are the benefits if they join the study?***
Their oral health will be more closely monitored over the course of the 10-12 weeks study period and existing oral problems will be detected early. Earlier management of dental problems will avoid pain and possibly more complex treatment in the future.
Advanced oral care plans should have a positive effect in improving their oral and general health and decrease the risk of future disease.

***Results***
At the completion of the dental assessment by the dentist/hygienist your relative will be provided with a report to take to their regular dentist – see attached form - (this may be taken to the dental clinic at Montefiore or elsewhere).

***What does the study involve?***
*Medical history and medication list:*
Older people tend to suffer more medical problems and take medications that directly affect the quality of saliva and often cause the mouth to become very dry. The study will collect information about your relative's general medical condition and the medicines they are taking to see if there is a relationship between the quality of their saliva and their risk of oral disease.

***Study Summary***

| Nurses Oral Health Assessment | When | Dental Professional Assessment | When |
|---|---|---|---|
| Questionnaires 15 mins | Beginning | | |
| Oral Health Assessment Inspection 15-20 mins | Beginning | Oral Health Assessment and Clinical Examination 30 min Results of examinations explained | Beginning |
| Saliva Test 15 min contact time (50min over-all) | Beginning | Saliva Test 15 min. contact time(50min over-all) | 1 week later |
| Advanced oral care plans developed by RN, implemented and monitored | 1 to 10 weeks | Supervision and monitoring of Advanced oral care plans | 1-10 weeks |
| | | Saliva Test 15 min. contact time(50min over-all) | End of study |

*Questionnaires:*
Your relative will be asked to fill out two short questionnaires on how dry their mouth is and how the state of their mouth and teeth affects their quality of life. Some people may need family or carers to help them fill out these questionnaires which take about 15-20 minutes to complete.

*Oral Health Assessment Tool (OHAT):*
OHAT is a Commonwealth Government validated standardised assessment tool used to assess oral health on entry into an aged care facility. The Montefiore Dental Clinic performs OHATs as part of a resident's routine periodic dental check-up. The OHAT involves inspecting lips, tongue, gums, saliva, teeth, oral cleanliness and assessing dental pain to detect oral problems and to refer to a dentist for treatment if needed. An OHAT assessment takes about 10-20 minutes to complete. The OHAT will be performed twice, firstly, by a registered nurse who will use a light and mirror only, followed by a dental professional. Their results will be compared.

*Dental Examination by a Dentist or Oral Therapist:*
A dental professional will perform an OHAT exam and a detailed clinical examination using a mirror, small round ended probe and air to dry your teeth. This will take about 30 minutes No X-rays will be taken

*Saliva Tests:*
Simple saliva tests to assess saliva quality and mouth dryness will be performed by both a specially trained registered nurse and a dental professional to see if they get the same results.

Your relative will have 3 saliva tests over a 10 (up to 12) week period. The first saliva test will be by a nurse at the start of the study. The same test will repeated within the first week by a dental professional. The last test will be performed a dental professional at the end of the study to see if there has been any improvement through nurse care plans involving preventive interventions.

***Summary of Saliva Test Procedures***

The acidity of your relative's saliva will be measured by wetting a small sponge applicator under their tongue for 2-5 seconds and applying the applicator to litmus paper to measure acidity (pH).

Dryness will be measured by placing tissue paper on their lip for 1 minute and seeing how long it takes for beads of saliva to form.

They will be asked to spit into a plastic cup for 3-5 minutes to assess how much saliva they have at rest.  They will then rinse with a 20% glucose solution for 1 minute. The acidity of their saliva will again be measured after 5 minutes. This test replicates eating or drinking something sweet without chewing.

They will be asked to chew wax gum for 3-5 minutes and their saliva will be collected into a cup to measure how much saliva they can produce and the saliva's ability to neutralise acids. Saliva acidity will again be measured every 5 minutes for 10-15 minutes to see how long it takes before their saliva starts to return to a normal.

Finally, a small amount of commercially available toothpaste (Colgate Acid Neutraliser) containing sodium bicarbonate will be placed in their mouth to see if the paste neutralises mouth acid without having to chew by measuring pH every 5 minutes for 10-15 minutes.

Their actual time of involvement when they have to do something during the test is about 10-12 minutes. The majority of the time is spent waiting to take the next 5 minute saliva acid measurement over a 30- 45 minutes period during which time they will be chatting to the people doing the tests.

*Saliva analysis*

Saliva collected may be sent to a commercial bio-chemical laboratory for analysis.

***Advance Oral Care Plans***

Based on all their assessments, the registered nurse, under dental professional supervision, will create advanced oral care plans individualised to your relative's needs. This care plan will be followed by all nursing staff for the 10 (up to 12) week period of the study.

The care plans will include some or all of the following preventive interventions:-

*Hydration:* How much they drink will be recorded to see if they maintain adequate hydration

*Remineralisation of teeth:* High fluoride, calcium and phosphate toothpastes will be used mornings to harden teeth and decrease decay.

*Xylitol chewing gum:* Chewing gum stimulates saliva gland production to produce saliva that can neutralise acid.  The xylitol also acts against bacteria that can cause decay.

*Artificial saliva substitute (Oral7):* Oral 7 topical gel or rinse is used to keep the mouth moist and lubricated and prevent the mouth from drying out.  A dry mouth is more acidic and may have more aggressive bacteria.

*Sodium Bicarbonate toothpastes:* The introduction of small amounts of this toothpaste after eating can rapidly neutralise mouth acids without brushing or chewing.

*Chlorhexidene (Curascept) Toothpaste:* This toothpaste will be used in the evenings to reduce the overall amount of bacteria living in the mouth.

*Assisted brushing*: Where required, nursing staff will assist your relative in brushing their teeth and dentures.

### Are there any Risks?

The risk of injury is extremely low. Nurses will use a mirror and light while the dental therapists will use rounded probes, mirror and dry air. It is highly unlikely that injury may be caused during any examination or testing procedure.  A risk of accidentally swallowing chewing gum is possible but even this is well tolerated by the gut.

### Privacy

All information will be strictly confidential and restricted to the researchers. Statistical results of the research may be described in local and international scientific meetings of doctors and scientists and published in scientific journals.  No identifiable information will be given to an outside party.

### Who is organising the study

This is a collaborative study between the Dementia Collaborative Research Centre -DCRC, Centre for Healthy Brain Ageing -CHeBA, University of NSW, Centre for Education in Ageing -CERA, (Concord Hospital), Sydney University and the Montefiore Dental Clinic.  The study is funded through research grants.

### Further information

  If you would like to know more at any stage, please feel free to contact:

Jayne Braunsteiner -  Oral Therapist Montefiore Dental Clinic, Ph: 8345 9232

Alan Deutsch -        Consultant Montefiore Dental Clinic Ph: 9369 3973

Dr Peter Foltyn -      Consultant Montefiore Dental Clinic, Ph: 8382 3129

This study has been approved by the Sydney Local Health District Human Research Ethics

Committee- Concord Repatriation General Hospital.  If you have any concerns or complaints

about the conduct of the research study, you may contact the Executive Officer of the Ethics

Committee, on (02) 9767 5622.

Resident Participant Information Sheet– Montefiore RN Care Plan Study. Ver. 2
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1 Sep 2014

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# Appendix 9:  Participation Information for Volunteers

**Participant Information: For a study to improve your health by preventing oral infections, disease and decay in Montefiore Aged Care Nursing Home**

<u>**Title**</u>:

Can Residential Aged Care Nurses improve the oral health of Residents through oral assessments?

You are invited to take part in a research study into whether saliva and various oral examinations of older residents in an Aged Care Facility (ACF) can predict the likelihood of having an increased risk of dental decay, oral and/or general disease.

This Volunteer Participant Information Sheet will tell you what is involved in the study and help you decide whether or not to participate.  Please read this information carefully and feel free to ask more questions and information about this study.

***Why have you been invited to volunteer and why is good Oral Health important***

In order for registered nurses to be able to perform accurate saliva tests on residents with dementia they will require advanced training in oral health and saliva testing.

You are asked to assist the education and training of nurses by volunteering to be the initial saliva test subjects before nurses test dementia residents.

Older people often suffer accelerated tooth decay, have gum disease, dental abscess formation and sometimes respiratory infections from bacteria living in the mouth. In older adults these conditions are made worse due to difficulty in maintaining one's own oral care, medical problems and the taking of multiple medicines that may cause dry mouth. Oral health directly impacts on general health and quality of life. Oral infections, pain and discomfort can have devastating effects compounding psychological and social problems that impact on a patient, family and carers.  Maintaining good teeth and oral health throughout life benefits general health, social wellbeing, nutrition and quality of life.

***What is the purpose of this study?***

We are conducting a research study at Montefiore Aged Care Nursing Home to see whether oral examinations can be performed by nursing staff (as well as dental professionals) in aged care facilities. We would also like to see whether nurses under dental professional supervision can create 'advanced oral care plans' and whether these care plans can help improve oral health and decrease risk of disease.

### How the project intends to fill the gap in current knowledge

There is little research on normal and abnormal saliva and oral markers in older adults living at home or in Aged Care Facilities and how these markers relate to oral health, disease and the quality of life.

### How it may contribute to care or education or future research

This study may help many other older people living at home or in aged care facilities should simple interventions, based on saliva testing allow nurses to formulate advanced oral care plans prove to be effective in preventing disease and improving your oral health.

### Can I withdraw from the study?

Taking part in any research is entirely voluntary. If you do decide to take part you can withdraw at any time without having to give a reason. Please be assured that, whatever your decision, it will not affect your relationship with Montefiore Aged Care Nursing Home management or staff.

### Consent Form

The consent form will be signed by you after consultation with you, prior to any saliva testing being performed.

### What are the benefits if I join the study

Although you will not have a clinical examination by a dental professional , you will be referred to your dentist for appropriate treatment should any dental problem or problems with the quality of your saliva be found.

### Results

At the completion of your saliva test by the dentist/hygienist you will be provided with a report to take to your regular dentist

### What does the study involve?

*Medical history and medication list:* The study will ask you to list information about your general medical condition and medicines you are taking to see if there is a relationship between the quality of your saliva and your risk of oral disease.

### Summary of Saliva Test Procedures

The acidity of your saliva will be measured by wetting a small sponge applicator under your tongue for 2-5 seconds and applying the applicator to litmus paper to measure acidity (pH). Dryness will be measured by placing tissue paper on your lip for 1 minute and seeing how long it takes for beads of saliva to form.

You will be asked to spit into a plastic cup for 3-5 minutes to assess how much saliva you have at rest. You will then rinse with a 20% glucose solution for 1 minute. The acidity of your saliva will again be measured after 5 minutes. This test replicates eating or drinking something sweet without chewing. You will be asked to chew wax gum for 3-5 minutes and your saliva will be collected into a cup to measure how much saliva you can produce and your saliva's ability to neutralise acids. Saliva acidity will again be measured every 5 minutes for 10-15 minutes to see how well your saliva starts to return to a normal. People with poor

saliva quality will have more acidified saliva with some never being able to return to normal saliva pH levels. Finally, a small amount of a commercially available toothpaste (Colgate Acid Neutraliser) with sodium bicarbonate will be placed in your mouth to neutralises mouth acid without you having to chew by measuring pH every 5 minutes for 10-15 minutes.

The actual time you are involved when you have to do something during the test is about 10-12 minutes. The majority of the time is spent waiting to take the next 5 minute saliva acid measurement over a 45 minutes period during which time you will be chatting to the people doing the tests.

### *Are there any Risks*
The risk of injury is extremely low. A risk of accidentally swallowing chewing gum is possible but even this is well tolerated by the gut.

### *Privacy*
All information will be strictly confidential and restricted to the researchers. Statistical results of the research may be described in local and international scientific meetings of doctors and scientists and published in scientific journals.  No identifiable information will be given to an outside party.

