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The effects of clinical dental status on eating difficulty and oral health-related quality of life in an older Chinese population

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Abstract

Most studies about the relationships between dental status and eating difficulty and food choice have been done in Western countries. Their foods and methods of preparation differ from Eastern countries. Therefore, studies are required in countries such as China to assess whether the findings are universal. **Hypothesis:** Clinical dental status significantly affects eating difficulty and oral health-related quality of life in older Chinese people. The main objectives were to: 1. Develop an Index of Eating Difficulty (IED); 2. Assess prevalence and severity of eating difficulties and relationship between clinical dental status and eating difficulties, and 3. Assess prevalence and severity of oral impacts on oral health-related quality of daily life and the relationship between clinical dental status and oral health-related quality of life using the Oral Impacts on Daily Performances (OIDP) measure of impact. **Methods:** The study was done in Nanning city, Guangxi province, China. Subjects were 1229 older people aged 55 to 100 years from the Routine check-ups Centre of Guangxi Medical University Hospital. Subjects were clinically examined and replied to questionnaires. The IED based on Chinese foods was developed and validated. The OIDP was validated. **Findings:** 51.8% of dentate subjects had general eating difficulty. Ease of eating certain foods was related to the numbers of teeth, occluding pairs and unfilled spaces. There were significant relationships between clinical dental status and IED in both unadjusted and adjusted models. Clinical dental status was also significantly related to general eating difficulty and dissatisfaction with chewing ability. There were significant relationships between clinical dental status and the overall OIDP score as well as the prevalence of the OIDP eating impact. **Conclusions:** The findings of this research support the hypothesis of this study and indicate that clinical dental status significantly influenced eating difficulty and quality of life in a sample of older Chinese population in Guangxi province, China.

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This thesis is dedicated in loving memory of

my mother,

Lv Sufen

To my father

Zeng Zhiqiang

and

my husband and my son

Nong Kezhong

Nong Zexi

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Chapter 1

1. Introduction

1.1. Oral health and eating difficulty

Food choice and eating difficulty are influenced by numerous factors, such as socioeconomic status, customs, availability of foods, dietary habits, general health and oral health status. Oral health plays a very important role in mastication. Therefore, oral health status, such as number of teeth, number of occluding pairs of teeth, and dry mouth, may influence eating difficulty and chewing ability. It is surprising, therefore, that whist there has been much research on how diet affects the teeth, until recently relatively a little work has been carried out on the effects of dental status on diet. And most of the research that has been done is on Western populations whereas most of the world's populations live in the East, where the diet is different from that in the West.

The evidence that food selection and intake of food was affected by poor dental condition was shown by Geissler and Bates (1984). They published a critical review of the effects of tooth loss on nutrition and concluded that complete denture wearing, or wearing ill-fitting dentures, or having few teeth resulted in lower intake of important nutrients and lower levels of nutrients in the blood because some foods were avoided due to dental status. Geissler and Bates (1984) were critical of the studies done. Most importantly, they did not find any good studies assessing the relationship between dental status and nutrition related outcomes.

During the past two decades there has been an increased interest in the relationship between dental condition and eating difficulty and the quality of the studies has improved. The studies mainly show that poor oral health leads to deficient masticatory function (Akeel et al., 1992; Chauncey et al., 1984; Gunne, 1985a; Miura et al., 1997; Miura et al., 2001; Tsuga et al., 1998; Wayler et al., 1982; Wayler and Chauncey, 1983; Wayler et al., 1984) or lower chewing ability (Gilbert et al., 1998; Leake, 1990). And people with poorer mastication are more likely to avoid chewing hard natural foods, such as raw vegetables and fresh fruits (Anastassiadou and Heath, 2002; Brodeur et al., 1993; Ettinger, 1973; Joshipura et al., 1996; Sheiham et al., 1999; Sheiham et al., 2001a; Sheiham et al., 2001b; Wayler et al., 1982), and dry foods such as bread or bagels (Hildebrandt et al., 1995; Hildebrandt et al., 1997). They prefer to eat soft and easy-to-eat foods. On the one hand, some of them eat more processed foods which are softened by industrial food processes (Chauncey et al., 1984; Greksa et al., 1995; Hildebrandt et al., 1995; Hildebrandt et al., 1997; Krall et al., 1998; Laurin et al., 1994; Norlen et al., 1993; Wayler and Chauncey, 1983; Wayler et al., 1984). On the other hand, they use special methods of food preparation that make food easier to eat, for example cooking for longer or removing the skin from fruits and vegetables in order to make them easier to eat. Such processes decrease or deplete some nutrients such as dietary fibre, antioxidants and vitamins C and E (Walls et al., 2000). Denture wearers often do not like eating fruits and vegetables with seeds, such as raspberries, strawberries, grapes, tomatoes, pears and nuts because these foods contain seeds which often lodge under the dentures (Ettinger, 1973).

Most of the above mentioned studies relating to older people were reviewed by Walls (2000) and his colleagues. Their review explored the evidence for a relationship between masticatory efficiency and foods choice and confirmed that there was a change in diet with decreasing number of teeth. Fibrous vegetables, fruits and other fibrous foods such as apples, raw carrots, nuts, whole grain breads and cereals were more difficult to chew in those with fewer teeth or removable denture wearers. The foods that were eaten less contain important nutrients that are implicated in reduction of cardiovascular disease and cancer risk.

