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The Role of the Oral Health Therapist in the Provision of Oral Health Care to Patients Across All Ages

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1. Introduction

This chapter will describe the role and evolution of the scope of clinical practice of dental hygienists, dental therapists and oral health therapists. These three groups of allied oral health professionals are playing an increasingly important role in the provision of oral health services and it is therefore important to understand how they are utilised as part of the dental team.

Historically, the dental hygiene profession originated in the early 1900s in the US, followed by Norway, 1924; United Kingdom, 1943; Canada, 1947; Japan, 1948; and Australia, 1971 (Johnson, 2009). Dental hygienists predominantly provide health education, preventive, periodontal and orthodontic auxiliary services to people of all ages.

Dental therapists were introduced in New Zealand in 1921 to provide basic preventive and restorative dental care for children in the School Dental Service. Currently more than 50 countries utilise dental therapists (Nash et al., 2008). In Australia and New Zealand, dental therapists have been responsible for examining, diagnosing, and developing plans for the oral health treatment they provide to children and adolescents, and referring patients with treatment needs beyond their scope of practice to dentists (Satur et al., 2009).

Oral health therapists are a relatively new addition to the dental team. They have the combined education and training of both a dental therapist and a dental hygienist. Currently across Australia all oral health therapy education is provided through the tertiary education sector.

An emerging oral health problem in many Western countries is access to dental services by disadvantaged groups, in particular public adult dental patients. Oral health disparities and socioeconomic disadvantage have led to a growing burden of disease amongst sections of the community who at the same time have difficulties accessing appropriate oral health services. There is currently debate in the United States and elsewhere about the need for an oral health practitioner with similar skills to a dental therapist to address the high levels of unmet restorative treatment needs and extend access to oral health care services for lower income groups. This is somewhat different to the situation in countries like Australia, where dental therapists have been long accepted as playing a role in the provision of oral health

care for children and adolescents. In Australia, the debate concerns the expansion of the clinical scope of practice for dental therapists to provide restorative dental treatment to adult patients. One proposed model in some countries is the extension of dental hygiene practice to include these restorative skills. With the advent of a dually-qualified oral health therapist, i.e., combining the clinical skills of a dental hygienist and those of a dental therapist, there is a real opportunity to redefine the way in which the dental team operates. It is important for public health planners to explore a range of models of oral health care that utilise the skills and expertise of all members of the dental team in order to ensure equitable access to oral health services.

To date, there has been very little research conducted on the appropriate utilisation of dental therapists, dental hygienists and oral health therapists as members of the broader dental team. This chapter will explore some of the research relating to models of care and utilisation of members of the dental team, and expanding their scope of practice to improve access to oral health care, with a particular focus on research conducted in Victoria, Australia, the policy implications of that research and the implications that this may have internationally. This research was conducted as a result of changes to the regulatory framework that were introduced in 1999 and 2002 in Victoria designed to expand the scope of practice for dental hygienists and dental therapists. These changes initially allowed dental therapists to provide restorative dental treatment to young adult patients aged 19-25 years, but only on the prescription of a dentist, and encouraged research into the roles and scope of practice for dental therapists and hygienists. In 2009, regulations were further amended to allow dental therapists to provide dental care within their scope of practice to patients across all age groups. These regulations require dental therapists and hygienists to practice the skills in which they have been formally educated and are competent and registered to undertake. The move towards a regulatory framework based on education and competence rather than a defined list of duties, as is common in many jurisdictions, has important implications for the utilisation of the allied oral health workforce.

2. Oral health workforce and utilisation

Dental therapists and dental hygienists were variously introduced into the dental profession around the world to deal with specific issues relating to access to dental care and to work as an adjunct to dentists in the provision of dental care. The continued expansion and evolution of the roles and scope of clinical practice for dental and oral health therapists is seen as an important mechanism in addressing issues relating to workforce shortages and working in underserved communities, where oral health disparities tend to be greater.

2.1 Dental hygienists

In many countries around the world, dental hygienists have traditionally played a much greater role than dental therapists in the provision of oral health care. Eaton et al. (2003) reported that across Canada, the United States of America and Japan, there were a total of 215,435 hygienists for a total population of 421 million people, alongside 253,825 practising dentists. In contrast to this, in 2007, there were a total of 343,922 active dentists and only 30,963 registered dental hygienists in the 30 European Union and European Economic Area (EU/EEA) member states plus Switzerland, with a total population of approximately 500 million people (Widstrom et al., 2010). Over a ten year period from 1997 to 2007, the

population of the EU/EEA plus Switzerland increased by less than 3%, the number of dentists increased by 13% and the number of dental hygienists by 42%. The overall ratio of active dentists:dental hygienists changed from 18:1 to 11:1 across Europe, but this was still a long way from the nearly 1:1 ratio across Canada, the United States and Japan.

Although dental therapists have been widely utilised in Australia, it has taken Australia much longer to embrace the dental hygienist profession. In 2006 there were 1045 practising dental hygienists (including 371 dually qualified oral health therapists) and 10,404 practising dentists, a ratio of dentists to dental hygienists of 10:1, for a population of 21 million people. Between 1997 and 2006 there has been a 139% increase in the number of practising dental hygienists in Australia, and it is predicted that this growth will continue with a projected increase of 116% to 1,458 dental hygienists by 2025, in addition to an increase in dual trained oral health therapists of 460% to 2,117 by 2025 (Australian Institute of Health and Welfare [AIHW], 2011).

2.2 Dental therapist and oral health therapist workforce

In the United Kingdom there are approximately 5,600 dental hygienists providing mainly periodontal and preventive care; 1,100 dually qualified hygienist-therapists whose remit also includes a wide range of restorative work; and approximately 200 singly qualified therapists (whose training programme ceased some 20 years ago), who traditionally worked mainly in community clinics and with children (Turner et al., 2011). In New Zealand there were 749 registered and practising dental therapists in 2011, with 515 dental hygienists and 2060 dentists, an increase from 640 dental therapists, 377 dental hygienists and 1,640 dentists in 2005 (New Zealand Dental Council, 2005, 2011).