### *Who is organising the study*
This is a collaborative study between the Dementia Collaborative Research Centre -CDRC, Centre for Healthy Brain Ageing -CHeBA, University of NSW, Centre for Education in Ageing -CERA, (Concord Hospital), Sydney University and the Montefiore Dental Clinic.  The study is funded through research grants.

### *Further information*
When you have read this information, Alan Deutsch, Peter Foltyn and Jayne Braunsteiner will discuss it with you further and answer any questions you may have.  If you would like to know more at any stage, please feel free to contact:

Jayne Braunsteiner -   Oral Therapist Montefiore Dental Clinic, Ph: 8345 9232

Alan Deutsch -          Consultant Montefiore Dental Clinic Ph: 9369 3973

Dr Peter Foltyn -       Consultant Montefiore Dental Clinic, Ph: 8382 3129

This study has been approved by the Sydney Local Health District Human Ethics Committee- Concord Repatriation General Hospital

## Appendix 10: Volunteer Consent Form

Appendix K Consent Form (Residents)

### VOLUNTEER CONSENT FORM

**TITLE OF PROJECT**
Can Residential Aged Care Nurses improve the oral health of Residents through oral assessments?

I, ...........................................................................[name]

of...........................................................................[address]

have read and understood the Information for Participants for the above named research study and have discussed the study with ....................................................................

- I have been made aware of the procedures involved in the study, including any known or expected inconvenience, risk, discomfort or potential side effect and of their implications as far as they are currently known by the researchers.

- I understand that I may be asked to provide a list of medications that I am taking.

- I freely choose to participate in this study and understand that I can withdraw at any time.

- I also understand that the research study is strictly confidential.

- I hereby agree to participate in this research study.

Name (Please Print): ..................................................................................................

Signature:................................................... Date: ...................................................

Name of Person who conducted informed consent discussion (Please Print):

..........................................................................................

Signature of Person who conducted informed consent discussion:

..........................................................................................

Volunteer Consent Form – Montefiore RN Care Plan Study Ver. 3
27 Sep 2014                                                                                    Page 1

# Appendix 11: Findings -Clinical Examinations and Assessments

DCRC          MONTEFIORE          cera

## Appendix L    Findings From the Dental and Mouth Inspection

Please note that the Dental and Mouth Inspection conducted as part of this study does not replace your normal, regular dental examination conducted by your dentist or dental health provider.

Name:_____

Today a dental inspection was carried out for the above named participant in the Project and the following conditions were noted:

☐ Decay (Dental Caries)            Number of decayed teeth ...............................

☐ Moderate to advanced gum disease (Periodontal Pocketing of 4mm of more)

☐ Early gum disease (Calculus/ Gingivitis)

☐ Inflamed / Abnormal oral soft tissues like lips, tongue or cheeks (Mucosa)

☐ Instability or defects of dentures          ☐ Denture Cleanliness [Good], [Poor], [Very Poor]

☐ Other condition_____

☐ None of the above

I have advised the Project Participant and/or their Carer that this dental inspection does not replace a complete dental examination and treatment plan and that their details of a dental management plan must be decided by their own dentist.  I have advised the Project Participant and/or their Carer that in my opinion he should seek dental advice and care.

☐ Immediately        ☐ In the near future        ☐ Within the next 6-months.

Name of Dental Provider_____          Date:_____

Findings from Dental and Mouth Inspections – Montefiore RN Care Plan Study Ver.2
27 Sep 2014                                                                    Page 1

## Appendix 12: Nurse Education NSCOCP, Assisted Brushing

Power Point Presentation Material discusses:-
OHAT, How to Manipulate Dentures, Dry Mouth, Polypharmacy, Diet & Food pH,
Home care products and procedures

**Slide 25**
ASSISTED BRUSHING
Why is important?

INREASED FREQUENCY OF SNACKING AND EATING

Encourages oral biofilm growth and a greater pH drop (more acidification) in the mouth.
Need to disrupt oral biofilm growth.

**Slide 26**
ASSISTED BRUSHING
Why is important?

DRY MOUTH FROM POLYPHARMACY

Does not allow flushing out the system
Does not neutralise mouth acids
Encourages oral biofilm growth and causes a pH drop (more acidification) in the mouth

**Slide 27**
ASSISTED BRUSHING
Why is important?

NEED TO DISRUPT OR RETARD ORAL BIOFILM GROWTH TO REDUCE MOUTH ACIDIFICATION and ORAL DISEASE

ASSISTED BRUSHING PHYSICALLY DISRUPTS BIOFILM-
is one strategy but not the only one

**Slide 28**
be organised:
work in pairs

**Slide 29**
provide a pleasant environment

**Slide 30**
let the resident do what they can

**Slide 31**
check for any sore looking teeth or gums

**Slide 32**

**Slide 33**

**Slide 34**

**Slide 35**
Sodium Bicarbonate (baking soda) swabs (Oraswab by ConfidentCare)

**Slide 36**

**Slide 37**

**Slide 38**

**Slide 39**

**Slide 40**

**Slide 41**

**Slide 42**

**Slide 43**

**Slide 44**

**Slide 45**
Calculus (tartar) can be dissolved by Vinegar- Leave for 20 minutes and scrub.
Twice a year

Do not wear dentures at night.
Soak in water overnight

**Slide 46**
ASSISTED BRUSHING

Use head support
   Pillows
   Back board
   Own Body

retract lower lip

**Slide 47**
Use a very soft brush

Brush gently where the gum meets the tooth

Practice by having someone brush your own teeth

retract lower lip

**Slide 48**
PATIENTS WITH VERY POOR CO-OPERATION

Brush a different part of the mouth each day

Make a brush chart, record start point and date

U Right   U Left
inside
L Right   L Left

retract lower lip

# Appendix 13: Nurse Education NSCOCP

Material discusses:

SXI-D, OHIP14, OHAT, Dry Mouth, Polypharmacy, Mouth pH, Diet & Food, NSCOCP, Preventive products and procedures

**Slide 25** — Health / Disease Balance — Young Age



**Slide 26** — Health / Disease Balance — Old Age



**Slide 27** — Health / Disease Balance

$$Health = P_{lague}\ E_{xtrinsic}\ S_{aliva}\ T_{ooth} / D_{isease}$$

- Health: New Plaque +ve Biofilm > pH; Ft, Ca, POx Lifestyle; Resting ph > 6.5, +ve Quality, > Flow-buffer, > Clearance, > Film thickness
- Disease: Old Plaque -ve Biofilm <pH; Caries Periodontal; POLY PHARMACY, Food acids, Smoking, Hand control, Eating Frequency; -ve Quality, Resting pH < 6.0, < Volume, < Clearance, < FLOW; FOOD MANAGEMENT in Aged Care; LOSS OF BUFFERING CAPACITY

**Slide 28** — Health / Disease Balance

(similar layout as slide 27 with Anatomy, < Fe, Ca, POx Exposure, MMPs)

**Slide 29** — Risk Assessment Tools — *Quick look*

- **Tongue:** Dry, rough, red, lobulated, fissured, atrophic papillae, swollen, sore, burning
- **Lips:** Dry, scaly, chapped, cracked, loss of elasticity, soreness, angular chielosis, fissured

**Slide 30** — Risk Assessment Tools — *Quick look*

- **Teeth:** Multiple early changes to tooth surface texture or colour
- **Restorations:** Heavily filled mouth with many fillings
- **Caries (Decay):** Multiple (3-4) decayed teeth, Active decay on anterior teeth
- **Roots Stumps:** Decayed teeth level with or below gum

**Slide 31** — Risk Assessment Tools — *Quick look*

- **Saliva:** Overall dryness. Lack of salivary coating on teeth and soft tissues, ropey, frothy
- **Mucous:** Very thick sticky mucous in mouth and pharynx associated with risk of aspirational pneumonia
- **Calculus:** No supra or sub-gingival calculus in presence of poor oral hygiene

**Slide 32** — Risk Assessment Tools — *Quick look*

- **Food:** Poor food clearance- food still retained in the mouth and under dentures. Difficulty eating dry foods, requires water to swallow food
- **Thirst:** Frequent sips of water, glass by bedside
- **Speech:** Difficulty speaking (lack of confidence!!)
- **Swallowing: Dysphagia-** Observe swallowing, Increased risk of aspirational pneumonia

**Slide 33** — Xerostemia Short Questionnaire



**Slide 34**



**Slide 35** — OHIP14 Oral Health Impact Profile 14Qs



**Slide 36** — OHAT Oral Health Assessment Tool



**Slide 37** — SALIVA TEST



**Slide 38** — Poly-Pharmacy — *≥50 Years in Previous 24 Hours*

With increasing age:
→ Mix of conventionally prescribed and complementary medicines changes from minimising risk factors (lipid lowering, bone density, etc.) to treating disease

A national census of medicines use: a 24-hour snapshot of Australians aged 50 years and older. T Morgan et al. Med J Aust 2012

**Slide 39** — Poly-Pharmacy — *≥50 Years in Previous 24 Hours*

In 24 hour period ≥ 5 Medicines

| AGE | 50-64 | 65-74 | ≥75 |
|---|---|---|---|
| POLYPHARMACY | 32.2% | 49.4% | 66.0% |

**Slide 40** — Poly-Pharmacy — *Anti-Cholinergic Potential/Potencies*

1. Tricyclic Anti-depressants: 40-55%
   amitriptyline > clomipramine > amoxapine > potriptyline > doxepin > imipramine > trimipramine > nortriptyline
2. Selective Serotonin Reuptake Inhibitors (SSRI's): 21%
   citalopram, fluoxetine, fluvoxamine, paroxetine, and sertraline
3. Relative Anticholinergic Potencies of Select Anti-psychotic Drugs
   +++ Promazine, trifluopromazine, mesoridazine, thioridazine, clozapine, olanzapine
   ++ Chlorpromazine, pimozide= Fluphenazine, perphenazine, prochlorperazine, trifluoperazine, thiothixene, haloperidol, molindone, loxapine.
   O  Quetiapine, risperidone
   [+++ = strong; ++ = moderate; + = weak; O = none]
4. Diuretics
5. Anti-hypertensive / anti angina
6. Anti-histaminic Drugs
7. Analgesics – Narcotic, NSAID

**Slide 41** — Poly-Pharmacy — *Aged Care Strategies*

Synergistic Affect
- 4 or more drugs = 40-50% xerostemia
- 5 or more drugs = 50-70% xerostemia
- Xerostomia worse if psychological reason for drug

**Slide 42** — Risk Assessment Tools — *pH*

Enamel Critical pH — **5.5 pH**

Solid (Enamel) ⇌ Solution (Caries)

Hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$ — acid — $Ca + PO_4 + H_2O$ ions in solution

- Critical pH not constant
- Inversely proportional to concentrations of Ca & $PO_4^{3-}$ in saliva & biofilm
- Critical pH may rise to 6.5 for low salivary Ca and $PO_4$

Dawes. J Can Dent Assoc (2003)

**Slide 43**



00:09

**Slide 44** — Risk Assessment Tools — *Flow Rates Saliva Testing*

| SALIVA FULL TESTS GC | COMPETENT CO-OPERATIVE | NON COMPETENT CO-OPERATIVE | NON COMPETENT NON CO-OPERATIVE |
|---|---|---|---|
| | Radiotherapy of jaws Sjogrens | Low Care Dementia High Care Nursing | High Care Dementia High Care Nursing |
| Flow Rates | Y | Y / n | N |

*Resting Saliva:* Important for assessing tissue protection and lubrication
*Stimulated Saliva:* Important in indirectly assessing buffering capacity
*Testing flow rates:* May not be possible without co-operation. May need to rely only on oral visual assessment only