Intake of foods is influenced by masticatory functions. Recent reviews categorized five basic methods to evaluate masticatory function (MF) (N'Gom P and Woda, 2002). The first is self-assessment by means of scales and questionnaires. The second is measurement of the ability to chew food into particles. The third method is measurement of the amount of sugar extracted from chewing gum. The fourth includes some sophisticated techniques such as bite force and video recording. The final method is based on anatomic criteria. It also categorized three different ways to analysis food choice in people with poor MF and gave a clearer picture of food choice in individuals with impaired MF. This review provided some evidence to demonstrate that the impaired food intake or unbalanced nutrition could cause systemic disease but that the associations between poor oral health and general health are not clear (N'Gom P and Woda, 2002).

A much clearer view of the relationship between dental status and difficulty eating certain common foods was obtained from large national surveys in Britain and the United States. The study in Britain was part of the National Diet and Nutrition Study of older people (Sheiham et al., 1999; Sheiham and Steele, 2001; Sheiham et al., 2001a). The main findings of this study for the free-living sample was that after controlling age, sex and social class and region of origin the edentulous had significantly greater difficulty eating tomatoes, raw carrots, apples, nuts, lettuce, and well done steaks than dentate subjects. The ability to eat certain foods significantly increased as the number of natural teeth increased.

Nowjack-Raymer studied the relationship between dental status and diet in U.S adults of all ages by analysis data from NHANES III survey (Nowjack-Raymer, 2000; Nowjack-Raymer and Sheiham, 2003). In this study, dental status was based on the number of teeth, the number of occluding pairs of teeth, and the number of posterior occluding of teeth amongst those who had a dentition comprising natural teeth and a combination of both replaced and natural teeth, and those who were edentulous and either wore or did not wear complete dentures was categorized. This study overcame the weakness of many studies based on counts of natural teeth only or counts of a combination of natural and artificial teeth ignoring the types and quality of prostheses. Adjustments were made for the potential confounding by socio-cconomic status, age, gender, race/ethnicity, smoking status, and vitamin and mineral supplementation. The results showed that the level of consumption of some hard foods in complete denture wearers was lower compared with the fully dentate. In people with only natural teeth some hard to eat food, such as carrots, tossed salad had a significant strong relationship to number of teeth and number of occluding pairs (Nowjack-Raymer, 2000; Nowjack-Raymer and Sheiham, 2003).

Dry mouth, which affects about 20% of older people, has also been associated with eating difficulties (Gilbert et al., 1993; Locker, 1993; Sheiham et al., 1999).

Most of the studies about the relationship between dental status and difficulty eating or chewing have been done in western countries, with just a few studies carried on in eastern countries (Fiske et al., 2001; Nagai et al., 1991; Scott et al., 2001; Srisilapanan et al., 2002).

The diets of most people living in South East Asia differ from those in the West. It would therefore be interesting to see whether the findings from Western populations apply to those in South East Asia. To our knowledge, no study focusing on the relationship between dental status and eating difficulty has been done in Mainland China. Chinese foods are quite different from Western foods. The classic Chinese diet includes mainly cereals and vegetables with little fruit and few animal products (Table 1.1). For example, the results from the China Health and Nutrition Survey (1987-1997) showed the total mean daily intake of cereals is 514g per person per day. The daily mean intake of food of animal origin was 178.2g per person per day in urban residents and 116.7g person per day in rural residents (Du et al., 2002). Western foods contain more meat, animal fats, raw vegetables and fruits.

In addition to the differences in foods eaten, the methods of cooking in China and Western countries are very different. For example, most vegetables are cooked in China whilst Western people are more likely to eat raw vegetables such as raw carrots and green leaf vegetables. In general, Chinese foods are softer and easier to eat. The question that was addressed in this thesis is 'what is the relationship between dental status and eating difficulty in older Chinese people?

Table 1.1 Diet in China in 2000.

	Items	**2000**
Food consumption (Annual consumption)	Cereals (kg)	183.2
	Vegetables oil (kg)	9
	Sugar (kg)	6
	Vegetables (kg)	120
	Fruits (kg)	18
	Meat (kg)	24
	Eggs (kg)	12
	Fish (kg)	9
	Milk products (kg)	9
Nutrition	Energy (kcal)	2575
	Protein (kg)	72.7
	Fat (kg)	71.6

(Source: http://www.centreherbs.com/file/yszl/002.htm)

1.2. Oral health and oral health-related quality of life (OHRQoL)

There is a growing interest in quantifying the consequences of oral disorders which affect function, comfort and ability to perform everyday activities and quality of life. Many measurements of oral health-related quality of life (OHRQoL) have been developed to assess an affect of oral health problems on physical functioning, pain, psychosocial functioning and life satisfaction. For example, one of the earliest measures is the Social Impacts of Dental Disease (SIDD) (Cushing et al., 1986). This measure includes five domains: eating restrictions (e.g. difficulty chewing, having to change diet), communication restrictions (e.g. smiling, talking, kissing), pain (e.g. toothache), discomfort (e.g. foodpacking, sensitivity) and aesthetic dissatisfaction. Several years later, Atchison and Dolan (1990) developed a Geriatric Oral Health Assessment Index (GOHAI) for measuring oral health-related quality of life in elderly people. Another measure, the Dental Impact Profile (Strauss, 1997) was developed to ask individuals about the value of their oral health in the domains of social, psychological and biological function and quality of life. One of the most widely used OHRQoL measures is the Oral Health Impact Profile (OHIP) (Slade and Spencer, 1994a). The OHIP was developed and evaluated in an older population (aged 60 years and over) in South Australia and can measure self-reported dysfunction, discomfort and disability impact on daily life. The index of the Dental Impacts on Daily Living (DIDL) is another important instrument which consists of 36 questions and assesses five dimensions of quality of life: appearance, comfort, pain, eating restriction and performance (Leao and Sheiham, 1996). The OIDP index (Adulyanon and Sheiham, 1997) was developed and measures "ultimate impacts", namely physical, psychological or social impacts on the individual's ability to perform daily activities caused by oral disorders and has been used in different countries and different age groups.