In 2006 the oral health workforce in Australia comprised of 1,171 practising dental therapists and 371 practising oral health therapists (Balasubramanian & Teusner, 2011). In 2006, 98.8% of dental therapists and 94.8% of oral health therapists were female. This pattern of female predominance is similar to that seen for both dental therapists and dental hygienists internationally. This has potential implications for workforce planning, with female practitioners more likely to take time off work and work part-time for child-rearing and family reasons (Hopcraft, 2008). Whilst Australian dentists and dental specialists comprised only 77% of the oral health workforce in Australia, they provide approximately 85 per cent of all dental visits (Teusner & Spencer, 2003). However, whilst the number of practising dental therapists in Australia declined from 1,324 to 1,171 between 1997 and 2006, this was offset by an increase in dual-trained oral health therapists of 371 in 2006 (Balasubramanian & Teusner, 2011).

In Australia, with the majority of training programs now combining dental therapy and dental hygiene to graduate as an oral health therapist, there will be a growing proportion of the oral health workforce who will have clinical skills in both fields, allowing them to play a significantly different role as members of the dental team. Indeed, workforce projections in Australia indicate that the number of oral health therapists will increase 460% to 2,117 by 2025, whilst the number of dental therapists will decline to only 443 over the same period (AIHW, 2011).

3. Oral health therapy education and scope of practice

Oral health education varies across the globe, with the growth in dental schools and graduate numbers dependant on the particular workforce requirements in each country.

There has been enormous change in the oral health education landscape in Australia over the past 20 years, with four new dental schools opening to complement the five existing schools that offer training for dentists. There are also three additional training programs in Australia for dental therapists and dental hygienists that do not concurrently train dentists. In terms of education for dental and oral health therapists, there has been a substantial shift from programs training single qualification graduates (dental therapist or dental hygienist) to Bachelor of Oral Health programs training oral health therapists (dual qualified dental therapists and hygienists).

3.1 Dental therapy, dental hygiene and oral health therapy education

Dental hygiene, dental therapy and oral health therapy education programs have evolved differently around the world, and there is not a common approach to their training. Programs have invariably developed as a response to the particular requirements of a given country, as well as the regulatory environment governing their practice. A number of reviews of dental therapist and dental hygienist education show this significant variation in the duration and nature of educational experiences (Luciak-Donsberger & Aldenhoven, 2004; Johnson, 2003; Nash, 2004; Nash et al., 2008). Interestingly, whilst the roles and functions of dental therapists are reasonably similar internationally, dental hygienists, who practice across many countries, undertake very different clinical duties around the world depending on the legislative environment under which they practice. As a consequence, the education and training requirements also differ considerably. A decade ago, a review of the scope of practice for dental hygienists in nineteen countries investigated eight clinical procedures that hygienists might engage in (Johnson, 2003). In most countries, only four or five of the procedures were within the hygienists' scope of practice, and in only one country did hygienists perform all eight procedures.

3.1.1 Dental hygiene education and scope of practice

The education and training of dental hygienists varies considerably internationally, although there is a trend towards baccalaureate programs in many countries. In the USA in 2002, training programs varied from two to four years, with 78 per cent of graduating dental hygienists awarded an associate degree, 17 per cent a baccalaureate degree, 3 per cent a combined certificate/associate degree and 2 per cent a certificate or diploma (Brown et al., 2005). Dental hygiene education commenced in Australia in 1971, moving from a diploma to a baccalaureate degree in 1998.

Internationally, the practice of dental hygiene has been shifting from traditional models of direct and indirect supervision by a dentist towards a more collaborative approach to practice, where the dentist and hygienist work together to decide on the best approach to patient management and the services required (Johnson, 2003). In Sweden, Denmark, Norway, Finland, the Netherlands and Colorado (USA), dental hygienists are able to practice independently from dentists (Gatermann-Strobel & Perno-Goldie, 2005). Limited independent practice or models of care allowing direct access in restricted practice locations such as nursing homes and public health facilities are permitted in Germany, Latvia, and a number of states in the USA.

In New Zealand, dental hygienists practise in a team situation with clinical guidance provided by a practising dentist or specialist. Clinical guidance means the professional support and assistance provided to a dental hygienist by a dentist/specialist as part of the

provision of overall integrated care to the patient group, and may be provided remotely. Dental hygienists are responsible and accountable for their own clinical practice within their scope of practice but the dentist or specialist is responsible and accountable for the clinical guidance provided. Dental hygiene practice includes - obtaining and reassessing medical and dental health histories; examination of oral tissues and recognition of abnormalities; assessing and provisionally diagnosing diseases of periodontal tissues, and providing appropriate referral; obtaining informed consent for dental hygiene care plans; scaling, debridement and prophylaxis of supra and sub-gingival tooth surfaces (New Zealand Dental Council, 2005).

The Danish *Dental Hygienists Act 1996* permits hygienists to undertake a dental examination and subsequent periodontal management of the patient. Hygienists are able to register to own their practice without the supervision of a dentist, and are required to refer patients with complex treatment requirements, oral pathology which is beyond the scope of practice of a hygienist, complex medical conditions or patients who do not respond to treatment to a dentist. In Finland, dental hygienists work only under the prescribed instructions of a dentist, generally in a team environment. However, they can work independently, and can have their own practice. In Norway, dental hygienists normally work with dentists, although they are able to have their own private practices and are able to diagnose and treat patients. In Sweden, dental hygienists are able to work independently, diagnosing dental caries and periodontal disease and planning appropriate treatment, and providing temporary restorations (Gatermann-Strobel & Perno-Goldie, 2005).

In the Netherlands, dental hygienists have independent status, and predominantly train in special hygiene schools that are not associated with dental schools. Most hygienists are employees in dental practices, however they are able to practice independently from a dentist in a dental hygiene clinic, but all treatment must be referred by a dentist. The first independent practice commenced in 1978 (Gatermann-Strobel & Perno-Goldie, 2005). Approximately 10 per cent of hygienists operate in this manner, and there is pressure from hygienists to acquire the right to initiate their own treatment plans.