**Slide 45** — Stimulated Saliva Flow — Chewing Gum



**Slide 46** — RESTING Lubrication & Protection

Lubricates teeth and soft tissues
Facilitates: Speech, Taste, Swallowing
Prevents abrasion and entry of micro-organism into tissues
Stops bacteria sticking to teeth and gums
Clumps bacteria to be swallowed

Film Thickness: NORMAL 70-100 microns / ABNORMAL 10 microns

**Slide 47** — STIMULATED Buffering Clearance

| GLAND TYPE | SALIVA TYPE | RESTING SALIVA | STIMULATED SALIVA | BUFFERING CAPACITY |
|---|---|---|---|---|
| Parotid | Serous | 20-25% Minor Source | Major Source | High in buffers |

Increased Flows Increases
- Buffering
- Neutralisation of plaque acid
- Neutralisation of mouth acid
- Glucose Clearance
- Flushes system > oral micro-organisms are destroyed in the gut

**Slide 48** — Stimulated Saliva Flow — Chewing Gum



Adapted from Collin Dawes & Dong (1988)

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## Slide 49 — Saliva Flow Rate Effects

|  | Normal | Abnormal |
|---|---|---|
| Resting Saliva Flow Rate | 0.3-0.4 ml/min | <0.1 ml/min |
| Stimulated Saliva Flow Rate | 1-2 ml/min 7.0 ml/min max | <0.8 ml/min |
| HALF LIFE GLUCOSE CLEARANCE | 2.2 minutes | 6.5 minutes |

## Slide 50 — Stephan Curve

Normal population sample
Resting pH < 6.2 = Caries Activity
Returns to baseline 30-60 minutes



## Slide 51 — Stephan Curve

Resting saliva pH returns to baseline after 30-60 minutes
Normal Resting Saliva pH 7.0 – 6.3
RESTING pH < 6.2 = CARIES ACTIVITY
CRITICAL pH = 5.5 (Enamel Dissolves in pH range 5.5 – 5.0)

| CARIES STATUS | BEFORE RINSE pH | AFTER RINSE pH |
|---|---|---|
| Caries Free | 7.1 | 5.5 |
| Slight Caries Active | 6.8 | 4.9 |
| Marked Caries Active | 6.2 | 4.6 |
| Extreme Caries Active | 5.5 | 4.3 |

## Slide 52 — Stephan Curve
### Normal vs. Dry Mouth



Saliva restricted
Saliva not restricted

## Slide 53 — Risk Assessment Tools - Diet

FOOD MANAGEMENT:
Non nutritious use of food to manage behaviour and take medicines

Increased frequency of eating results in increased frequency of pH drops in mouth and increased acidification

## Slide 54 — Stephan Curve
### Acid Attack Freq. 24hr Period



## Slide 55 — Acid Attack Freq. 24hr Period
### < pH 5.5 → Enamel Demin.



## Slide 56 — Acid Attack Freq. 24hr Period
### Food Management in ACF



## Slide 57 — pH of Foods

| Food | pH |
|---|---|
| Milk | 6.3 - 8.5 |
| Crackers | 7.0 - 8.5 |
| Bread / Cakes | 5.3 - 8.0 |
| Cheese | 5.0 - 7.0 |
| Fish | 6.6 - 6.8 |
| Most Vegetables / Meats | 5.0 - 6.5 |
| Most Fruits | 3.8 - 6.0 |
| Honey | 3.9 |
| Prunes | 3.1 |
| Jams | 3.1 - 3.5 |
| Wines | 2.9 - 3.9 |
| Coca Cola | 2.5 |
| Most Berries | 2.4 - 4.0 |
| Lemon / Citric Acid | 2.2 |

## Slide 58 — Aged Care Strategies
### Early Warning Signs

- Multiple lower anterior interproximal root caries
- Multiple buccal root caries

## Slide 59 — Preventive Aged Care Strategies
### Early Warning Signs

- Poor Oral Hygiene
- Multiple changes to tooth surfaces
- Poor OH but no calculus
- 'My teeth feel sharp and rough'

## Slide 60 — Broad Tx Objectives
### 80:20 Rule

Aim to have minimum 20 teeth (premolar to premolar) at age 80 years

## Slide 61 — Dry Mouth Tx Strategies
### Preventative Strategies

- Symptomatic Relief
- Diet
- Oral Hygiene
- Strengthen Tooth Structure
- Re-buffer after meals if SGH
- Saliva Quality (quantity/buffering capacity)
- Systemic

## Slide 62 — Advanced Oral Care Plan



## Slide 63 — Dry Mouth Tx Strategies
### Remineralisation Agents  Enamel 5ppm  Dentine 100ppm

| Remin Agent | Details |
|---|---|
| GC Mousse | Casein phosphopeptide – amorphous calcium phosphate (CPP-ACP)<br>Re-mineralises enamel subsurface lesions<br>Anti-cariogenic / antibacterial activity<br>Potentiates fluoride activity<br>Buffering capacity, supersaturated Ca and PO₄ ions |
| Fluorides | NeutraFluor 5000 toothpaste (5000ppm) 1-2x/day spit, no rinse<br>Colgate Acid Neutraliser (1500ppm) use to neutralise mouth acids<br>Normal toothpaste (1000ppm) |
| Chewing Gums | Xylitol Chewing Gum – Re-mineralise through own saliva stimulation |
| GIC Fillings | A class of tooth coloured filling rich in fluoride can re-mineralise teeth |

## Slide 64 — Advanced Oral Care Plan



## Slide 65 — Symptomatic Relief
### HYDRATION

Minimum total fluid intake 1500mls-2000ml
Is weight dependant
Activity dependant
Males greater fluids than females

Equivalent to 6-8, 250ml cups of fluid from all sources

Guidelines To Effective Hydration in Aged Care Facilities. M. Woodward 2007

## Slide 66 — Symptomatic Relief
### HYDRATION

Strategies to maintain / increase fluid intake

- Ensure all staff are adequately trained in the importance of hydration.
- Regularly offer fluids – e.g. every 1 ½ hours by day
- Offer fluids at specific routine events
  - before / after showering or washing
  - after toileting
  - before / after physiotherapy or other activity program
  - medication rounds
- Regular hydration cart rounds

Guidelines To Effective Hydration in Aged Care Facilities. M. Woodward 2007

## Slide 67 — Symptomatic Relief
### HYDRATION

- Offer residents their preferred drinks
- Prompt residents to drink at meal times
- Ensure fluid is within residents' reach
- Educate families / visitors to offer fluids when visiting
- Encourage "wet" foods such as jelly, custard, yoghurt, ice cream, soup, pureed fruit
- Have a social hour where fluids are offered
- Keep a fluid intake chart especially for at risk residents
- Use a symbol such as a drop of water on trays of residents who need to drink more, to prompt staff.

Guidelines To Effective Hydration in Aged Care Facilities. M. Woodward 2007

## Slide 68 — Advanced Oral Care Plan



## Slide 69 — Symptomatic Relief
### pH of ORAL LUBRICANTS
### Artificial Saliva Products

| Product | pH |
|---|---|
| Sodium Bicarb Rinse/Toothpaste | 8.2 |
| GC Dry Mouth Gel | 7.1 |
| Oral 7 Gel | 6.1 |
| Colgate Dry Mouth Relief Fluoride Mouthwash 0.02% NaF | 5.8 |
| Biotene – Gel | 5.6 |

## Slide 70 — Symptomatic Relief
### pH of ORAL LUBRICANTS
### Artificial Saliva Products

| Product | pH |
|---|---|
| Sodium Bicarb Rinse/Toothpaste | 8.2 |
| GC Dry Mouth Gel | 7.1 |
| Oral 7 Gel | 6.1 |
| Colgate Dry Mouth Relief Fluoride Mouthwash 0.02% NaF | 5.8 |
| Biotene – Gel | 5.6 |
| ENAMEL DISSOLVES | 5.5 |

## Slide 71 — Symptomatic Relief
### pH of ORAL LUBRICANTS
### Artificial Saliva Products

| Product | pH |
|---|---|
| Sodium Bicarb Rinse/Toothpaste | 8.2 |
| GC Dry Mouth Gel | 7.1 |
| Oral 7 Gel | 6.1 |
| Colgate Dry Mouth Relief Fluoride Mouthwash 0.02% NaF | 5.8 |
| Biotene – Gel | 5.6 |
| ENAMEL DISSOLVES | 5.5 |
| Oral Seven Rinse | 4.8 |
| Biotene Paste | 4.6 |
| Stannous Fluoride | 2.2 |
| Stomach acid | 1.0 |

## Slide 72 — Advanced Oral Care Plan

## Slide 73

### Dry Mouth Tx Strategies

Chewing Gum
Mint
Toothpaste
Table Use

#### *XYLITOL CHEWING GUM*

- Artificial sweetener can increase blood glucose levels
- Xylitol chewing gum *reduces:*
  - Dental plaque quantity *S. mutans* levels
  - Caries incidence
  - Cytokine expression by LPS from *P. gingivalis*
- *Increases:*
  - Saliva production
  - Re-mineralisation of carious lesions
- Regular use may help prevent gingivitis & periodontitis
- *Contraindication:* Crohn's Disease and Irritable Bowel Syndrome can aggravate symptoms & induce diarrhea

W Roberts & J Wright, Int J Dent. (2012)

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## Slide 74

### Advanced Oral Care Plan

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## Slide 75

### Dry Mouth Tx Strategies

#### *Severe SGH Re-buffer Post Meals*
*Once patients can no longer re-buffer themselves*

**Sodium Bicarbonate** (baking Soda) has
- Anti-bacterial
- Bicarb. toothpaste – effective buffering agent
- Rapidly elevates plaque pH
- Neutralises plaque & mouth acids for up 60 mins following glucose challenge

Hoshmet al. J Dn dent&(8) 176-177, 1997

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## Slide 76

### Dry Mouth Tx Strategies

#### *Re-buffer After Meals*
*Personal View*

Diagnosed SGH or poor saliva quality & volume

**RE-BUFFER after every meal**

**Baking Soda Toothpaste (Sodium Bicarbonate) – easier to use**
- Brush after meals
- Topical application after all snacks

**Sodium Bicarbonate (Baking Soda) Rinse**
- Rinse after meals
- Teaspoon in water

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## Slide 77

### Sodium Bicarbonate Toothpaste

#### *Colgate Sugar Acid Neutraliser Toothpaste*

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## Slide 78

### Advanced Oral Care Plan

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## Slide 79

### Chlorhexidine

- Bactericidal
- Bacteriostatic: Prolonged effect for soft tissues, gingivitis

*Precautions:*
- No evidence CHX prevents caries (gel may be better)
- Deactivated by SLS & F⁻ toothpastes:
  - CHX at night
    (Fluoride toothpaste + Tooth Mousse morning / lunch)

- **Need a 2-hour interval between F⁻ & CHX**

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## Slide 80

### Chlorhexidine in Aged Care

**Rx:**
CHX 'Curasept' Toothpaste nightly 0.05% & 0.12%
Rinse 0.2% nightly, 0.5% 2 week intensive
Gel 0.5% 2 week intensive
- Effective for soft tissue – **NO CARIES REDUCTION**
- Swab or atomiser spray delivery

CURASEPT TOOTHPASTES

CURASEPT GEL

CURASEPT RINSES

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## Slide 81

### Advanced Oral Care Plan

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## Slide 82

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## Appendix 14: Short Xerostomia Questionnaire (SXI-D) Dutch Version

**Appendix C    Dry Mouth Questionnaire** - Summated Xerostomia Inventory - Dutch Short Version    Date:

First Name: _____    Surname: _____

Participant Number: _____
Room Number: _____
Administered by: _____

For each row, please circle the answer that best applies to you during the last year.

| | Never (1) | Occasionally (2) | Often (5) |
|---|---|---|---|
| 1. My mouth feels dry when eating a meal | | | |
| 2. My mouth feels dry | | | |
| 3. I have difficulty in eating dry foods | | | |
| 4. I have difficulties swallowing certain foods | | | |
| 5. My lips feel dry | | | |
| Subtotal | | | |
| TOTAL | | | |