Recently, a number of studies to measure oral health related quality life in elderly people had been carried out in some countries (Astrom et al., 2005; Chen and Hunter, 1996; McGrath et al., 2000; John et al., 2002; John et al., 2003; Kida et al., 2006a; Kida et al., 2006b; Kressin et al., 1996; Locker and Slade, 1993; Locker et al., 2000; Locker et al., 2001; Locker et al., 2002; Locker et al., 2004; MacEntee, 1996; Sheiham et al., 2001b; Slade, 1998; Steele et al., 2004; Tsakos et al., 2001b; Tsakos et al., 2004; Tsakos et al., 2006). Two studies have been done on Chinese populations in Hong Kong (Wong et al., 2002a; Wong et al., 2002b), however, none have been done in Mainland China.

Many factors including age, sex, cultural background, social-economic status, dental clinical condition, dental attendance, and dental anxiety may affect oral health related-quality of life (OHRQoL) (Astrom et al., 2006; John et al., 2002; Kelly M, 2000; Kida et al., 2006b; McGrath and Bedi, 2004; Steele et al., 2004; Tsakos et al., 2004; Tsakos et al., 2006). Oral health problems can result in pain and discomfort. They impact on eating, communication, appearance, and consequently lead to embarrassment, social problems and lower self-esteem, particularly among elderly people (Cushing et al., 1986; Locker, 2002; Slade and Spencer, 1994a). Therefore, clinical dental status may play a very important role in OHRQoL.

Number of teeth and particularly number of occluding pairs of teeth, which takes into account both number and position of teeth in the mouth, significantly affect on OHRQoL because missing teeth can cause eating difficulty and affect food choice (Brodeur et al., 1993; Sheiham et al., 1999). In addition, people with missing teeth felt discomfort when eating some hard foods, felt embarrassed, avoided eating with others or ate slowly (Locker and Miller, 1994; Slade et al., 1996).

Apart from number of teeth other clinical indicators such as dry mouth, decayed teeth, decayed roots, filled teeth, tooth mobility and periodontal disease can affect oral health-related quality of life. Dry mouth may impact on OHRQoL since it can cause cracked lips, soreness, a burning sensation, reduced ability to speak, chew, swallow, or taste (Pankhurst et al., 1996a; Pankhurst et al., 1996b; Porter et al., 2004). The results from some studies showed that the quality of life decreased in patients with dry mouth compared with healthy volunteers (Belenguer et al., 2005; Hay et al., 2001; Rostron et al., 2002; Strombeck et al., 2000). In addition, Slade et al (1996) reported that apart from missing teeth, retained root fragments, root-surface decay and periodontal pockets were associated with higher levels of oral impacts in a study of adults aged 65 years and over in South Australia, Ontario and North Carolina. While Srisilapanan & Sheiham (2001a) reported that OIDP was significantly associated with mobile teeth, but not with either decayed teeth or decayed roots in a study of elderly Thai people aged 60-74 years. Tsakos et al (2004, 2006) found that filled teeth were significantly related to OIDP scores in Greece while oral impacts had no significant association with decayed teeth, filled teeth, decayed roots in British subjects. These different results may indicate that "clinical disease affecting subjective perceptions of well-being can be influenced by the nature of the disease, as well as expectation, preferences, financial, social and psychological resources" (Locker, 1992).

In conclusion, this brief introduction indicates that oral health affects eating difficulty and quality of life. The review that follows will explore the nature of the association between dental status and eating difficulty and quality of life.

Chapter 2

2. Literature review

2.1. Introduction

This literature review is divided into six sections. The first is concerned with assessment of eating difficulty and chewing ability. This is followed by a review of current evidence on factors which affect eating and chewing difficulty. The next sections are about the oral health-related quality of life measures and the factors affecting oral health-related quality of life. Finally, a review is presented about oral health-related quality of life measures in elderly people and an overall summary is presented.

2.2. Assessment of eating difficulty and chewing ability

The literature on the subject of difficulty eating and chewing suffers from problems related to nomenclature. Some authors refer to difficulty eating as chewing ability (Gilbert et al., 1998; Leake, 1990; Locker, 1992; Locker, 2002; Miura et al., 1998a) (Kurita et al., 2001; Miura et al., 1997; Miura et al., 2000; Miura et al., 2005; Sanders et al., 2006; Takata et al., 2006) or chewing difficulty (Gilbert et al., 2004; Peek et al., 2002; Sarita et al., 2003) or chewing activity (Miura et al., 1997; Miura et al., 1998b). Others call it ability to eat (Sheiham et al., 1999) or ability to chew (Locker and Miller, 1994). Some authors refer to mastication function (Hirai et al., 1994; Koyama et al., 2005) or mastication ability (Hirano et al., 1999; Miura et al., 2003; Tatematsu et al., 2004; Tsuga et al., 1998). Others refer to eating difficulty (Anastassiadou and Heath, 2002). The different names appear to refer to the same problem. In addition to naming differences, there were different names for indices related to difficulty eating and chewing. Because of the variations in names about what may be the same problems in this literature review, the measures of assessing difficulty eating or chewing is based on questions derived from the various authors (Table 2.1).

Table 2.1 The measures of assessing difficulty eating or chewing.