In most of the provinces in Canada, the profession of dental hygiene is self regulated, with hygienists and not dentists responsible for registration and licensing (Gatermann-Strobel & Perno-Goldie, 2005). Dental hygienists were first granted self regulation in Quebec in 1975, with other provinces following in the 1990s. In some provinces, hygienists may practice independently, but some treatment may have to be prescribed by a dentist, or the patient must have been seen by a dentist in the previous 12 months. Canadian dental hygienists have expressed a strong interest in expanding their scope of practice and their knowledge base to achieve greater professional independence, expertise and professional respect. However, Canadian dentists believe that hygienists are not adequately trained to practice independently (Adams, 2004).

In the United States of America in 22 states, dental hygienists can initiate treatment and provide dental hygiene services in various settings based on their assessment of the patient need (American Dental Hygienists Association, 2007). This model of dental hygiene is known as direct access, which is defined as a model of practice where the dental hygienist initiates treatment based on their assessment of patient's needs without the specific authorisation of a dentist, treats the patient without the presence of a dentist, and maintains a provider-patient relationship. Independent dental hygiene practice is permitted only in Colorado, and for a short period was also permitted in California. There has been a number

of studies that have examined dental hygienists working in some form of independent practice, examining and treating patients that have not been previously examined by a dentist. In 1986, the Colorado state legislature revised the Colorado Dental Practice Law (DPL) to permit dental hygienists to practice either supervised or unsupervised, and also to allow a dental hygienist to own a dental hygiene practice (Astroth & Cross-Poline, 1998). The Colorado DPL does not require any additional education in order to practice independently. The Colorado study noted that referrals originated from current patients to the independent hygiene practices, implying patient satisfaction with care and treatment received. Hygienists also received referrals from dentists and other health-care professionals, again implying recognition of the value of the dental hygiene services being supplied. The authors noted that this type of referral pattern could signal the establishment of collaborative and respectful working relationships between dentists and dental hygienists engaged in this type of practice. An audit of patient records found a high standard of process of care and management of patient information. The authors concluded that the care provided by the dental hygienists in this study did not exhibit any undue risk to public health and safety. The California Health Manpower Pilot Project 139 (HMPP 139) operated from 1987 until 1990, and various aspects of practice were examined (Kushman et al., 1996; Freed et al., 1997). A total of 16 hygienists established 10 practices, including office-based, home-based and organisational practices. The authors found that all of the practices consistently attracted new patients. Comparisons were made with six dental practices, and this showed that the hygiene practices were superior in several areas, including infection control, follow-ups to medical findings, and updating the medical history and documentation of periodontal and soft-tissue status. A total of 98 per cent of patients were satisfied with their treatment. The authors concluded that, given the methods used in the study, the adequacy of dental care without dentists' supervision was at least as good as hygiene care provided with supervision, and the evidence indicated that independent dental hygiene practice did not increase the risk to the health and safety of the public or pose an undue risk of harm to the public. In both of these studies, the dental hygienists were examining patients and developing oral hygiene care plans, and referring patients to dentists when required.

In Australia, dental hygienists are currently licensed by the Dental Board of Australia, but prior to 2010 they were licensed separately in each State or Territory, with different regulations and scope of practice. In Victoria under the Dentists Act 1972, dental hygienists were licensed to practise within a defined scope of practice listed under the *Dentists Regulations 1992 r.505 Duties of a dental hygienist*, which stated that a dental hygienist may, under the supervision, direction and control of a dentist, perform certain tasks, including the following - measurement and recording of periodontal disease; removal of plaque, extrinsic staining and calculus from teeth; root planing; cleaning and polishing of teeth and restorations; topical application of solutions to teeth or oral tissues; taking of impressions for study casts; limited orthodontic procedures; and taking of periapical and bitewing radiographs. Furthermore, in a dental practice, there had to be one supervising dentist for each dental hygienist employed. In 2002 the Code of Practice for dental hygienists in Victoria removed these words, and their scope changed to include fissure sealants and local analgesia as well as undertake an oral examination, and also altered the supervision requirements so that dental hygienists could work under general supervision - the dentist did not need to be on site for them to practice (Dental Practice Board of Victoria, 2002).

3.1.2 Dental therapy and oral health therapy education and scope of practice

Dental therapy originated in New Zealand, with the recognition of poor oral health of children and the need for a workforce that had an emphasis on prevention (Satur, 2010). After considerable debate over nearly a decade, the Health Department established a dental therapy school in 1921 to train School Dental Nurses to work in the School Dental Service, with the first cohort graduating in 1923. Two further schools were established in 1952 and 1956, however by 1980 with a declining child population and improving oral health these two schools were closed. The training program moved from the control of the Health Department to the Education Department in 1991, and moved to the tertiary sector in 2000 with a Diploma of Dental Therapy at the University of Otago, and later also at Auckland University of Technology. These two programs eventually moved to a dual-outcome Bachelor of Oral Health in 2006 and 2007.

Dental therapy training commenced in 1966 in Australia, following the success of the New Zealand program, and was run under the umbrella of State-based Health Department dental therapy schools (Dunning, 1972; Gussy, 2001; Satur, 2003). In Victoria, the training program was two years in duration and was designed to provide basic dental treatment to children using preventive, educational and reparative measures, under the supervision, direction and control of dentists. The course was upgraded from a Certificate to a Diploma in 1988, and a greater emphasis was placed on preventive care, including the use of fissure sealants, before transitioning to the tertiary education sector in 1996 in Victoria with a Diploma in Oral Health Therapy (Satur, 2010).

Although the first dual-trained Bachelor of Oral Health program did not commence in Australia until 1998 at the University of Queensland and the Queensland University of Technology, in South Australia dental therapists were able to undertake a bridging program since 1980 enabling them to acquire dental hygienist skills and register as both a dental therapist and dental hygienist (Satur, 2010). Other universities in Australia began to offer both add-on programs to allow dental therapists and dental hygienists to upskill and gain dual registration, and eventually they began to combine their training programs into dual-trained Bachelor of Oral Health programs. Currently in Australia there are eight programs that offer dual-trained outcomes in dental therapy and dental hygiene, with two dental hygiene only programs and one dental therapy only program (Satur, 2010).