Dry Mouth Questionnaire          Montefiore Study Ver.1          1 Sept 2014          Page 1

## Appendix 15:  Oral Health  Impact Profile (OHIP 14)

Date:    _____

First Name: _____    Surname:_____    Room Number: ___

Administered by_____    Participant Number: _____

**We are interested to know how the health of your teeth, gums and mouth impacts your daily life. Please answer the following questions even if you only wear dentures.**

**OHIP14**

1.  **In the LAST 12 MONTHS, have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?**

☐ Never

☐ Hardly ever

☐ Occasionally

☐ Fairly often

☐ Very often

**In the LAST 12 MONTHS, have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?**

☐ Never

☐ Hardly ever

☐ Occasionally

☐ Fairly often

☐ Very often

**In the LAST 12 MONTHS, have you had painful aching in your mouth?**

☐ Never

☐ Hardly ever

☐ Occasionally

☐ Fairly often

☐ Very often

**In the LAST 12 MONTHS, have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?**

☐ Never

☐ Hardly ever

☐ Occasionally

☐ Fairly often

☐ Very often

**In the LAST 12 MONTHS, have you been self-conscious because of your teeth, mouth or dentures?**

☐ Never

☐ Hardly ever

☐ Occasionally

☐ Fairly often

☐ Very often

**In the LAST 12 MONTHS, have you felt tense because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, have you had to interrupt meals because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, have you found it difficult to relax because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, have you been a bit embarrassed because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, have you had difficulty in doing you usual job because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, have you felt that your life in general was less satisfying because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

**In the LAST 12 MONTHS, have you been totally unable to function because of problems with your teeth, mouth or dentures?**

- [ ] Never
- [ ] Hardly ever
- [ ] Occasionally
- [ ] Fairly often
- [ ] Very often

# Appendix 16:  Oral Health Assessment Tool (OHAT)

**Front Page**

Montefiore Nursing Home RN Study          Adapted from OHAT SA Dental Service 2009

## Appendix E          Oral Health Assessment Tool

Resident:                          Completed by:                          Date:

Resident:  ☐ is independent   ☐ needs reminding   ☐ needs supervision   ☐ needs full assistance

☐ Will not open mouth   ☐ Grinding or chewing   ☐ Head faces down   ☐ Refuses treatment
☐ Is aggressive   ☐ Bites   ☐ Excessive head movement   ☐ Cannot swallow well
☐ Cannot rinse and spit   ☐ Will not take dentures out at night

| | 1 Healthy | 2 Changes | 3 Unhealthy | 4 Dental Referral | | 1 Healthy | 2 Changes | 3 Unhealthy | 4 Dental Referral |
|---|---|---|---|---|---|---|---|---|---|
| **Lips** | ☐ Smooth, pink, moist | ☐ Dry, chapped or red at corners | ☐ Swelling or lump, red / white / ulcerated bleeding / ulcerated at corners* | ☐ Yes ☐ No | **Natural Teeth** | ☐ No decayed or broken teeth or roots | ☐ 1-3 decayed or broken teeth / roots, or teeth very worn down | ☐ 4 or more decayed or broken teeth / roots or fewer than 4 teeth, or very worn down teeth * | ☐ Yes ☐ No |
| **Tongue** | ☐ Normal moist, roughness, pink | ☐ Patchy, fissured, red, coated | ☐ Patch that is red and/or white / ulcerated, swollen* | ☐ Yes ☐ No | **Dentures** | ☐ No broken areas or teeth, worn regularly, and named | ☐ 1 broken area or tooth, or worn 1-2 hours per day only or not named | ☐ 1 or more broken areas or teeth, denture missing / not worn, need adhesive, or not named * | ☐ Yes ☐ No |
| **Gums and Oral Tissue** | ☐ Moist, pink, smooth, no bleeding | ☐ Dry, shiny, rough, red, swollen, sore, one ulcer / sore spot, sore under dentures | ☐ Swollen, bleeding, ulcers, white / red patches, generalised redness under dentures* | ☐ Yes ☐ No | **Oral Cleanliness** | ☐ Clean and no food particles or tartar in mouth or on dentures | ☐ Food, tartar, plaque 1-2 areas of mouth, or on small area of dentures | ☐ Food particles, tartar, plaque most areas of mouth, or on most of dentures * | ☐ Yes ☐ No |
| **Saliva** | ☐ Moist tissues watery and free flowing | ☐ Dry, sticky tissues, little saliva present, resident thinks they have a dry mouth | ☐ Tissues parched and red, very little / no saliva present, saliva is thick, resident thinks they have a dry mouth * | ☐ Yes ☐ No | **Dental Pain** | ☐ No behavioural, verbal or physical signs of dental pain | ☐ Verbal &/or behavioural signs of pain such as pulling at face, chewing lips, not eating, changed behaviour. | ☐ Physical pain signs (swelling of cheek or gum, broken teeth, ulcers), as well as verbal & / or behavioural signs (pulling at face, not eating, changed behaviour) * | ☐ Yes ☐ No |

*Unhealthy signs usually indicate referral to a dentist is necessary

Assessor Comments

**Back Page**

**Lips**

Sore corners of the mouth
Angular Cheilitis

**Tongue**

Sore Tongue
Glossitis

Thrush
Candidiasis

**Gums and Oral Tissue**

Gum Disease
Gingivitis

Severe Gum Disease
Periodontitis

Oral Cancers

**Gums and Oral Tissue**

Ulcers and Sore Spots

Sore Mouth
Stomatitis

**Saliva**

Dry Mouth
Xerostomia

**Natural Teeth**

Tooth Decay
Caries

Root Decay
Root Caries

Retained Roots

**Dentures**

Requiring Attention

Poorly Fitting

**Oral Cleanliness**

Poor Oral Hygiene

# Appendix 17:  Saliva Test Worksheet

DCRC     MONTEFIORE     cera

## Appendix  G    SALIVA TEST (Glucose Challenge + Na Bicarb)

Cover sheet registration form is to be filed seperately from test results

| Surname | First Name |
|---|---|
| Room No. | Particip No. |
| Date | Test Time | Last ate/drunk (hrs) |

**INITIAL DRY MOUTH  CLINICAL ASSESSMENT BEFORE SALIVA TEST**

- Normal
- Xerostemia ( Symptoms only)
- Sal Gland Hypofuction

Administered by

### SETUP & MATERIAL

| | | |
|---|---|---|
| Scales are calibrated | Litmus paper cut into 10 squares | GC- plastic test guide |
| GC-Saliva Kit | 2 pieces of guaze & 2 cotton buds | Black marking pen, blue pen |
| Glucose (20%) Solution | Tissue for: Lip, Buffer test strip | 25 ml measuring cup |
| Timer | Pillows to position head down | 5 plastic cups |
| Sodium Bicarb. Toothpaste | 10 large applicators | Spreadsheet documentation |

### Pre-Record Check List

- Cup A  Pre weight of empty cup for unstimulated (resting saliva) spit ( test 4) ___ gms — Mark cup 'A. Resting Saliva cup' and weight
- Cup B  Pre weight empty cup-stimulated for saliva chewing (test 6) ___ gms — Mark cup 'B. Stimulated Saliva Cup' and weight
- Cup C  Cup to hold applicators — Mark cup 'C. Applicator cup'
- Cup D  Waste cup for used applicators — Mark cup 'D. Waste Cup-applicators'
- Cup E  Waste cup foe used gum — Mark cup ' E. Waste cup- gum

Page 1 of 4

Saliva Tests -Montefiore Advanced RN Oral Care Plan Study
Ver 2.
20/01/2015

| Particip No. | | Date | | Start Time | | End Time | | Administd by |

## UNSTIMULATED (RESTING) SALIVA TESTS

| STAGE | TEST | METHOD | TIME/test TICK/CIRCLE | pH | WEIGHT | CUMULATIVE TIME (mins) | NOTES |
|---|---|---|---|---|---|---|---|
| 1 | Resting pH | Wet applicator under tongue (5 secs). Apply to litmus paper | 30 sec | pH | | 0.5 min | |
| | | Read pH off chart and record pH | | | | | |
| | | If mouth is so dry that applicator can not be wetted record [X] | | | | | |
| 2 | Hydration<br>Tissue inside lip | Head tilts backwards | 0-30 sec<br>30-60 sec<br>>60 sec<br>Tick one box | | | 2 min | |
| | | Tissue inside lower lip | | | | | |
| | | Time saliva formation on tissue in seconds | | | | | |
| 3 | Consistency | Mucousy, very thick, pussy (may have difficulty swallowing) | 30 secs<br>Tick one box | | | 1 min | |
| | | Sticky, frothy (saliva sticks to instrument and can be strung out) | | | | | |
| | | Frothy, bubbly | | | | | |
| | | Watery, clear | | | | | |
| 4 | Spit Test- Collect unstimulated saliva | Cup A Use empty cup A, place on scales **Tare to read ZERO** | 3 mins<br>Y/N | | Minutes<br>gms resting saliva | 6 min | Very low resting saliva rate < 0.1mg/min<br>Normal resting saliva rate > 0.3-0.4mg/min |
| | | Ask Resident to swallow, activate timer, collect saliva | | | | | |
| | | Head tilts down | | | | | |
| | | Spit or dribble saliva into A cup | | | | | |
| | | Record time if subject spits for less (or more) than 3 mins | | | | | |
| | | Return cup A with unstimulated saliva onto scales and record weight | | | | | |
| | | Resting Saliva Weight | | | | | |
| 5 | Measure pH of resting saliva in cup A | Wet applicator with saliva in cup and apply to litmus paper | | pH | | 7 min | |

Colour chart:
5.0 5.2 5.4 5.6 5.8 — Highly acidic (red)
6.0 6.2 6.4 6.6 6.8 — Moderately acidic (yellow)
7.0 7.2 7.4 7.6 7.8 — Healthy saliva (green)

Saliva Tests -Montefiore Advanced RN Oral Care Plan Study
Ver 2.
20/01/2015

| Particip No. ___ | | | Date ___ | | Start Time ___ | | End Time ___ | Administd by ___ | |

| STAGE | TEST | METHOD | TIME | TICK/CIRCLE | pH | WEIGHT | CUMULATIVE TIME (mins) | NOTES |
|---|---|---|---|---|---|---|---|---|
| 6 | Glucose Challenge | Rinse with 20% Glucose solution, then spit out | 1 min | | | | 8 min | |
| | | Wait | 5 min | | | | 13 min | |
| 7 | Measure pH after glucose challenge. | Wet applicator under tongue (5 secs). Apply to litmus paper | | | pH | | 13 min | |
| 8 | Chew Wax | | | STIMULATED SALIVA TESTING | | | | |
| | Cup B | Use empty cup B, place on scales **Tare to read ZERO** | | | | | | |
| | | Head tilts down, give warning not to swallow | | | | | 14 min | |
| | | Chew wax for 3 min | | Y/N | | | | |
| | | Spit into Cup B every 15-30 secs for 5 mins | | | | | | |
| | Cup E | Collect gum in empty cup marked "E, Waste cup -Gum" | 3 min | | | | 17 min | Very low saliva flow < 0.5mg/min |
| | | Place cup B onto scales and record weight | | | | gms stimulated saliva | 18 min | Normal saliva flow >1-2mg/min |
| | | Record time if subject chews for less (or more) than 3 mins | | | | Minutes | | |
| 9 | Measure pH of stimulated saliva after chewing wax in Cup B | Wet applicator with saliva in Cup B and apply to litmus paper | | | pH | | 19 min | |
| 10 | Buffering Capacity | Place Buffer test strip on tissue | 1 min | | | | | |
| | | Pipette 1 drop onto Buffer test strip | | | | | | |
| | | Turn Buffer test strip 90 degrees to remove excess | | | | | | |
| | | Go onto next test while waiting 5 minutes for buffer test | | | Number | | | |
| | | Measure colour after 5 minutes | | | | | | Return at 24 min |

*Where a colour combination provides an unclear result, use intermediate scores.