Name of eating problem	Author's name (year of publication)	Subjects, N (age). Study area	Methods	Main results
Chewing ability	Leake (1990)	233 (50 yrs and over) Canada	Leake's Chewing Ability Index score to measure chewing ability.	23% of people had scores 0-4 meaning unable to chew some certain foods.
	Gilbert et al (1998)	873 (45 yrs and over) the USA	Leake's Chewing Ability Index score to measure chewing ability. Some questions on experiencing some psychosocial eating impact. A single-item question on satisfaction with chewing ability.	16% of subjects dissatisfied with their chewing ability. A higher probability of dissatisfaction with chewing ability was significantly related to report oral disadvantage, chewing difficulty, speaking difficulty, a sore and/or broken tooth and/or broken crown, a loose tooth, a broken filling, a food catching problem, not wearing their maxillary full denture and having fewer occluding pairs of teeth.
	Miura et al (2000)	212 (65-80 yrs) Japan	The Hirai's mastication score as a measure of chewing ability.	Chewing ability was significantly related to the quality of life.
	Kurita (2001)	473 (mean age 32.9 yrs) Japan	The Sato's masticatory function score to measure chewing ability.	The masticatory function score was significantly related to TMJ pain and mouth opening capacity but not with TMJ noise and muscle tenderness

Table 2.1 Continued

Chewing ability	Locker (2002)	611 (50 yrs and over) Canada	Leake's Chewing Ability Index score to measure chewing ability. Some questions on experiencing some psychosocial eating impact. A single-item question on satisfaction with chewing ability.	The proportion of subjects with a chewing problem increased over the 7-year observation period.
	Takata et al (2006)	823 (80 yrs) Japan	An index of Chewing Ability based on 15 common Japanese foods with different texture to measure chewing ability.	Self-assessed chewing ability but not number of teeth was associated with the quality of life.
Chewing difficulty	Peek et al (2002)	873 (45 yrs and over) the USA	Leake's Chewing Ability Index score to measure chewing difficulty	About 21% baseline subjects reported chewing difficulty and 34% reported chewing difficulty during study.
	Sarita et al (2003)	725 (20 yrs and over) Tanzanian	20 common Tanzanian foods including 12 soft and 8 hard foods were listed randomly to test perceived difficulty of chewing.	Perceived chewing difficulty decreased as occluding pairs of teeth decrease. Shortened dental arches with intact premolar regions and at least one occluding pair of premolars provided sufficient chewing ability.

Table 2.1 Continued

Chewing activity	Miura et al (1997)	79 (65-74 yrs) Japan	Hirai's mastication score as a measure of chewing ability and a single-item question on satisfaction with chewing ability.	Chewing ability was significantly related to the quality of life.
	Gilbert et al, (2004)	873 (45 yrs and over) the USA	Leake's Chewing Ability Index score to measure chewing difficulty.	People with fewer occluding pairs or those who received removable prosthodontic treatment had more chewing difficulty
Ability to eat	Sheiham & Steele (2001)	753 free-living sample (65 yrs and over) the UK	16 western food items with different texture to measure ability to eat.	About one in five dentate had difficulty eating raw carrots, apples, well-done steak or nuts. The number of natural teeth and number of occluding pairs of natural teeth were significantly related to ability to eat certain foods.

Table 2.1 Continued

Eating difficulty	Anastassiadou & Heath (2002)	Primary study: 138 (mean age 68.5 yrs) Second study: 119 (mean age 71.5 yrs)	Semi-structured format of open questions with conversational style. Some questions on levels of eating difficulty.	Most patients expressed eating difficulty for at least one type of food, the majority of patients had difficulty eating some foods while others use special food preparation and make food easier to eat.
Masticatory ability	Tsuga et al (1998)	160 (80 yrs) Japan	A masticatory problem index to measure satisfaction with masticatory ability.	16% of subjects reported they had some difficulty chewing certain foods and 6% reported three or more problems with mastication
	Miura et al (2003)	88 (65 yrs and over)	The Hirai's mastication score as a measure of mastication ability.	There was significant relationship between masticatory ability and cognitive status in elderly females.
	Takamatsu et al (2004)	283 (80 yrs) Japan	16 Japanese foods items with different masticatory determinations to measure masticatory ability	There was a weak correlation between the number of remaining teeth and masticatory ability.
Masticatory function	Koyama et al (2005)	50 (43-88 yrs) Japan	Sato's masticatory function score to measure masticatory function.	The masticatory function score in the dentate people was higher than in the edentate people There was no significant relationship between the score and numbers of remaining teeth.

Masticatory efficiency or chewing efficiency has been defined as "the capacity or efficiency of the dentition based as the capacity of an objective and repeatable laboratory test" (Feldman et al., 1984). While masticatory ability was defined as "the subjective self-assessment of subjects concerning their chewing capacity and chewing comfort, obtained by questionnaire or interview" (Agerberg, 1988). Ability to eat and chew can be assessed using both objective and subjective assessment. Objective assessment is usually assessed by measuring the size of test food samples that have been chewed for a specific number of chewing cycles. Then the test food is analyed using a sieving method or, more recently, using image analysis techniques to determine how finely the food has been broken down (Walls and Steele, 2004). In subjective evaluation of masticatory or chewing ability subjects are asked to rate their ability to eat or chew as good, fairly good, or poor or to rate foods as easy, fairly easy, difficult, or very difficult to eat or chew by questionnaire or personal interviews (N'Gom P and Woda, 2002). Objective evaluation of chewing efficiency requires special equipment and specialized personnel and is very time-consuming, therefore, subjective assessment of chewing ability is practical to use in epidemiological studies, which need a large sample. The evidence from several epidemiologic surveys shows that subjective assessment of individuals chewing ability is reliable and valid (Agerberg, 1981; Gilbert et al., 1998; Gilbert et al., 2004; Hirai et al., 1994; Leake, 1990; Locker and Miller, 1994; Locker et al., 2002; Sanders et al., 2006; Takata et al., 2006). Subjective assessment of chewing ability can be assessed in three ways, namely using an index, a food list and a single-item question about eating problems (Table 2.2).