In the United Kingdom there has been a shift towards dual training as a result of the Nuffield Inquiry in 1993, although there are still many single outcome programs on offer.

There is currently significant debate in the United States about the introduction of dental therapists into the dental workforce, which is seen as a reasonably recent process. However, the history of dental therapists in the United States dates back to 1949, when the state of Massachusetts passed legislation allowing for the training of non-dentists to prepare and restore teeth under the supervision of a dentist (Mathu-Muju, 2011). Strong opposition from the American Dental Association saw the legislation rescinded the following year. Then in 1972 there was a proposal from the University of Southern California to use school dental nurses based on the New Zealand model to address the problems of untreated dental caries in school children (Friedman & Ingle, 1973a, 1973b). Again, strong opposition from two state Dental Associations contributed to the failure of this proposal to gain funding and proceed. In both instances, the dental profession argued that there were significant concerns regarding the quality of care provided by dental therapists.

More recently though, there has been the successful introduction of dental therapists in Alaska and Minnesota, and a growing movement across a number of states to introduce legislation allowing for the creation of a dental therapist model. The Alaska initiative commenced in 2005 with six Alaska Native dental health aide therapists completing a training program in New Zealand and commencing practice in Alaska under Federal authority (Nash & Nagel, 2005). Several studies have subsequently demonstrated that the dental therapists are performing at an acceptable level, with short-term restorative outcomes comparable with those of dentists treating the same populations (Bader et al., 2011; Bolin, 2008). Minnesota enacted legislation that allowed for the establishment of two new groups of dental practitioner – the dental therapist and the advanced dental therapist, with a training program established at the University of Minnesota alongside dental students (Mathu-Muju, 2011). Dental therapists in Minnesota will require direct or indirect supervision from a dentist, whilst the advanced dental therapist (with two years of additional training) will be able to provide treatment without a dentist on-site and also have a broader clinical scope of practice including the extraction of mobile permanent teeth and the limited prescription of medications. Legislation also requires that at least half of the patients treated by dental therapists in Minnesota be from disadvantaged and underserved groups within the community in order to improve access to dental care, and a dentist must complete the initial examination, diagnosis and treatment plan for the patient.

4. Evolving scope of practice

A quarter of a century ago, Barmes and Tala (1987) observed that changing patterns of oral disease were resulting in a polarisation in treatment needs between those requiring minimal simple intervention and those who required more extensive and high technology care. They suggested re-evaluating dentist: auxiliary ratios, with a need to increase the number of auxiliaries (dental therapists and dental hygienists) to provide the low-medium technology dental services, while working in a team environment with dentists who provided the high-technology care.

More recently, Baltutis and Morgan (1998) noted that changes in the epidemiology of dental diseases in Australia had resulted in a significant change in the dental needs in the community. Significant declines in caries experience in children and young adults, decreasing rates of edentulism and an increase in the number of people retaining more teeth into older age had altered the treatment mix. They argued that there was a need to redefine the roles of all members of the dental team, in order to best utilise the skills of each member, so that services are delivered appropriately to the community.

Reports on dental workforce in Australia at the turn of the century suggested a potential crisis in supply and demand, with an ageing workforce nearing retirement impacting on the ability to supply services, and an increasing demand for dental treatment. There is also a significant maldistribution of the dental workforce in Australia, both in terms of geography (rural and urban), and also private and public sector. Approximately 30 per cent of the adult population is eligible for public dental services but less than 10 per cent of dentists work in the public sector, and nearly 80 per cent of dentists working in major cities. (Teusner et al., 2007; Teusner & Spencer, 2003). It was projected that the capacity of the dental workforce in Australia to supply dental services would increase from 28.4 to 29.4 million visits from 2000 to 2010, however the expected demand for services would increase from 23.8 to 33.2 million visits from 1995 to 2010 (Spencer et al., 2003). This was reported as a potential workforce

shortage of 1500 dental care providers by 2010, prompting an expansion in the number of dental schools, and training numbers for dentists and oral health therapists. It also prompted closer consideration of the configuration and roles of members of the dental team, in particular dental hygienists and oral health therapists.

One proposed solution to the problems of access to dental care lies in productivity. Increased productivity in the workforce has driven much of the economy over recent decades, and it is not unreasonable to think that similar gains can be achieved in dentistry, with improvements in dental technology, material and instruments (Spencer et al., 2003). However, it has also been proposed that increases in productivity, that is the number of dental visits or services provided per hour, can be achieved through the substitution of allied dental personnel for a dentist (Spencer et al., 2003). This has been clearly demonstrated in the utilisation of dental hygienists in North America, and also more recently in research in Australia, demonstrating the utilisation of dental hygienists to provide dental care directly to residents of nursing homes without the prescription or supervision of a dentist (Hopcraft et al., 2011b). Spencer et al. (2003) note that any expansion of the dental team role will be a combination of a substitution effect, or more of the same, and a complementary effect with additional new services provided. For example, the addition of a dental therapist to the dental team, with a scope of practice expanded to treat adult patients, would produce the same simple restorative services (substitution), but also additional restorative services (complementarity), as well as additional complex dental services provided by the dentist using the time freed up from previously providing simple restorative procedures.

We will outline here research that has been undertaken to investigate innovative dental therapy and dental hygiene workforce models designed to improve access to dental services.

4.1 Dental hygienists working in nursing homes

The increased utilisation of dental hygienists as part of the multi-disciplinary team has long been recognised as an approach to improve dental service delivery. However, there is still strong opposition from the dental profession to increasing dental hygienists scope of practice, particularly in relation to autonomous or independent clinical practice. Dental hygienists have expressed a willingness to expand their scope of practice to work in underserved areas in order to address workforce shortages or access needs. However many regulatory models for dental hygienists require them to work under the supervision and/or direction of a dentist.