# Saliva Tests - Montefiore Advanced RN Oral Care Plan Study
## Ver 2.
### 20/01/2015

| Particip No. | Date | Start Time | End Time | Administd by |
|---|---|---|---|---|

| TEST | METHOD | TIME | TICK/CIRCLE | pH | WEIGHT | CUMULATIVE TIME (mins) | NOTES |
|---|---|---|---|---|---|---|---|
| 11 | Measure pH every 5 mins after chewing. Wet applicator under tongue (5 secs). Apply to litmus paper. Read pH off chart and record pH every 5 minutes | | | | | | |
| | Measure at +5 min | 0.5 min | | pH | | 24 min | Measure saliva pH every 5 mins |
| | Skip 10 min pH reading if tired/stressed | 0.5 min | | pH | | 29 min | |
| | **If subject looks stressed or uncomfortable -Apply Na Bicarb after 10 secs** | | | | | | |
| 12 | Apply Sodium Bicarb. toothpaste. Apply small amount of Na Bicarb paste on cotton bud into mouth. Read pH off chart and record pH every 5 minutes | 0.5 min | | pH | | 30min | |
| | Measure at +5 min | 0.5 min | | pH | | 35 min | |
| | Skip 10 min pH reading if tired/stressed | 0.5 min | | pH | | 40 min | |

**Stop at 50 minutes latest.**

## pH

Instruct the patient to expectorate any pooled saliva into the collection cup. Take a pH test strip, place this into the sample of resting saliva for 10 seconds, and then check the colour of the strip. This should be compared with the testing chart available in the package.

5.0 5.2 5.4 5.6 5.8
6.0 6.2 6.4 6.6
6.8 7.0 7.2 7.4 7.6 7.8

- Red — Highly acidic
- Yellow — Moderately acidic
- Green — Healthy saliva

## Buffer Test 11

a) Remove a Buffer test strip from the foil package and place onto an absorbent tissue with the test side up.

b) Using a pipette, draw sufficient saliva from the collection cup and dispense one drop onto each of the 3 test pads. Immediately turn the strip 90° to soak up excess saliva from the absorbent tissue. This will prevent the excess saliva from swelling on the test pad and possibly affecting the accuracy of the test result.

c) The test pads will begin to change colour immediately and after 2 minutes the final result can be calculated by adding the points according to the final colour of each pad. See conversion table and examples underneath.

Conversion table
Test pad colour at 2 minutes

| | |
|---|---|
| Green | 4 points |
| Green/Blue | 3 points* |
| Blue | 2 points |
| Red/Blue | 1 pont * |
| Red | 0 points |

Examples

Interpreting the result.

| Combined total | Buffering ability of Saliva |
|---|---|
| 0-5 | Very low |
| 6-9 | Low |
| 10-12 | Normal / High |

*Where a colour combination provides an unclear result, use intermediate scores.

Page 4 of 4

# Appendix 18: Plaque / Calculus Oral Hygiene Scores and Oral Bioburden Scores

## PLAQUE/CALCULUS OH + TOTAL ORAL BIOBURDEN SCORES

Surname _____  First Name _____  Room No. _____

Date _____  Participant No. _____

Adapted from Greene & Vermilion Indices

| Scores | Criteria |
|---|---|
| 0 | No debris or stain present |
| 1 | Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered |
| 2 | Soft debris covering more than one third, but not more than two thirds, of the exposed tooth surface. |
| 3 | Soft debris covering more than two thirds of the exposed tooth surface. |

leave blank

plaque 3 2 1 0

**DENTURE OHAT SCORE** _____

**TOTAL No. TEETH/ROOTS** _____

**SEXTANTS**
Record the number of sextants (segments) scored  1- 6

Debris Index = (The total of the upper and lower buccal-scores) + (The total of the upper and lower lingual-scores) / (The number of segments scored).

### DEBRIS / PLAQUE INDEX

| | Right Post | | Anteriors | | Left Posts | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | Buccal | Lingual | Buccal | Lingual | Buccal | Lingual | Buccal | Lingual |
| Upper | | | | | | | 0 | 0 |
| Lower | | | | | | | 0 | 0 |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

PLAQUE(Debris) Index    #DIV/0!

Sextants Scored = ____ (No. 1-6)

Calculus Index = (The total of the upper and lower buccal-scores) + (The total of the upper and lower lingual-scores) / (The number of segments scored).

### CALCULUS INDEX

| | Right Post | | Anteriors | | Left Posts | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | Buccal | Lingual | Buccal | Lingual | Buccal | Lingual | Buccal | Lingual |
| Upper | | | | | | | 0 | 0 |
| Lower | | | | | | | 0 | 0 |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

CALCULUS INDEX    #DIV/0!

Sextants Scored = ____ (No. 1-6)

ORAL HYGIENE (OH) INDEX = Plaque Index + Calculus Index    **OH INDEX**    #DIV/0!

TOTAL TEETH (tOH) INDEX =    #DIV/0!

TOTAL DENTAL ORAL BIO-BURDEN ( DOB) = tOH + Denture OHAT    **DOB INDEX**    #DIV/0!

# Appendix 19:- St Vincents Hospital Anti-cholinergic Burden Scores

**Anti-cholinergic Burden Scores:**                    Page 1 of 5
**St Vincents Hospital Pharmacy Department**
**Compiled by Professor Rick Day clinical Pharmacologist for Dr Peter Foltyn**

| Score per ACB list 2011 | | Score per ACB list 2011 | |
|---|---|---|---|
| Aceazolamide | | Brimonidine | 0 |
| Aciclovir (Zovirax) | 0 | Brinzolamide (Azopt) | 1 |
| Aclidinium | 1 | Bromhexine | 0 |
| | | Brompheniramine (Demazin) | 1 |
| Advantan Cream | 0 | | |
| Alendronate (Fosomax) | 0 | Budesonide | 1 |
| Allopurionolol (Zyloprim) | 0 | Buprenorphine | 1 |
| Alpha tocapherol | 0 | Bupropion (Zyban, Prexaton) | 1 |
| Alprazolam (Xanax) | 3 | Calcium Carbonate | 0 |
| Amantadine (Symmetrel) | 2 | Calcium carbonate | 0 |
| Amiloride | 1 | Calcium citrate | 0 |
| Amiodarone (Cordarone) | 1 | Caltrate | 0 |
| Amitriptyline (Endep) | 3 | Candesartan (Atacand) | 0 |
| Amlodipine (Norvasc) | 1 | Captopril (Capoten) | 1 |
| Amlodipine (Norvasc) | 1 | Carbamazepine (Tegretol, Teril) | 2 |
| Amoxycillin | 0 | Carbidopa | 1 |
| Ampicillin (Omnipen, Polycillin, Principen) | 0 | Carbimazole | 1 |
| Anginine sublingual | 0 | Carbomer | 0 |
| Apixaban | 1 | Carmellose Sodium | 0 |
| Aripiprazole | 1 | Carvedilol (Coreg) | 1 |
| Aristocort cream | 0 | Cefazolin Injection | 0 |
| Asasantin | 1 | Cefotaxime | 0 |
| Ascorbic Acid | 0 | Ceftazidime (Fortaz) | 0 |
| Aspirin | 1 | Celecoxib | 0 |
| Atenolol (Tenormin) | 1 | Celestone | 1 |
| Atorvastatin (Lipitor) | 0 | Cephalexin | 0 |
| Atropine | 3 | Cephalexin (Keflex) | 0 |
| Augmentin Duo Forte | 0 | Chloramphenicol | 0 |
| | | Chlorpheniramine (in Demazin, Sudafed Colds&Flu) | 3 |
| Avandia | 0 | Chlorpromazine | 3 |
| Baclofen | 1 | Chlorthalidone (Hygroton) | 1 |
| Beclomethasone | 0 | Cholecalciferol | 0 |
| Benserazide (Levodopa) | 1 | | |
| Benztropine (Cogentin, Benztrop) | 3 | Cholestyramine (Questran) | 0 |
| Betahistine | 1 | Cimetidine (Tagamet) | 1 |
| | 1 | Ciprofloxacin | 1 |

| | | | | |
|---|---|---|---|---|
| Betamethasone | | | Circadin | 0 |
| Betaxolol | 1 | | Citalopram | 3 |
| Betnovate cream | 0 | | Clomipramine (Anafranil) | 3 |
| Bicalutamide (Casodex) | 0 | | Clonazepam | 1 |
| Bicor | 1 | | Clopidogrel (Plavix) | 0 |
| Bimatoprost (Latisse, Lumigan) | 0 | | Clotrimazole | 0 |
| Biotene mouthwash | 0 | | Clozapine (Clozaril, Clopine) | 3 |
| Bisacodyl | 0 | | | |
| Codeine (also in Panadeine Forte) | 1 | | Felodipine (Plendil) | 1 |
| Colchicine (Colgout) | 1 | | Fentanyl (Durogesic) | 1 |
| | | | Ferrous Fumarate (Iron, Femiron) | 0 |
| Coloxyl | 0 | | Fexofenadine (Allegra) | 0 |
| Cranberry Capsule | 0 | | Finasteride | 1 |
| Creon (Pancrelipase) | 0 | | Fish Oil | 0 |
| Cyanocobalamin | 0 | | Flecainide | 1 |
| Cyclizine | 3 | | Flucloxacillin | 0 |
| Cyclobenzaprine | 2 | | Fluconazole | 0 |
| Cyproheptadine (Periactin) | 2 | | Fludrocortisone | 1 |
| Cyproterone | 0 | | Fluorometholone (Allergan) | 0 |
| Dabigatran (Pradaxa) | 1 | | Fluticasone (Avamys, flixotid | 0 |
| Dabigatran etexilate | 1 | | Fluvastatin (Lescol, Canef, Vastin) | 0 |
| Darifenacin (enablex) | 3 | | Fluvoxamine (Luvox) | 1 |
| Denosumab | 0 | | | |
| Desipramine (Norpramine, Pertofrane) | 3 | | Folic Acid | 0 |
| Dexamethasone (Maxidex) | 1 | | Fosinopril | 1 |
| Dextran | 0 | | Furosemide /frusemide (Lasi | 1 |
| Diazepam (Valium) | 1 | | Gabapentin | 2 |
| Dicyclomine (Merbentyl) | 3 | | Galantamine | 1 |
| Digoxin (Lanoxin) | 1 | | Gastrogel | 0 |
| Dilantin (Phenytoin) | 2 | | Gemfibrozil | 1 |
| Diltiazem | 1 | | Gentamicin | 1 |
| Dimenhydrinate (Travacalm original) | 3 | | Gliclazide | 0 |
| Diphenhydramine (in some cough/flu meds) | 3 | | Glimepiride | 0 |
| Dipyridamole (Persantin, Asasantin Retard) | 1 | | Glucosamine | 0 |
| Disopyramide (Rhythmodan) | 1 | | Glyceryl Trinitrate | 1 |
| Docusate/Sennosides | 0 | | Haloperidol (Serenace) | 1 |
| Domperidone | 0 | | Heparin | 0 |
| Domperidone | 0 | | Hiprex (Hexamine) | 0 |
| | | | Hydralazine | |
| Hydralazine | 1 | | | 1 |