Table 2.2 Methods of subjective evaluation of difficulty eating or chewing.

Methods of evaluation	Typical study and where used
An index	1. Leake (1990) in Canada; 2. Florida Dental Care Study, (1996-2002) in the USA. 3. Hirai (1994) in Japan
A food list	1. NDNS in the UK 1998
A single-item question	1. Sanders (2006) in Australia. 2. Nordstrom (1990) in Sweden.

2.2.1. An Index of Chewing Ability as a measure of eating difficulty or chewing ability

There are three indices assessing chewing ability that are frequently used. The first is the Chewing Ability Index, developed by Leake (1990). This index has five categories providing a range of foods different enough to allow subjects to discriminate between them. Subjects were asked: "are you ordinarily or would you be able to chew or bite:

Fresh carrot or celery salad?

Fresh lettuce or spinach salad?

Steaks, chops, or firm meat?

Boiled peas, carrots, or green or yellow beans?

Whole fresh apple without cutting?"

Depending on the subject's answer, they were given a Chewing Ability Index score. Index score ranging from 0 to 5 that indicates to what extent the individual has difficulty eating different kinds of food. The higher the score, the less limited ability to chew some certain food. Chewing disability was defined as having a CAI score of 0-4 (Table 2.3).

Table 2.3 Chewing Ability Index.

Food items	Score
None of foods listed	0
Boiled vegetable	1
Salad	2
Raw carrots	3
Steak or chop	4
Apple	5

Some studies used a revised version of Leake's Chewing Ability Index to measure ability to chew (Demers et al., 1996; Foerster et al., 1998; Gilbert et al., 2004; Locker and Miller, 1994; Locker, 2002; Peek et al., 2002). For example, based on Leake's Chewing Ability Index, the Florida Dental Care Study (FDCS) measured chewing ability in a longitudinal study of oral health and related behaviours to describe patterns of chewing difficulty and identify the predictors of chewing difficulty over a number of years (Foerster et al., 1998; Gilbert et al., 2004; Peek et al., 2002). Locker (2002) used this Chewing Ability Index combined with a four-item measure of the psychosocial impacts of chewing difficulty and a single-item rating of satisfaction with chewing ability to measure changes of chewing ability over a 7 year period in a population of community-dwelling older adults aged 50 years and over. Subjects were asked if they were ordinarily able to chew or bite: a piece of fresh carrots, boiled vegetables, fresh lettuce salad, firm meats such as steaks or chops, a piece from a whole fresh apple and hamburger. The total number of foods they could chew was the CAI index scores. The mean index scores were an indicator of the severity of the chewing problem (Locker, 2002).

The second index, namely the Mastication Scores, was based on Japanese foods and was used in a series of studies in Japan. The Mastication Score was determined by rating the ability to chew 35 food items, which were grouped into five grades of mastication difficulty. Subjects were asked whether they could eat each of the groups of foods as the following score: 2-can be eaten easily; 1-can be eaten with difficulty; 0-cannot be eaten. Lower Mastication Scores were regarded as lower mastication ability (Hirai et al., 1994; Miura et al., 1997; Miura et al., 2000; Miura et al., 2003). Finally, Mastication Function Score as a measure chewing ability has been used in some studies in Japan (Koyama et al., 2005; Kurita et al., 2001; Sato et al., 1989). The Mastication Function Score was obtained by rating ability to masticate 20 kinds of food. These foods were classified into four grades. Subjects were asked whether specific foods were "easy to masticate", "difficult to masticate" or "impossible to masticate". The Mastication Function Score was presented as the percentage of foods, which were reported as "easy to masticate". A higher score indicates better mastication function. The abovementioned indices have some limitations. All three indices use the mean score to indicate the severity of chewing ability. However, index should not used on an interval but on an ordinal scale because we cannot assume that the differences between two scores are equal. For example, the difference between score 0 (eat everything) and score 1 (eat everything except some the foods) is not equal to the difference between score 2 and score 3 and so on. The Mastication Scores and Mastication Function scores systems did not evaluate reliability and validity of index. In addition, some studies by the Japanese group had very small and unrepresentative samples (Table 2.1).