Extensive literature clearly demonstrates that elderly people living in residential aged care facilities display some of the poorest oral health in the community, and with an ageing population in many Western countries and declining rates of edentulism, this group of patients is likely to present significant challenges to the dental profession (Hopcraft et al., 2011a; Hopcraft et al., 2011c). Dentists have also demonstrated low levels of interest and participation in providing dental care for residents of aged care facilities (Hopcraft et al., 2008). Dentists had a strong preference for treating patients at their own practice, and there are a number of significant barriers that appeared to impact on the provision of dental care in nursing homes.

A study was undertaken in Victoria, Australia in 2005 with the aim to determine whether a dental hygienist could undertake dental examinations for residents of aged care facilities,

devise adequate periodontal and preventive treatment plans, and identify and refer patients who require treatment and assessment by a dentist, without the patient first being examined by a dentist. Prior to the commencement of this study under existing legislation, dental hygienists in Australia could only undertake treatment after a patient had an oral examination and a treatment plan devised by a dentist. This is the most common model of care for dental hygienists internationally, with varying levels of supervision the norm. Of course, the problem with this model of care is that it limits access to dental care, particularly because in a nursing home environment, most dentate residents required periodontal and preventive treatment that could be provided by a dental hygienist. This is an inefficient use of resources, requiring a patient to see a dentist for an examination when this aspect of dental treatment could conceivably be provided by a dental hygienist. Therefore, it was important to provide evidence for a model of care where dental hygienists were able to provide dental care without prior examination and referral from a dentist.

A total of 510 residents from 31 nursing homes were examined by a dentist and one of four dental hygienists in 2005-06, with their referral and treatment decisions compared (Hopcraft et al., 2011b). Three of the hygienists had diploma qualifications and one had a bachelor degree, and had graduated between 1988 and 2003. None of them had previously undergone extra training in special needs or gerodontology or had significant experience working in nursing homes. No additional training was undertaken for the dental hygienists prior to commencing this project.

The dentist and hygienist conducted dental examinations of residents in the nursing home in field conditions, with a headlamp, mouth mirror and probe, and were blinded to the others findings until the examination had been completed and documented. The medical history was assessed independently by both the dentist and dental hygienist prior to the dental examination, particularly to determine whether antibiotic prophylaxis for infective endocarditis would be required. No periodontal probing was undertaken for subjects considered at risk. The dental examination measured coronal and root caries for each tooth surface and assessed periodontal disease using the Community Periodontal Index. After completing the dental examination, the dentist and hygienist independently devised a referral plan and an oral hygiene care plan for treatment to be performed by the hygienist, which were then compared for agreement. The referral plan required the clinician to determine whether the subject required treatment that was beyond the permitted scope of practice of a dental hygienist as determined by the Dental Practice Board of Victoria Code of Practice for Dental Hygienists, and therefore, could only be provided by a dentist. The oral hygiene care plan required both the dentist and hygienist to choose what treatment the patient required that should be provided by a dental hygienist from a list of treatment categories: scaling and/or root planing, oral hygiene instruction, denture cleaning, topical fluoride application, dietary advice/counselling, management of dry mouth or no dental hygiene treatment required. In this study, the diagnosis and treatment decisions of the dentist were considered the gold standard, and comparisons were made with the treatment decisions of the dental hygienists.

The treatment needs of residents were high, with most dentate residents requiring preventive and periodontal treatment that could be provided by a dental hygienist, and three-quarters of residents required a referral to a dentist for treatment. Only 4.0% of dentate residents were assessed as requiring a referral to assess for potential oral pathology. There was excellent agreement between the dentist and hygienists regarding the decision to

refer residents to a dentist for treatment, with high sensitivity (99.6%) and specificity (82.9%). Importantly, only 8.0% of residents were referred to a dentist by a hygienist when it was determined that no referral was required. In most cases, these referrals were to check potential soft tissue pathology or for review of inadequately fitting dentures. Nederfors et al. (2000) found that dental hygienists overestimated treatment need for 6.8% of residents. They concluded that it is possible to use an experienced dental hygienist as the professional of the dental team to act as a consultant in long-term care facilities and that this would be preferable from both an economic and pedagogical point of view. The results of this study were similar to those of Nederfors et al. (2000) and demonstrate that dental hygienists can play an important role in the delivery of oral health care to residents of aged care facilities.

One of the key strengths of this study is that the dental hygienists did not require additional education or training prior to undertaking examination of nursing home residents. Sensitivity and specificity of the examination and treatment recommendations were high despite the fact that the four dental hygienists were educated in different jurisdictions, with no prior experience working in nursing homes or with frail and functionally dependent elderly patients. This suggests it is possible to expand the clinical scope of practice for dental hygienists to practise in nursing homes without undertaking specific further education or training.

The increased utilization of dental hygienists as part of the multidisciplinary team has been clearly recognized as an approach to improve dental service delivery. Dental hygienists have been shown to be capable of undertaking a dental examination for residents, correctly identifying the majority of residents who require a referral to a dentist as well as formulating appropriate dental hygiene treatment plans for residents. With a greying population who are retaining more natural teeth, it is important that public dental policy embraces a model of care that places dental hygienists at the frontline of dental service provision in nursing homes. Dental hygienists can be utilized to provide dental examinations for residents on admission to a nursing home, develop an oral hygiene care plan, provide dental hygiene treatment, refer to a dentist and provide ongoing support and oral health education to carers as required. This model of care is likely to improve access to care for residents and has a positive impact on their oral health and quality of life.

More broadly, this study demonstrates that dental hygienists are able to exercise autonomous clinical decision making in the treatment of their patients. In Australia, dental hygienists are trained and educated to diagnose, treatment plan, prevent dental diseases and treat periodontal disease, and their training is often provided alongside dental students in a university setting.