Donepezil

| | | | |
|---|---|---|---|
| Dorzolamide | 0 | Hydrochlorothiazide | 1 |
| Doxepin (deptran, Sinequn) | 3 | Hydrocortisone | 1 |
| Doxycyline | 0 | Hydroxocobalamin | 0 |
| Duloxetine (Andepra) | 3 | Hydroxyzine (Atarax, Vistaril) | 3 |
| Dutasteride (Avodart) | 1 | Hyoscine (Buscopan) | 3 |
| Enalapril | 1 | Hyoscyamine | 3 |
| Endone | 1 | Hypromellose | 0 |
| Enoxaparin (Lovenox) | 0 | Ibuprofen | 1 |
| Epilim (Sodium Valporate) | 1 | Ikorel (Nicorandil) | 1 |
| Escitalopram (Lexapro) | 3 | Imipramine (Tolterade, Tofra | 3 |
| Esomeprazole (Nexium) | 1 | Indacaterol | 0 |
| Ezetimibe | 0 | Indapamide | 0 |
| Ezetimibe (Vytorin) | 0 | Insulin | 0 |
| Ipratropium (Atrovent) | 1 | Metronidazole | 1 |
| Ipratropium Bromide | 1 | Mianserin | 1 |
| Irbesartan (Avapro) | 0 | Microlax Enema | 0 |
| Isosorbide (Duride, Imdur) | 1 | Microlax Rectal Solution Ene | 0 |
| | | Mirtazapine (Avanza, Axit, Mirtaz, Mirtazon, Remeron, Zispin) | 1 |
| Keppra (Levetiracetam) | 1 | Moclobemide | 1 |
| Ketorolac (Toradol) | 0 | | |
| Labetalol (Normodyne, Trandate) | 1 | Moclobemide (Aurorix) | 1 |
| Lactulose Oral Liquid | 0 | Mometasone | 0 |
| Lamotrigine | 1 | Montelukast (Singulair) | 0 |
| Lansoprazole | 1 | Morphine (MS-Contin, Kepar Ordine, Sevredol) | 1 |
| Lantoprost | 0 | Movicol Powder for Oral Solution | 0 |
| Lasix | 1 | Moxifloxacin | 1 |
| Latanoprost | 0 | Moxonidine | 0 |
| Leflunomide | 1 | Naloxone (with oxycodone) | 1 |
| Lercanidipine | 1 | Nebivolol | 1 |
| Leuprorelin | 0 | Nicotine | 0 |
| Linagliptin | 0 | Nicotine Transdermal Patch | 0 |
| Lithium | 1 | Nifedipine (Adalat) | 1 |
| Loperamide (Imodium) | 1 | Nitrazepam | 1 |
| Loratadine  (Claritin, Claritin, Alavert) =1 on Revised | 1 | Nitrofurantoin | 1 |
| Lorazepam (Ativan) | 1 | Nizatidine (Axid) | 1 |
| Lutein Vision | 0 | Norfloxacin | 1 |
| Lyrica (Pregabalin) | 2 | Normison | 1 |
| Macrogol | 0 | Norspan (transdermal patch) | 1 |
| | 0 | Nortriptyline (Allegran) | 3 |

Macuvision (Blackmores)

| | | | |
|---|---|---|---|
| Magnesium Aspartate | 0 | Novomix | 0 |
| Magnesium Aspartate | 0 | Nystatin | 0 |
| Mebeverine | 3 | Oestriol | 0 |
| Melatonin | 0 | Ofloxacin | 0 |
| Meloxicam (Mobic) | 0 | Olanzapine (Zyprexa) | 3 |
| Meloxicam (Mobic) | 0 | Olmesartan | 0 |
| Meperidine (Pethidine) | 2 | Omeprazole (Losec, Prilosec) | 1 |
| Mesalazine | 0 | Ondansetron (Zofran) | 0 |
| Metamucil | 0 | Orphenadrine (Norflex) | 3 |
| Metformin (Diabex) | 0 | Oseltamivir | 1 |
| Metformin (Glucophage) | 0 | Ostelin | 0 |
| Methadone | 1 | Oxazepam (Serepax) | 1 |
| Methocarbamol | 3 | Oxcarbazepine (Trileptal) | 2 |
| Methotrexate | 1 | Oxybutynin (Ditropan, Oxyro patch) | 3 |
| Methotrimeprazine (Levoprome, Nozinan) | 2 | Oxycodone (Endone, Targin) | 1 |
| Methylphenidate (Concerta, ritalin) | 1 | Pantoprazole (Protonix) | 0 |
| Metoclopramide (Maxalon) | 0 | Paracetamol | 0 |
| Metoprolol (Lpresor, Betaloc, Toprol-XL) | 1 | Paroxetine (Aropax, Paxtine) | 3 |
| Perindopril (Coversyl) | 1 | Sodium Chloride | 0 |
| Phenylephrine | 0 | Sodium Citrate | 0 |
| Phosphate Sandoz | 0 | Sodium phosphate | 0 |
| Phytomenadione | 0 | Sodium Valporate (Epilim) | 1 |
| Pimozide (Orap) | 2 | Solifenacin = 3 on revised!! | 3 |
| Potassium Chloride | 0 | Somac | 0 |
| Pramipexole | 3 | Sotalol (Betapace) | 0 |
| Pramipexole | 3 | Spironolactone | 1 |
| Pravastatin (Pravachol) | 0 | Stalevo (Levodopa) | 1 |
| Prazosin | 1 | Strontium Ranelate (Protos) | 1 |
| Prednisone (Panafcort, Predsone) | 1 | Sulfasalazine | 1 |
| Pregabalin | 1 | Sulfonate | 0 |
| Prochlorperazine | 3 | Sumatriptan | 0 |
| Promethazine (Phenergan) | 3 | Systane Eye Drops | 0 |
| Propanolol | 1 | Tamoxifen | 0 |
| Propantheline | 3 | Tamsulosin (Flomax, flomaxt | 1 |
| Provastatin | 0 | Targin (Oxycodone + Naloxor | 1 |
| Quetiapine (Seroquel) | 3 | Tazocin | 0 |
| Quinapril | 0 | Telmisartan | 0 |
| Quinidine (Kinidin) | 1 | Temazepam | 1 |
| Quinine | 1 | Terbutaline (Bricanyl) | 0 |
| | 0 | Testosterone | 0 |

| | | | |
|---|---|---|---|
| Rabeprazole | | Theophylline (Nuelin) | 1 |
| Ramipril (Altace, Tritace) | 1 | Thiamine (Thiamilate) | 0 |
| Ranitidine (Zantac) | 1 | Thioridazine (Mellaril) | 3 |
| Rifampicin | 1 | Thyroxine | 1 |
| Risedronate (Actonel) | 0 | Tiatropium Bromide (Spiriva) | 3 |
| Risedronate (Actonel, Atelvia) | 0 | Timolol | 3 |
| Risperidone (Risperdal) | 1 | Tiotropium Bromide (Spiriva) | 3 |
| Rivaroxaban (Xarelto) | 1 | Tolterodine (Detrusitol) | 3 |
| Rivastigimine (Exelon) | 0 | Tramadol | 1 |
| Romiplostim | 1 | Trandolapril | 1 |
| Ropinirole | 1 | Tranexamic Acid | 0 |
| Rosuvastatin (Crestor) | 0 | Travoprost | 0 |
| Roxithromycin | 0 | Triamcinolone | 1 |
| Salbuatomol | 0 | | |
| Scopolamine (hyoscine hydrobromide) | 3 | Triamterene (Dytac) | 1 |
| Senokot | 0 | Triazolam (Halcion) | 1 |
| Seretide | 0 | Trifluoperazine (Stelazine) | 3 |
| | | Trihexyphenidyl (Artane, Benzhexol) | 3 |
| Sertaline (Zoloft) | 3 | Trimethoprim (Primsol, Trim| | 0 |
| Sertraline (Zoloft) | 3 | Trimethropim | 0 |
| Sevelamer (Renagel, Renvela) | 0 | Trimipramine (Surmontil) | 3 |
| Simvastatin | 1 | Truazolam | 1 |
| Sodium Bicarbonate | 0 | | |
| | | Ubidecarerone | |
| | | Ural Sachets | 0 |
| | | Ursodeoxycholic Acid | 0 |
| | | Vagifem | 0 |
| | | Valaciclovir | 1 |
| | | Valacyclovir | 1 |
| | | Valsartan | 0 |
| | | Vancomycin | 1 |
| | | Venlafaxine (Efexor, Effexor and Trevilor) | 1 |
| | | Ventolin Nebuliser | 0 |
| | | Verapamil | 1 |
| | | Vitamin B | 0 |
| | | Vitamin D | 0 |
| | | Voltaren | 1 |
| | | Warfarin (Coumadin) | 1 |
| | | Xatalan | 0 |
| | | Zopiclone | 1 |
| | | Zyrtec (Cetirizine) | 0 |

## Appendix 20: Residents Medical Diagnoses, Medications and Anti-cholinergic Burden Score    From 11 Feb 2015

## Participant No 1

- short term memory loss (STML) +++
- Lower back pain
- gastro-oesophageal reflux disease (**GORD**)
- pain
- worries
- restlessness and agitation

| Participant No 1 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| | 0 | Cholecalciferol (VTX VITAMIN D) | Two capsules in morning | 28/6/13 | |
| Laxative | 0 | Docusate & Sennosides 50mg/8mg | One tablet in morning | 21/11/13 | 4/3/15 |
| Diuretic | 1 | Frusemide 20mg | One tablet in morning | 24/7/13 | |
| Started Care plan 11/2/15 | 1 | Ibuprofen 200mg | One tablet three times a day | 5/9/14 | 4/3/15 |
| | 0 | Paracetamol (Panadol osteo) 665m | Two tablets three times day | 5/12/13 | 4/3/15 |
| Anti-convalescent, pain | 2 | Pregabalin (Lyrica) 75mg | One capsule at night | 1/8/14 | 4/3/15 |
| Do not count | 2 | Pregabalin (Lyrica) 25mg | Two capsules in morning | 4/6/14 | 22/1/15 |
| BP, | 1 | Ramipril (Prilace) 1.25mg | One tablet in morning | 24/7/13 | |
| Do not count | 3 | Sertraline 50mg | One tablet in morning | 24/7/14 | 12/1/15 |
| Do not count Anti-depressant | 3 | Sertraline 100mg (Zoloft) | One tablet in morning | 9/8/13 | |
| Opiate analgesic | 1 | Fentanyl (Fenpatch) 25mcg/hr | Apply one patch every three days | 24/10/14 | |
| Synthetic opioid pain | 1 | Oxycodone hcl/Naloxone hcl 5mg/2.5mg | One tablet twice a day | | |
| **TOTAL** | **7** | **9 Meds** | | | |

# Participant No 2

- Osteoarthritis
- Total knee replacement
- Depression/mood affective
- High cholesterol
- GORD

| Participant No 2 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| Eye Health | 0 | BM Macuvision | One tablet in morning | 27/10/14 | |
| Laxative Do not count | 0 | Docusate & Sennosides 50mg/8mg | Two tablets twice a day | 19/12/14 | 13/1/15 |
| Depression | 3 | Duloxetine 30mg | One capsule in morning | 19/12/14 | |
| GERD | 1 | Lansoprazole 30mg | One capsule twice a day | 25/11/14 | |
| Depression | 3 | Duloxetine 60mg | One capsule in morning | 25/11/14 | |
| Eyes | 0 | Lutein/zeaxanthin (BM lutein defence) 10mg/2mg | One tablet in morning | 27/10/14 | |
| Pain | 0 | Paracetamol (Panadol osteo) 665mg | Two tablets three times a day | 19/12/14 | |
| Reflux | 1 | Nizatidine (nizac) 150mg | One capsule twice a day | 24/10/14 | |
| Anti-psychotic | 3 | Quetiapine 200mg | One tablet at night | 24/10/14 | |
| Opioid | 1 | Oxycodone ncl/Naloxone ncl 10mg/5mg | One tablet twice a day | 19/12/14 | |
| Opioid pain | 1 | Fentonyl patch 50g | One every three days | 13/1/15 | |
| TOTAL | 10 | 11 Meds | | | |