2.2.2. A food list as a measure of eating difficulty or chewing ability

Another subjective evaluation method of eating difficulty or chewing ability is a food intake questionnaire including certain food items with different textures as a measure of eating difficulty (Gunne, 1985b; Gunne and Wall, 1985; Hirai et al., 1994; Lindquist and Carlsson, 1985; Miura et al., 1997; Miura et al., 1998b; Miura et al., 2000; Miura et al., 2001; Ranta et al., 1988; Sheiham et al., 1999; Steele et al., 1998). For example, Lindquist et al (1985) conducted a 3-year follow-up study to test bite force, chewing efficiency, and chewing ability in a group of patients with bridges or implants in the lower jaw but who still wore a complete denture in the upper jaw. A questionnaire was used for the patients' own evaluation of their chewing ability (1 = easy; 2 = difficulty; 3 = very difficult/impossible) to chew eight foods: apple, bacon, carrot (raw), chicken, crisp bread, ham, pork, and potato (boiled). A list of 45 foods items in a questionnaire was used by Gunne (Gunne, 1985b; Gunne and Wall, 1985) to assess chewing ability. Ekelund (1989) carried out a study to investigate the dental state and subjective chewing ability in elderly people in Finland. In this study, the subjects were asked, if because of their dental condition, they were able to eat all foods they want to eat (= chewing ability good), and if not (= chewing ability poor), what foods they would most have liked to eat (crisp bread, meat, cheese and eggs, vegetables and fruits, some other foods). In the NDNS in the UK (Steele et al., 1998), the subjects were asked to rate their ability to chew 16 western food items according to the following scale: 1 = could eat easily; 2 = could eat with some difficulty; 3 = could not eat at all. In a study of a population of 725 adults with Shortened Dental Arches (SDA) in Tanzania, 20 common Tanzanian foods including 12 soft and 8 hard foods was used to measure chewing ability in subjects with SDA (Sarita et al., 2003). These measures can assess ability to eat specific foods but do not measure the severity of general eating difficulties or chewing ability for an individual. In addition, it is not easy to compare different dental status groups by whether they had different degrees of eating difficulty using some statistical methods, such as logistic regression.

2.2.3. A single-item question as a measure of eating difficulty or chewing ability

In some studies, subjects were asked a single-item question about their chewing ability to assess chewing ability. Questions like "can you chew satisfactorily? (yes/no)" or "do you consider that you can chew well? (yes/no)", "do you have a chewing problem now? (yes/no)" were used (Agerberg, 1981; Nordstrom, 1990; Tsuga et al., 1998). For example, Agerberg (1981) carried out a study to assess chewing ability, which was defined as the individuals' own assessment of their mastication function. The subjects were asked, "how well can you chew your foods? (well, fairly, badly)", "can you chew all sorts of food (yes/no)". An older population in Denmark (Avlund et al., 2001) were asked about ability to chew or bite. They were offered the following answers (with out difficulty/with some difficulty/with much difficulty/not able). These questions are easy to answer. However these methods are crude measures of chewing ability and do not provide detailed information on which foods people have difficulty eating or could not eat at all.

In conclusion, a variety of methods to assess difficulty eating or chewing have been used. Evidence from many studies support the fact that subjective assessment chewing ability is reliable, valid, and practical for epidemiological surveys. Most of the methods have been developed for Western populations. In this thesis, we used a subjective assessment of eating difficulty in a sample of older Chinese people.

2.3. Factors affecting eating difficulty

Chewing ability is influenced by many factors, such as age, sex, social class, cultural background, general health, and dental status. Ono et al (2003) showed that better chewing ability was associated with age (< 85 years), gender (male), state of dentition (dentate), biting force (high), swallowing ability (good) and activity of community (high) (Ono et al., 2003). The evidence that age significantly affected ability to eat is supported by some studies (Kurita et al., 2001; Locker and Miller, 1994; Morita et al., 2003), Some studies also demonstrated that sex was a significant factor affecting the ability to eat (Morita et al., 2003; Penner and Timmons, 2004). In a study to determine what impact, if any oral health had on the quality of life of seniors in Prince Edward Island, Canada, males were two times as likely to indicate chewing dysfunction when it came to meat eating and they reported more chewing difficulties than females for certain foods (Penner and Timmons, 2004).

A study was carried out to assess which factors were related to ability to manage daily activities in Japan. The results showed that the number of remaining teeth was significantly related to ability to eat (Minakuchi et al., 2006). Agerberg (1988) showed that chewing ability was very closely correlated to the number of teeth, and also closely correlated to wearing dentures and symptoms of mandibular dysfunction, such as difficulty in opening the mouth wide, difficulty in taking a large bite, pain in the face, pain when opening the mouth wide, pain when chewing, and TM joint sounds. In the Piedmont 65+ Dental Study of 1,000 free-living people aged 65 years and over in North Carolina stratified by race and dentate status, the 821 dentate subjects were asked to rate their chewing ability. Chewing ability was statistically significantly related to having less than 24 teeth, missing anterior teeth, and needing extractions. Subjects who reported "bad" chewing ability were 6.6 times more likely to have missing, non replaced anterior teeth. They were 7 times more likely to have less than 24 teeth, and 5 times more likely to need at least one extraction (Drake et al., 1990). The results from the UK National Diet and Nutrition Survey (NDNS) showed that the number of teeth, particularly the number of POPs was very strongly associated with ability to eat (Sheiham, 1999). Similarly the Florida Care Study showed that chewing ability was very significantly associated with the number of occluding anterior teeth, number of occluding posterior teeth, dental pain, dry mouth, sex, wearing a denture, and education (Foerster et al., 1998; Peek et al., 2002). Dry mouth also affected chewing ability in denture wearers (Sheiham et al., 1999). However, oral health status, such as number of teeth, number of occluding pairs of teeth and dry mouth may be particularly important factors for eating difficulty and chewing ability. Therefore, we shall review the literature to see what factors are important for eating difficulty and chewing ability.

2.3.1. The relationship between dental status and eating difficulty

2.3.1.1. Dental status and eating difficulty: natural teeth

Number of natural teeth and eating difficulty

The relationship between the number of natural teeth and eating difficulty has been explored (Halling et al., 1988; Joshipura et al., 1996; Krall et al., 1998; Papas et al., 1998; Ranta et al., 1988; Sheiham et al., 1999; Sheiham and Steele, 2001; Sheiham et al., 2001a; Wayler and Chauncey, 1983).