4.2 Dental therapists treating adult patients

In North America, the debate around dental therapists centres on the introduction of a new oral health care provider. Some commentators advocate limiting the scope of practice for dental therapists to children – indeed, this is inherently implied in the preferred terminology of ‘pediatric oral health therapist’ in the United States (Nash & Nagel, 2005). However, it is important to note the vast differences in the oral health care systems in the United States and other countries that utilise dental and oral health therapists. Dental therapists have a long established role in countries such as New Zealand, Australia and the

United Kingdom, treating children for many decades. With a more 'mature' profession, arguably the push for expansion to treat adult patients makes more sense than in the USA, where the establishment of dental therapy to focus on a particular problem of poor child oral health and access (the same problems that saw the creation of dental therapists in New Zealand nearly a century ago) necessitates restricting their practice to children and adolescents.

Recent legislative changes in Australia have allowed for an expansion in the scope of practice for dental therapists, beginning when the new *Dental Practice Act 1999* enabled dental therapists in Victoria to work in both the public and private sectors, after previously being restricted to working in the public sector only (Satur, 2003). Subsequently, the Dental Practice Board of Victoria developed a new Code of Practice in 2002 allowing dental therapists to expand their patient group to provide dental services to young adults up to the age of 25 years. In 2004, the National Advisory Council for Oral Health (a subcommittee of the Australian Health Ministers conference) called for the use of dental therapists, as members of the oral health team, to assist in addressing workforce and clinical demand issues (Australian Health Ministers' Advisory Council, 2004). In 2002 the Dental Practice Board of Victoria (DPBV) encouraged research aimed at expanding the role of dental therapists and dental hygienists.

In 2006 Dental Health Services Victoria undertook a study to investigate the capacity of dental therapists to provide direct coronal restorative care to adult patients over the age of 25 years on the prescription of a dentist (Calache et al., 2009). This was the first step in the process of determining whether oral health therapists could expand their dental therapy scope of practice to adult patients. This study was followed in 2010 by another study that investigated a pilot educational bridging program designed to provide university trained dental therapists with the requisite knowledge and clinical skills to translate their existing scope of practice to adult patients over the age of 25 years (Calache & Hopcraft, 2011a; Calache & Hopcraft, 2011b).

4.2.1 Capacity for direct restorative care

This project commenced in 2006 at the Royal Dental Hospital of Melbourne (RDHM), and was designed to assess the capacity of dental therapists to provide direct coronal restorations to adults older than 25 years on the prescription of a dentist (Calache et al., 2009). Dental therapists undertook a three day educational program prior to commencement of the study. This program included: infection control measures; demographics of adult patients attending the RDHM; medical problems affecting adult patients' care; psychological issues in care; communication skills; professional and technical skills for the ageing dentition; the impact of partial dentures on the dentition, on dental restorations, and on occlusion; a review of dental materials; periodontology; and health promotion approaches for adult patients. Seven dental therapists participated in the study, placing 356 restorations in 115 patients, with the support of a dentist. The examining dentists undertook the initial examination, and prescribed restorative treatment for the dental therapist to perform. They had to confirm that the procedure and the patient were suitable for management by the dental therapist.

The supporting dentists (separate from the examining dentists) provided support to the therapist as required (rather than "direct supervision"), on issues such as the choice of dental materials and appropriate technique, or if the therapists considered the prescribed

treatment to be beyond their scope of practice. The supporting dentists also undertook an evaluation of each restoration immediately after it had been placed. These restorations were reviewed six-months post placement by reviewing dentists (separate from the examining and supporting dentists) blinded as to which restorations were placed by the dental therapists. Patients' age ranged from 26 to 82 years (82% were >40 years). The supporting dentists and reviewing dentists had extensive experience in clinical teaching and assessment of dental students.

Six months after placement, 94.6% of the direct coronal restorations placed by dental therapists were assessed as meeting all standards, acceptable or satisfactory, with the remaining 5.4% requiring re-treatment. This re-treatment rate was comparable with that reported in the literature for most dental materials at six month of being placed (Sheldon & Treasure, 1999). Glass Ionomer Cement restorations in posterior teeth had the greatest failure rate (12.5%). However, Sidhu (2011) also highlighted that this type of restorative material may have a higher replacement rate, particularly in posterior teeth.

Based on feedback from the therapists and supporting dentists involved in the project, it was proposed that a dental therapist would require approximately 70 hours of additional training (28 hours didactic, 14 hours clinical observation and 28 hours clinical practice) to support their capacity to provide direct coronal restorative services to adults older than 25 years on the prescription of a dentist. This study suggests that dental therapists are capable of providing direct coronal restorations to adult patients on the prescription of a dentist after completing a short educational program.

4.2.2 Pilot educational model

Following the successful study that demonstrated that dental therapists were capable of providing restorative treatment to adult patients on prescription, it was important to further investigate the ability of dental therapists to treat adult patients without the prescription of a dentist, working within their own scope of practice. Models of care that provide substitution of personnel are likely to be more efficient when there are no constraints such as supervision or prescription. Therefore, further research was undertaken to investigate a pilot educational program designed to translate the existing clinical scope of practice for dental therapists in Victoria, Australia to adult patients. Dental therapists have traditionally performed dental examinations, preventive and simple restorative treatment for children without the supervision of a dentist. Translation of these clinical skills to adult patients is seen as one mechanism for improving access to dental care in underserved sections of the community.

An educational bridging program was developed based on educational models shown to be effective in changing clinicians' performance or patient outcomes. The educational program was designed to enable dental therapists with a university qualification to undertake clinical procedures within their existing scope of practice, for patients twenty-six or more years of age. Provision of dental care included the ability to recognise and provide appropriate referral of adult patients if their treatment needs were beyond the scope of clinical practice of the treating dental therapist. The existing scope of clinical practice for dental therapists relevant to management of adult patients is shown in Table 1.

Treatment needs considered outside the scope of clinical practice of dental therapists includes restorative treatment of root caries and carious lesions associated with crowns, bridges, and abutment teeth for removable prostheses; complex restorations extending onto

root surfaces; complex restorations requiring multiple cusp replacement; restorations on teeth affected by advanced periodontal disease; endodontic therapy (apart from pulp capping and pulpotomies) on permanent teeth; indirect restorations; restorative treatment for patients with implants; and extraction of permanent teeth.