# Participant No 3

- Poor STM
- Cholesterol
- Depression
- Hypertension
- Non-Insulin Dependent Diabetes Mellitus (NIDDM)

| Participant No 3 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| | 0 | Calcium carbonate 600mg | One tablet in morning | 30/5/13 | |
| | 0 | Cholecalciferol (VTX VITAMIN D) | One capsule in morning | 6/6/13 | |
| Blood thinner | 0 | Clopidogrel 75mg (Plavix) | One tablet in morning | 6/6/13 | |
| Diuretic | 1 | Frusemide 40mg (Lasix) | One tablet twice a day | 6/6/13 | |
| BP | 0 | Irbesartan 150mg | One tablet in morning | 1/8/14 | |
| 11 Diabetes | 0 | Metformin hcl 500mg | One tablet twice a day | 6/6/13 | |
| Laxative | 0 | Sennoside B (sennokot) 7.5mg | Two tablets at night | 5/8/14 | |
| Anti-depressant | 3 | Sertraline 50mg | One tablet in morning | 30/5/13 | |
| Statin | 1 | Simvastatin 20mg (Zocor) | One tablet at night | 6/6/13 | |
| Bronchodilator | 0 | Salbutamol 5mg 30 ST-NEBS | Inhale contents by pump 3Xday | 6/6/13 | |
| TOTAL | 5 | 10 Meds | | | |

# Participant No 4

- Arrhythmia
- Ischemic heart disease
- Transient ischemic attack (TIA)
- Depression
- GORD
- Osteoporosis
- Spinal fracture

| Participant No 4 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| | 0 | BM Macuvision | One tablet twice a day | 23/8/13 | |
| Anti-coagulant | 1 | Apixaban (elquis) 2.5mg | One tablet twice a day | 10/7/14 | |
| Vitamin | 0 | Cholecalciferol (OMEGALIFE VITAMIN D3) | Two capsules in the morning | 18/10/14 | |
| Laxative | 0 | Docusate & Sennosides 50mg/8mg | One tablet at night | 28/8/13 | |
| GERD | 1 | Esomeprazole (Nexium) 20mg | One tablet twice a day | 6/6/13 | |
| | 0 | Paracetamol (Panadol osteo) 665mg | Two tablets twice a day | 30/5/14 | |
| Anti-depressant | 3 | Sertraline 50mg | One tablet in morning | 10/12/13 | |
| Irregular Heart beat | 0 | Sotalol 80mg | Half a tablet at night | 20/6/14 | |
| Tranquiliser hypnotic | 1 | Temazapam 10mg | Two tablets at night | 1/9/2014 | |
| Opioid , pain | 1 | Buprenorphine (Norspan) 10mcg/hr patch | Apply once per week | 19/11/13 | |
| TOTAL | 7 | 11 Meds | | | |

# Participant No 5

- Parkinson's disease
- GORD
- Angina
- Back pain
- Depression
- Urge urinary incontinence

| Participant No 5 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| | ? | BM Acidophilus bifidus | One capsule twice a day | 11/8/14 | |
| | ? | Salt 600mg | One tablet once a day | 6/1/15 | |
| | 0 | Cholecalciferol (VTX VITAMIN D) | One capsule in morning | 27/2/14 | |
| Laxative | 0 | Docusate & sennosides 50mg/8mg | Two tablets at night | 24/12/14 | |
| Irritable bowel | 3 | Mebeverine (Colofac) 135mg | One tablet three times a day | 18/7/14 | |
| Antidepressant | 1? | Mirtazapine 30mg | One tablet at night | 21/1/15 | |
| MOAI Parkinsons | 2? | Rasagiline (azilect) 1mg | One tablet in morning | 30/6/14 | |
| Tranquiliser hypnotic | 1 | Temazepam 10mg | One tablet at night | 16/1/15 | |
| Parkinsons | 1 | Levodopa & Benserazide (Madapar) 100mg/25mg | One tablet five times a day | 6/1/15 | |
| Laxative | 0 | Movicol | One sachet at night | 10/11/14 | |
| **Total** | **8** | **10 Meds** | | | |

# Participant No 6

- Dizzy spells
- Depression/anxiety
- Cardiac bypass
- Osteoporosis
- Mastectomy

| Participant No 6 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| Slow Heart, Heart failure | 1 | Digoxin (Sigmaxin-PG (BLUE) 62.6mcg | One tablet in morning | 9/9/14 | |
| Laxative | 0 | Docusate & Sennosides 50mg/8mg | Two tablets at night | 9/9/14 | |
| Diuretic, Fluid | 1 | Frusemide 40mg | Two tablets in morning | 30/9/14 | |
| BP, Diuretic | 1 | Hydrochlorothiazide (Dithiazide) 25mg | Half a tablet twice a day | 9/9/14 | |
| Hypertension Diabetes progession | 0 | Irbesartan 150mg | One tablet in morning | 13/10/14 | |
| | 0 | Magnesium 500mg | One tablet twice a day | 9/9/14 | |
| Reflux GERD | 1 | Omeprazole 20mg | One tablet in morning | 13/10/14 | |
| | 0 | Potassium Chloride 600mg | One tablet twice a day | 9/9/14 | |
| Statin | 0 | Pravastatin (Sodium) 20mg | One tablet at night | 13/10/14 | |
| Anti-Hypertensive diuretic | 1 | Spironolactone (Spiractin) 25mg | One tablet in morning | 9/9/14 | |
| **TOTAL** | **5** | **10 meds** | | | |

# Participant No 7

- Alzheimer's disease
- Mild depression
- Pemphigus
- Macular degeneration
- Vertigo
- Lymphedema
- Hypertension
- Hypercholesterolamia
- Osteoarthritis

| Participant No 7 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| | 1 | Aspirin (Spren 100) 100mg | One tablet in morning | 30/5/13 | |
| | 0 | Calcium carbonate (VTX CAL) 600mg | One tablet in morning | 30/5/13 | |
| | 0 | Cholecalciferol (VTX VITAMIN D) | One capsule in morning | 30/5/13 | |
| Anti-depressant | 3 | Duloxetine 30mg | One capsule at night | 16/2/13 | |
| Alzheimer's | 1 | Galantamine 8mg | One capsule in morning | 13/11/13 | |
| Pain | 0 | Paracetamol (Panadol osteo) | 2 tablets three times a day | 30/5/13 | |
| Immunosuppressant | 1 | Prednisone 1mg | Two tablets in morning | 16/10/13 | |
| Reflux | 0 | Rabeprazole (Prabez) 20mg | One tablet in morning | 30/5/13 | |
| **TOTAL** | **6** | **8 Meds** | | | |

# Participant No 8

- Depression
- Post cholecystectomy problems

| Participant No 8 | ACB | Medication | | Start | Ceased |
|---|---|---|---|---|---|
| | 0 | Cholecalciferol (VTX VITAMIN D) | One capsule in morning | 31/5/13 | |
| No 8   GERD | 1 | Esomeprazole (Nexium) 20mg | One tablet in morning | 31/5/13 | |
| Antidepressant | 3 | Mirtazapine 45mg | One tablet at night | 31/5/13 | |
| Bisphosphonate | 0 | Risedronate sodium 35mg | One tablet on Thursday morning | 31/5/13 | |
| **Total** | **4** | **4 Meds** | | | |

# Appendix 21: NSCOCP Template Form

## Front page of NSCOCP template

**Appendix F     RN INTERVENTION CARE PLAN**     ( Print 1 page  per day for 77 days) * 20 Residents in 20 Folders)

| Date | Surname | First Name | Room No. | Participant No. |
|---|---|---|---|---|

| | | | | DRY MOUTH | |
|---|---|---|---|---|---|
| Accepts Intervention | [ Y ] | Is independent | [  ] | Can't swallow | [  ] | Normal | [  ] |
| Will NOT accept Intervention | [ X ] | Needs Reminding | [  ] | Can't rinse/spit | [  ] | Dry | [  ] |
| Will not open mouth | [  ] | Needs Supervision | [  ] | Constant grinding | [  ] | Very dry | [  ] |
| Aggressive/kicks/hits | [  ] | Needs Full Assistance | [  ] | Head down/moves | [  ] | Extremely dry | [  ] |
| Bites toothbrush/staff | [  ] | | | | |

Wont remove dentures  [  ]
Soak dentures  [  ]

**INTERVENTIONS (Intervention NOT Required = /)**

| Place Tick on Eating | Food Management Meal or or Snack | Remineralisation Neutrafluor 5000 | GC Mousse | Hydration Water mls | Artificial Saliva Oral7 | Saliva Gland Stimulation Xylitol Gum | Rebuffer After meals Colgate Acid Neutraliser | Anti-Microbials Curascept | Brushing Unassisted Teeth | Brushing Unassisted Dentures | Brushing Assisted Teeth | Brushing Assisted Dentures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6:00am -9:00am | | | | | | | | | | | | |
| 9:00am - 12:00pm | | | | | | | | | | | | |
| 12:00pm - 3:00pm | | | | | | | | | | | | |
| 3:00pm-6:00pm | | | | | | | | | | | | |
| 6:00pm -9:00pm | | | | | | | | | | | | |
| 9:00pm- 12:00am | | | | | | | | | | | | |
| 12:00am- 6:00am | | | | | | | | | | | | |
| **TOTALS** | | | | | | | | | | | | |

## Back page of NSCOCP template

**ADDITIONAL NOTES**

| | |
|---|---|
| 6:00am -9:00am | |
| 9:00am - 12:00pm | |
| 12:00pm - 3:00pm | |
| 3:00pm-6:00pm | |
| 6:00pm -9:00pm | |
| 9:00pm- 12:00am | |
| 12:00am- 6:00am | |

# Appendix 22: Nurse Resident Staff Ratios Montefiore Randwick Campus

| | Table 1. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **24 HOUR RANDWICK MONTEFIORE** | | | | | | | |
| | | **NURSING : RESIDENT STAFF RATIOS** | | | | | | | |
| | | | **Randwick** | **Nurse Ratios** | | | **Total Montefiore** | | |
| | **High Care Dementia** | | 30 | 13 | | | 75 | | |
| | **Low Care Dementia** | | 30 | 9 | | | 52 | | |
| | **Low care Hostel** | | 107 | 17 | | | 260 | | |
| | **Nursing High Care** | | 109 | 50 | | | 339 | | |
| | | | 266 | 89 | | | 728 | | |
| | | | | | | | | | |
| | | 10% Temp staff | | 9 | | | | | |

| **Nurse : Resident Ratios** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Residents** | | **Morning** | **Subtotal** | **Afternoon** | **Subotal** | **Night** | | **Total** |
| | for 30R | | | | | | | | |
| **High Care Dementia** | | RN | 1:30R | 1 | 1:30R | 1 | 1:30R | 1 | 3 |
| 30 Residents | [R] | AIN | 5:30R | 5 | 4:30R | 4 | 1:30R | 1 | 10 |
| | | No.nurses delivering care in a 24 hour period | | | | | **TOTAL** | | 13 |

| | **Residents** | | **Morning** | **Subtotal** | **Afternoon** | **Subotal** | **Night** | | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| | for 30R | | | | | | | | |
| **Low care dementia** | | | | | | | RN from High Care supervises | | |
| 30 Residents | [R] | RN | 1:30R | 1 | 1:30R | 1 | 0:30R | 0 | 2 |
| | | AIN | 3:30R | 3 | 3:30R | 3 | 1:30R | | 7 |
| | | No.nurses delivering care in a 24 hour period | | | | | **TOTAL** | | 9 |

| | **Residents** | | **Morning** | **Subtotal** | **Afternoon** | **Subotal** | **Night** | | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| | for 107 | | | | | | | | |
| **Low Care Hostel** | | | | | | | | | |
| 107 Residents | [R] | RN | 1:35R | 3 | 1:52R | 2 | 1:107R | 1 | 6 |
| | | AIN | 1:15R | 7 | 1:33R | 3 | 1:107R | 1 | 11 |
| | | No.nurses delivering care in a 24 hour period | | | | | **TOTAL** | | 17 |

| | **Residents** | | **Morning** | **Subtotal** | **Afternoon** | **Subotal** | **Night** | | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| | for 109 | | | | | | | | |
| **High Care Hostel** | | | | | | | | | |
| 109 Residents | [R] | RN | 1:28R | 4 | 1:28R | 4 | 1:54R | 2 | 10 |
| | | AIN | 1:6R | 18 | 1:7R | 16 | 1:18R | 6 | 40 |
| | | No.nurses delivering care in a 24 hour period | | | | | **TOTAL** | | 50 |
| High proportion of high care will have dementia | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | **TOTAL** | | 89 |
| | | | | | | | **10% temp staff** | | 9 |
| | | | | | | | | | 98 |

98 nurses are involved in the care of 266 Randwick Montefiore Residents per 24 hour period

## Appendix 23: Nurse Focus Group Transcripts

## Nurse Focus Group:

**NURSE FOCUS GROUP with Research Assistant, Emma Segal**

Present: ES, nurse1, nurse2, nurse3

ES: We just wanted to get an idea from you about how you felt the care plans were going and whether you had found them easy to implement so far.