Several researchers have looked specifically at relationships between number of natural teeth and avoiding foods. Wayler and colleagues, in a study of a population of

1,221 men aged 25 to 75 years in the U.S. Veterans Administration Cross-sectional and longitudinal Study of Oral Health in Healthy Veterans found that people with 10-13 teeth bilaterally (20-26 teeth) had less frequent intakes of carrots than did the fully dentate (Chauncey et al., 1984; Wayler and Chauncey, 1983; Wayler et al., 1984). Carlsson (1984) affirmed that all people in their study that had more than 20 teeth were not impaired in their chewing ability while 8% of denture wearers were. This study is consistent with other studies that have shown that chewing efficiency was reduced with a depleted natural occlusion (Heath, 1982; Wayler and Chauncey, 1983).

Halling et al (1988) found that women with more than 15 teeth consumed significantly more fresh vegetables and fruits that required more chewing, such as apples and pears than did women with no teeth or 1-15 teeth. Similar findings were reported in a large study of adults who had a diet analysis based on a 24 hour intake (Ranta et al., 1988). After controlling for age, sex, income and education, having a higher number of natural teeth significantly increased the probability of having eaten root vegetables, other vegetables and fruits (Ranta et al., 1988). Morita et al (1989) also reported that persons with a mean number of 17 natural teeth were more likely to be able to chew a cuttlefish while those with 10 natural teeth were not. There were more positive answers in non-denture wearers than denture wearers.

Joshipura and colleagues conducted a 10 year longitudinal study to assess the relationship between tooth loss and diet and nutrition (Hung et al., 2003; Joshipura et al., 1996). In this study, 50,000 U.S. male health professionals were asked to complete a food frequency questionnaire and a dental questionnaire. The consumption of vegetables, apples, pears and carrots increased with increasing number of teeth. Between 1986 to 1990, 279 men lost five or more teeth. The reduction in consumption of fruits and vegetables in subjects who lost five or more teeth was more than in those who lost no teeth. There was a significantly smaller reduction in the consumption of apples and pears between people who lost five and more teeth and those who lost no teeth over the four-year period (Joshipura et al., 1996).

Some researchers have analysed data from the National Diet and Nutrition Survey (NDNS) in Great Britain which assessed how the dental condition of older people impacted on their ability to eat and food choice (Sheiham et al., 1999; Sheiham and Steele, 2001; Sheiham et al., 2001a; Steele et al., 1998). The number of natural teeth was significantly associated with the ability to eat certain foods such as apples, raw carrots, nuts, and toast among dentate individuals. For example, 45% of people with 1-10 teeth had some difficulty eating apples, while only 12% of people with 21 or more teeth had the same degree of difficulty in eating apples. All subjects with 21 or more teeth had no difficulty eating sliced bread, crusty bread, toast, cheese, tomatoes, roast potatoes, cooked greens and chocolates.

Nowjack-Raymer (Nowjack-Raymer, 2000; Nowjack-Raymer and Sheiham, 2003) analysed data from individuals aged 25 years and older who participated in the third US National Health and Nutrition Examination Survey (NHANES III). In samples with only natural teeth, there were significant associations between the number of natural teeth and intake of carrots, tossed salad, citrus fruit, and whole grain or whole wheat bread. For example, all categories of people with fewer than 28 teeth had statistically significant lower mean intakes of carrots per month compared with the fully dentate. The mean intake of carrots increased with the number of teeth increased.

Those who had the fewest teeth (1-10) had the lowest intake, less than half that of the fully dentate (2.30 vs. 5.75, respectively). Those with the fewest teeth (1-10) had a mean intake of tossed salad which was less than those with the full complement of teeth after adjusting for socioeconomic status, age, sex, race/ethnicity, smoking status, vitamin and mineral supplementation.

Some studies used an index or scale to assess the relationships between number of natural teeth and chewing ability or eating difficulty (Tatematsu et al., 2004; Savolainen et al., 2005). In a study of a representative sample of 283 aged 80 years living five municipalities in Aichi prefecture, Japan, Tatematsu et al (2004) reported that the number of natural teeth including natural teeth with artificial crowns was significantly related to bite force and mastication ability. People with 10 or more natural teeth had a significantly higher bite force than those with less than 10 teeth. The number of remaining teeth also had significant relationship with Masticatory Ability score. The mastication score was obtained by asking subjects whether they were able to chew 16 Japanese foods. The masticatory ability score was significantly higher in people with 20 or more teeth than in those with less than 9 teeth.

Another study to evaluate the relationships between oral and occlusal condition and eating difficulty using percentile curves for Food Acceptance Response (FAR) score, which are generally evaluated subjectively, with subjects or patients filling in questionnaires on whether a food is eaten or not. This was conducted in Chiba city in Japan (Savolainen et al., 2005). There were 2,413 participants in survey I (aged 20-64 years) and 244 in Survey II (age 40-59 years). A questionnaire with 31 Japanese foods including different food texture was used in this study with the following scoring: 1-cannot be chewed at all; 2-considerable difficulty chewing; 3-some difficulty chewing; 4-no difficulty chewing. This gave maximum and minimum FAR scores of 124 and 31 as a personal FAR score. The finding showed that the number of teeth present was significantly related to FAR score in the 45-50 age range in males and the 51-55 age range in females after adjusting for age and sex. This indicated that people with more teeth had less difficulty eating certain foods (Savolainen et al., 2005).