Oral Diagnosis	Prevention	Operative Care	Orthodontics	Oral Surgery
Oral examination	Application of therapeutic solutions to	Local anaesthesia	Orthodontic procedures, under the supervision of a dentist	Extraction of deciduous teeth
Intraoral dental radiography	teeth (excluding in-surgery bleaching)	Restoration of coronal tooth structure (excluding indirect restorations)	(excluding diagnosis; treatment planning; initial fixation of brackets; design, activation and adjustment of orthodontic appliances)	
Extraoral dental radiography (on prescription)	Fissure sealants			
Impression taking (but not for prosthodontics treatment)	Scaling and prophylaxis	Pulpotomies		

Table 1. Scope of clinical practice for dental therapists in Australia

The educational program consisted of didactic and interactive workshops (42 hours), clinical observation sessions (14 hours), clinical practicum sessions (42 hours), and clinical experience sessions (105 hours) (Table 2). The clinical observation component consisted of fourteen hours over two days, including observation of public dentists in primary care, general dentistry, and oral medicine providing treatment to adults. This was designed so that participants could observe and discuss various treatments and engage in interactive one-on-one conversation with the dentist, in order to facilitate application of knowledge to practice. Following the clinical observation, the dental therapists then undertook forty-two hours of clinical practicum, providing dental care to adult patients aged 26+ years at the Royal Dental Hospital of Melbourne under the direct supervision of a dentist. These supervising dentists all had extensive experience in clinical teaching of undergraduate students.

This enabled participants to apply new knowledge and skills to their own clinical practice and also facilitated more interactive one-on-one conversation with the supervising dentist. Both the supervising dentist and the participant completed a logbook to provide performance feedback during the clinical practicum sessions. Participants then undertook 105 hours of clinical experience, providing dental care to adults over a period of at least fifteen days, working in close collaboration with a dentist at a local community dental clinic. Again, a logbook was completed by both the supervising dentist and the participant, to provide feedback on the participants' performance. At the completion of the education program, participants undertook a three-hour written examination and an oral examination of thirty minutes (after sixty-minutes to view a clinical case), including one patient case presentation, to assess their ability to provide dental care within their clinical scope of practice to adult patients.

	Hrs	Topics
Self-directed Learning		Pre-reading material on topics in the didactic and interactive workshop component of the program were sent to participants four weeks prior to commencement of the course.
Didactic Workshops		Didactic and interactive workshop activities were delivered by specialist dentists and academics.
Oral examination	3	Medical, dental and social history; extra- and intra-oral clinical examination, including coronal and root caries assessment; periodontal, occlusal and oral mucosal assessment.
Management of older adults	3	Management of attrition, erosion and abrasion, pulpal recession, root caries, xerostomia, oral changes resulting from disease/ medication; management approaches for older adults.
Communication skills	3	Utilisation of appropriate communication skills in specific dental contexts; nature and process of skilled interpersonal communication; record keeping including informed consent.
Medically compromised patients	3	Management of patients with disabilities, cardiovascular disease, endocrine, neurological, haematological and oncological disorders, and poly-medicated patients.
Periodontology	6	Introduction to the periodontium; chronic periodontal disease; periodontal examination including periodontal probing; the importance of periodontium health in treatment planning.
Dental Materials	3	Materials including linings/bases, amalgam, composite resin, glass ionomer cement.
Prosthodontics	3	Identification of appliances used in fixed and removable prosthodontics treatment and the implications of prosthodontics treatment on restorative care and vice versa.
Oral medicine	3	Recognition and identification of oral pathological conditions in the clinical situation; drug interactions; management of dental pain; instigation of appropriate referrals; pharmacology.
Local anaesthesia	6	Techniques for dentate/edentulous patients; appropriate local anaesthetics; maximum safe dose; implications of medical history; local/systemic complications and management.

	Hrs	Topics
Dental emergencies	3	Emergency management of pain associated with acute oral infections (excluding extraction of permanent teeth); instigation of appropriate referrals.
Medical emergencies	3	Principles of emergency care and management of life threatening situations including the unconscious patient, respiratory difficulty, myocardial infarction and allergic reaction.
Case presentations	3	Adult patient case reports for presentation and small group discussion for treatment planning.
Clinical Observation	14	Conducted over two days with observation of public dentists in primary care/general dentistry, and dental specialists (oral medicine) treating adults.
Clinical Practicum	42	Provision of dental care to adult patients under dentist supervision, to apply knowledge and skills learnt in didactic sessions. A logbook completed by the dentist and participant provided feedback.
Clinical Experience	105	Provision of dental care to adult patients over 15 days working in close collaboration with a dentist at their local dental clinic. A logbook completed by the dentist and participant provided feedback.

Table 2. Curriculum content for pilot educational bridging program

The evaluation of this bridging program suggests that it was able to meet its objectives, and was able to successfully prepare university educated dental therapists to translate their existing scope of clinical practice to adult patients 26+ years of age. It was effective in increasing both the knowledge and confidence of the participants to treat adult patients to similar levels they reported for treating children. Confidence is an important educational outcome, and has been linked to increased clinical competence (Lynch et al., 2010; Smith et al., 2006). The success of the education program was also reflected in the high levels of patient satisfaction reported during the clinical practicum and clinical experience sessions in this study. Patient satisfaction is being seen as an increasingly important component of health care, and new models of care must demonstrate patient acceptance if they are going to be effective. Nine participants successfully completed the course assessment, and eight of the participants were deemed clinically competent to treat adult patients without supervision, and were provided with an extended scope of practice by the Dental Practice Board of Victoria. Two therapists required additional assessments before being deemed clinically competent to treat adult patients, and in the end all 10 participants were awarded an extension of scope of practice.