N1: no, actually all the residents involved in this program they are all responding well

ES: OK

N1: and I think somehow it is helping them to have good health because one of them, actually three of them they are very happy to do that in the morning every day.

ES: right.

N1: yes, very thankful and they are really doing it well and properly-the way we tell them-and they are happy

N2: one of our residents, she used to be a bit smelly before

N1: yes she has dementia

N2: we would notice it because we were the one giving her (oral care)

N1 and N3: yeah, yeah

N2: and now it is much better, and it's good

ES: it's great that you are seeing some benefits already. In terms of the different intervention, you know how you have the toothpaste or gum or assisted brushing-which of those have you found easiest to implement?

N1: Actually, everything

N2 and N3: yeah everything's alright (it's alright)

N1: The neutraliser is easier because all they have to do is just to put the paste on their finger and they just rub it themselves on their own

ES: do you find that you have to prompt them to do it

N1: oh yeah. We have to prompt them.

N3: we have to prompt them, we have to find them. Some of them if we remind them they will do by themselves but others we have to help them.

N1: oh yeah, (resident) and (resident) they are quite independent so we don't even have to prompt them but they are doing themselves

ES: great, sure. Have you found that there are any difficulties in implementing the interventions so far?

N2: no

N3: nope

N1: not at all

N2: it's easy

ES: ok cool. Do you have any suggestions about how the process could be improved?

N1: at this stage it's working well.

ES: it's working well? OK great

N2: if the staff take care and they remember to do, it's all good.

ES: so for those of you who didn't get to do the oral health education and training sessions with Alan and Jayne

N2: yeah I didn't do it

N3: I didn't do it

ES: what have the other staff members shared with you? I mean, how have you been learning about the care plan?

N2: we just look to chart about how to do it-you know, toothpaste to be applied, what time. So if we just look (at) the chart its ok

ES: have you found the charts easy to follow?

N3: it's kind of a hassle sometimes

ALL: laughs

N3: yes, you will be confused sometimes-what time? Which one? You know, to tick off

N1: I think it would be better if they were to learn the rest. Like the saliva testing because it will be more interesting to them to do the plans and procedures.

ES: instead of just something to follow you understand why you are using each intervention?

N1: yeah. Instead of just DOING the oral hygiene, maybe it's better for all of us to learn the rest because that's the interesting part-the saliva testing

N2:  I didn't know what the saliva testing is, I just follow the chart and whatever it says

N1: see they don't know what the reason behind, you know, the acidity…

N2 and N3: yeah, you know the technical parts

N1: they don't know the technical parts, which are interesting, like the saliva testing

N2: yeah I just follow the chart so it's not so interesting

N1: we felt like we were dentists. It felt very technical and was interesting

ES (to N1): so it sounds like you found the education sessions interesting then. How would you say they affected your skills or knowledge about oral health and oral care?

N1: well a lot-as I have said, when you do that you feel like you are a dentist or a hygienist. All the technical side-learning about acidity and the saliva made it more interesting and exciting to do the procedures on the residents. You think at first that it will probably be yucky but after you do it and go along its quite exciting actually.

ES: sure. And do you think that this is something that you would be likely to use again and implement after the study was finished for other residents?

N1: yeah, cos it also helps us because when you are giving care sometimes you also feel bad when you smell something awful and you know-the offensive smell. And what we are doing now with (resident), our dementia patient, we really feel bad in the morning because as soon as she opens her mouth you could smell her

N2: actually also (other resident) they used to be smelly, just brush their teeth whenever they remembered. Now they are compelled to brush their teeth in the morning. They used to just brush maybe once but now they are doing it in morning, afternoon and evening

N1: yeah

ES: so it's been good for you and also good for the residents because it makes your job a bit more pleasant?

N1: yes, good for them first but also good for us in terms of giving care

ES: ok, awesome. So feel that generally everyone is on board and following the plans

N2: yes

N1: oh yes, every one of us

N3: yeah it's not that hard to follow the chart. At first I was like whoah! But it's not that hard just to follow it. Even though we don't know what the idea is behind that-it's kind of common sense as well to brush your teeth

N1: well we do it every day for ourselves as well-daily oral care

ES: it sounds like it may become part of every resident's daily care?

N1; I think we will do it-it has been going well so far

ES: before we finish up, is there anything else that you would like to add?

N2: I don't know, what is that saliva testing and stuff- maybe we could take that training?

N1: yes, this would be more interesting for them because they know what the reason behind (the interventions are). Because we just don't have time to explain it to them. We are all busy when we begin the shift. And it is better anyway if they will learn that technical stuff from you people (dental professionals?). It's quite technical.

ES: so there is interest among the other nurses to learn more about oral health and the interventions?

All: yes, definitely

ES: ok great. Well thanks so much for having a chat with me this afternoon. It's been very helpful.

## Appendix 24:
## Images of Room Set-up for OHAT Assessments and Saliva Tests
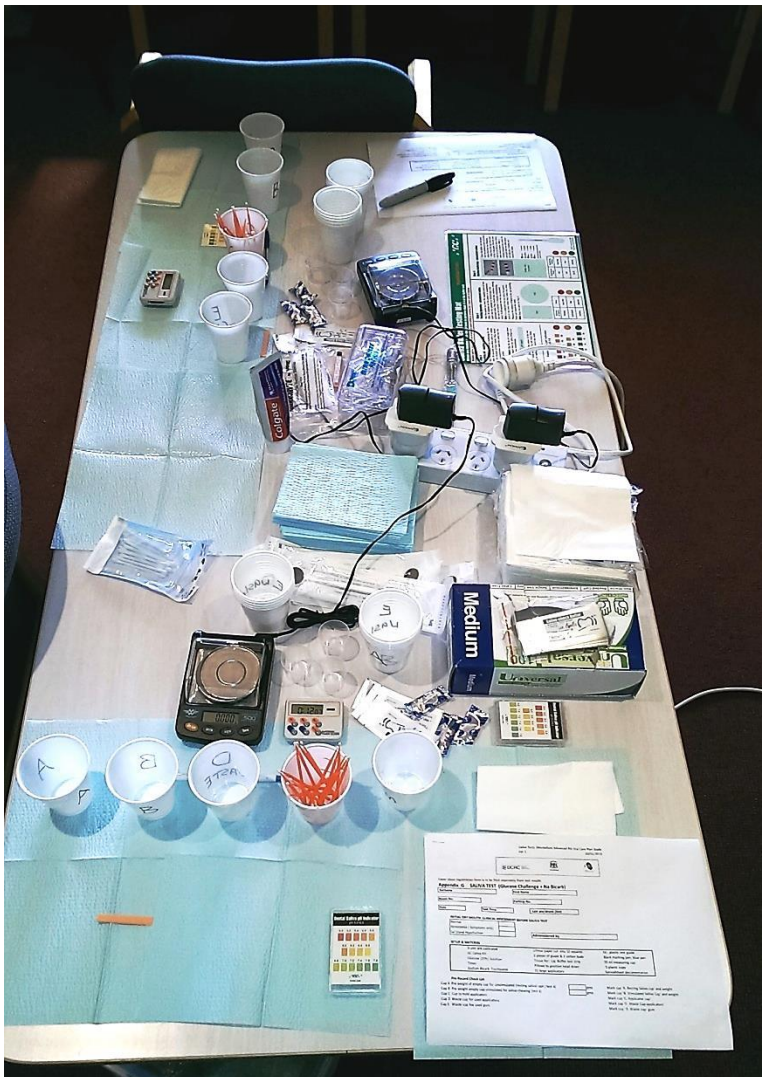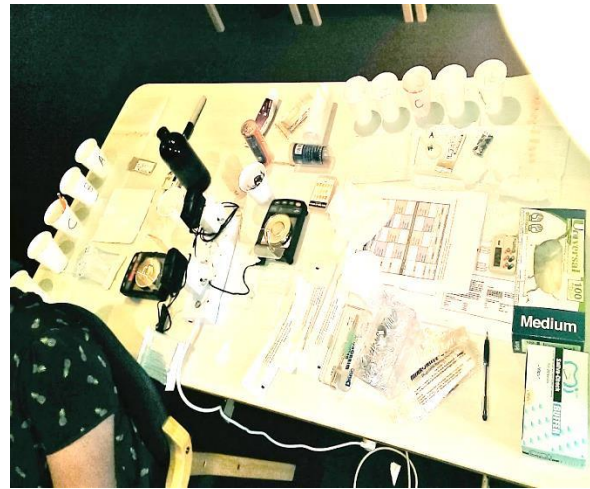






**Room set-up for OHAT assessments and saliva testing.**

Two test subjects could be tested by nurses working in pairs at the same time. Test subjects faced away from each other, seated on a chair at the head of table facing the window and on a chair on the side of the table, which allowed a level of privacy. The test subjects were close enough for nurses to observe each other's assessments and for OHTs and the dentist to easily supervise nurses.

Disposable plastic cups for each saliva test stage were pre-weighed using two electronic scales and tarred to zero. The weight of the cup was written onto the side of the cup and recorded into saliva test sheets in case the tarring was inadvertently lost. Saliva collected was then weighed and recorded into test sheets (See for ground). Timer, pH paper, saliva test colour chart, pH paper colour chart, wax, buffer test strips, saliva dispensing pipettes, disposable applicators, gloves , tissues and plastic cup used as a waste cup can be seen in the image

# Appendix 25:  Images of Room Set-up for Clinical Examination
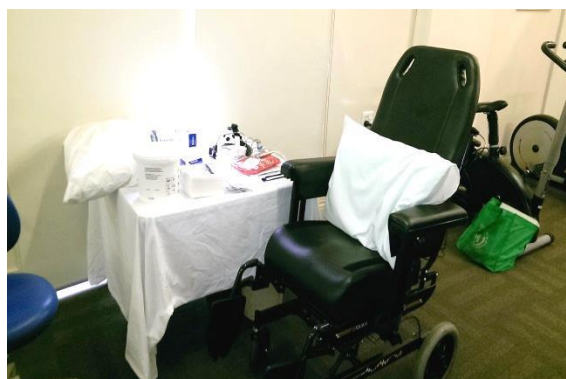






All clinical examination of participants were completed  by the author in a separate room prior the commencement of NSCOCPs with the aid of a dental assistant who acted as a scribe.

The test subject's reflection in the mirror, in the top right image, has been de-identified.

The clinical examination was performed with the aid of a reclinable portable chair, compressed air and water, disposable mirror, probe and tweezers, headlight, disposable gloves, tissues, gauze and magnification loops.

Stationary on the small table included clinical charting form, OHI plaque scores and Findings form