The evaluation of this project resulted in the identification, by participating dental therapists and supervising dentists, of some gaps in the course content. This included additional

clinical observation and didactic content covering cariology and minimal intervention dentistry, prosthodontics, emergency management of oral conditions, and oral medicine/pathology. These recommendations for additional course content were supported by the Dental Practice Board of Victoria in their endorsement of the extended scope of practice for the therapists who completed this pilot education program.

This educational program was specifically designed to extend the scope of practice for dental therapists to treat adult patients, and the evaluation indicated that this program was effective. An analysis of the curriculum content and evaluation by all participants demonstrated that university educated dental therapists were able to gain the necessary knowledge and skills to translate their existing clinical scope of practice to treat adult patients. This study has important implications in enhancing the flexibility of dental team of the future. Broadening the dental therapists scope of practice in this manner would create a more flexible oral health team, potentially allowing dentists to provide more complex procedures for patients most in need. This is significant in the public sector and rural areas where workforce shortages are most acute. However, the economic viability of this model has yet to be tested.

5. Policy developments

The last decade has seen enormous change in the regulatory environment in Australia regarding the clinical scope of practice for allied oral health professionals. Dental therapists have moved from working predominantly in the public sector in most States, to a mix of public and private sector employment. The close supervision and prescriptive requirements for dental therapists and hygienists has also been removed, providing significantly greater autonomy of dental practice. However, complete independent dental practice for dental therapists and hygienists is still not permitted in Australia.

5.1 Policy developments – dental hygienists

Research conducted into the utilisation of dental hygienists working in nursing homes was instrumental in the Dental Practice Board of Victoria amending the 'Code of Practice for the Practice of Dentistry by Dental Hygienists and Dental Therapists' in 2007, allowing dental hygienists to practice in all areas for which they have received formal education, including dental examination and treatment planning. This was the first critical step in increasing the scope of practice for allied oral health personnel, with the emphasis on a clinical scope of practice that was defined by education and competence rather than a defined list of duties. At the time, these changes were considered quite radical in some quarters, and were opposed by the dentist profession in submissions to the Dental Practice Board of Victoria. The changes also highlighted the idiosyncratic nature of dental regulation in Australia, with significant variations in the permitted scope of clinical practice and supervision requirements across other States and Territories. For example, in Queensland, dental hygienists were not permitted to take radiographs, while in New South Wales they were not permitted to perform periodontal probing depth charting. In 2010, a national approach was finally adopted, with the introduction of a national Dental Board, and a single scope of practice registration standard:

"Dental hygienists, dental therapists and oral health therapists exercise autonomous decision making in those areas in which they have been formally educated and trained.

They may only practice within a structured professional relationship with a dentist. They must not practise as independent practitioners. They may practise in a range of environments that are not limited to direct supervision.”

This national standardised approach to the regulation of the scope of practice for dental hygienists in Australia has the ability to significantly improve access to dental care for underserved population groups such as residents of aged care facilities.

5.2 Policy developments – dental therapists

Until recently, dental therapists in Australia were restricted to treating children (with the exception of Western Australia, where dental therapists were able to treat adult patients under the prescription of a dentist). Each State jurisdiction had its own regulations on clinical scope of practice. In Victoria, the Dental Practice Board of Victoria encouraged research aimed at increasing scope of practice for dental therapists, and improving access to dental care. The research undertaken on expanding the scope of practice for dental therapists treating adult patients provided the evidence which resulted in the Dental Practice Board of Victoria removing, in 2009, the age restriction on dental therapy practice and, in 2010, extending the scope of practice for the dental therapists who successfully completed an educational bridging program designed to enable them to treat adult patient. This research also strengthened the recent approach adopted by the DPBV, that dental therapists are able to work within a clinical scope of practice in which they have been formally educated and trained. The new regulatory framework in Australia from 2010 (under the Dental Board of Australia) now allows dental therapists across Australia to work in this manner, provided they have the appropriate education. The outcomes of this research have resulted in at least one university oral health therapy program introducing a module specifically aimed at the treatment of adult patients. Thus, this research has been pioneering in providing the evidence for both regulatory and educational change. What remains to be seen is the impact that this may have on the future practice of dental and oral health therapy in Australia, and the oral health of the community.

6. Conclusion

Dental therapists, dental hygienists and oral health therapists are increasingly becoming an important part of the dental team internationally, both in the provision of dental services and oral health promotion activities. Broader utilisation of allied dental personnel has the ability to improve access to dental care for many underserved sections of the community.

Recent research in Australia has demonstrated the effectiveness of extending the role of the oral health therapist to target sections of the community with unmet oral health needs. Dental hygienists are able to undertake dental examination, treatment and referral of patients in nursing homes. This model of care is likely to improve access to care, and the preventive focus of dental hygienists is critical in this population.

A 34-day bridging educational program has been shown to be successful in providing dental therapists with the skills required to translate their current scope of clinical practice to adult patients without prescription from a dentist. Dental therapists are competent and safe to provide care to patients across all ages without the prescription of a dentist. Dental therapists are aware of the limits of their abilities, and are likely to err on the side of caution with regard to referring complicated problems to registered dentists. This is important when

the safety and quality of dental services may be questioned in developing new models of care. Importantly, adult patients were satisfied with the restorative treatment services provided by dental therapists, and accepting of dental therapists as a primary health care provider.

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Geriatric dentistry, or gerodontics, is the branch of dental care dealing with older adults involving the diagnosis, prevention, and treatment of problems associated with normal aging and age-related diseases as part of an interdisciplinary team with other healthcare professionals. Prosthodontics is the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation, and maintenance of the oral function, comfort, appearance, and health of patients with clinical conditions associated with missing or deficient teeth and/or oral and maxillofacial tissues using biocompatible materials. Periodontology, or Periodontics, is the specialty of oral healthcare that concerns supporting structures of teeth, diseases, and conditions that affect them. The supporting tissues are known as the periodontium, which includes the gingiva (gums), alveolar bone, cementum, and the periodontal ligament. Oral biology deals with the microbiota and their interaction within the oral region. Research in oral health and systemic conditions concerns the effect of various systemic conditions on the oral cavity and conversely helps to diagnose various systemic conditions.

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