Number of occluding pairs of natural teeth and eating difficulty

Compared to the number of natural teeth, the number of occluding pairs of teeth maybe more important in determining eating difficulty because teeth contacts take into account both number and position of teeth in the mouth. The number of occluding pairs of teeth not only quantifies loss but also gives some indication of structural changes in the mouth as a result of disease. Occluding Pairs (OPs) are pairs of natural teeth that oppose each other anywhere in the mouth, Posterior Occluding Pairs (POPs) are pairs of premolar and molar natural teeth contacting each other, and Anterior Occluding Pairs (AOPs) are pairs of incisors and canines contacting each other. The number of OPs has been widely used to determine masticatory efficiency and chewing ability. Leake (1990), in developing an index of chewing ability, found that the most import factors in determining chewing ability were the number of OPs followed by the number of functional premolar pairs.

A much clearer view of the relationships between the number of OPs, and the number POPs and ability to eat was obtained from the National Diet and Nutrition Survey (NDNS) in the UK (Steele et al., 1998). In the 753 free living-sample aged 65 years and over including 407 dentate and 346 edentate, the number of OPs and the number of POPs had a strong association with the ability to eat certain foods. For example, only 8% of individuals with 5 or more POPs compared with 20% with 1-4 POPs and 48% of individuals with no POPs experienced same limitation on difficulty eating or could not eat apples. Similar trends were found in eating raw carrots, nuts, well-done steaks, toast and lettuce. The number of POPs affected eating of raw carrots, well done steaks, nuts and apples. The OPs had a similar effect on the ease of eating food as the number POPs (Steele et al., 1998). Hereby, the natural occluding pairs and natural posterior occluding pairs did not only refer to contacts between natural teeth, but fixed prosthesis was also counted.

In a study of a representative sample of 873 dentate people aged 45 years and over using Leake's Chewing Ability Index, similar like the NDNS in the UK, an occluding pair of teeth was defined as having a maxillary tooth or fixed prosthetic replacement (i.e., a pontic, cantilever, or implant), Gilbert et al (1998) reported people with 15-16 occluding pairs of teeth did not report dissatisfaction with chewing ability. Dissatisfaction was highest in those with only 1-7 occluding pairs of teeth. From the same study, Gilbert et al (2004) reported that people with 0-8 OPs at baseline were approximately 1.6 times as likely to experience chewing difficulty compared with those with 9-12 occluding pairs of teeth (28% vs. 18%) and about 3.5 times as likely as those who had 13 to 16 occluding pairs of teeth (28% vs. 8%) after adjusting for receipt of restorative dental treatment (fillings), receipt of root canal treatment, interview interval, approach to dental care as reported at baseline (problem-oriented vs regular dental attender), and sex..

Nowjack-Raymer (2000) explored the relationship between the number of occluding pairs of natural teeth and ability to eat, and food choice. There were significant associations between the number of OPs and intake of carrots, tossed salad, citrus fruit and whole grain or whole wheat bread in the unadjusted model but no significant relationship between the number of OPs and citrus fruit and whole grain or whole wheat bread in the adjusted model. There were clear and significant trends between the number of OPs and the number of intakes of carrots or tossed salad. A trend for those with fewer OPs to have lower intakes of carrots or tossed salad was observed. However, no significant trend was found between the number of OPs and reported mean intake of citrus fruit and whole wheat bread. There was a similar trend for POPs. The number of POPs were significantly related with reported intakes of carrots and tossed salads in both unadjusted and adjusted models. Those with fewer POPs (0-7) had significantly lower intakes of carrots or tossed salads per month when compared with the fully dentate in both unadjusted and adjusted models. The adjusted model included effects of age, gender, race-ethnicity, socioeconomic status, smoking status, vitamin/mineral supplement use and number of anterior occluding pairs of teeth. The occluding pairs of natural teeth referred to only natural teeth contact in this study.

In conclusion, there is increasing evidence from the many studies in the UK, the USA and other countries that the consumption of some hard to eat food, such as vegetables and fruit, decreases with fewer natural teeth and less the numbers of OPs and POPs. People with an impaired dentition often change their diet due to chewing problems, particularly for elderly people who are more likely to have tooth loss.

2.3.1.2. Dental status and eating difficulty: natural plus replaced teeth

Number of natural plus replaced teeth and eating difficulty

Several studies have explored whether a relationship exists between dental status and eating difficulty in people with both natural and replaced teeth (Halling et al., 1988; Johansson et al., 1994; Krall et al., 1998; Nowjack-Raymer, 2000; Nowjack-Raymer and Sheiham, 2003; Papas et al., 1998; Ranta et al., 1988; Wayler and Chauncey, 1983).

Chauncey et al., (1984) reported that the frequency of ingesting hard to eat foods (including carrots and celery) was less often in removable partial denture wearers than in those who were fully dentate. The results of a study in Finland with 7190 adults were that people who wore removable partial dentures had a significantly higher probability of having eaten root, or other vegetables and fruit when compared with those dentate people who did not wear appliances and had missing teeth. The findings were significant after controlling for socioeconomic variables and for number of teeth (Ranta et al., 1988).

In the third US National Health and Nutrition Examination Survey (NHANES III) specific foods eaten were assessed by the number of natural plus replaced teeth (Nowjack-Raymer, 2000). The results indicated that a clear relationship existed between dental status and the intake of foods for those with a dentition comprised of solely natural teeth and did not apply to those with a combination of replaced plus natural teeth. Only those with the lowest number of natural plus replaced teeth (20 or fewer) had significantly lower intakes of the carrots, whole wheat and whole grain bread compared to the fully dentate.

Number of occluding pairs of natural plus replaced teeth and eating difficulty

A few studies to assess the relationship between the number of occluding pairs of natural plus replaced teeth and difficulty eating or chewing have been conducted. A study in the USA assessed special foods by the number of occluding pairs of natural plus replaced teeth (OPRs) and the number of posterior occluding pairs of natural plus replaced teeth (POPRs) (Nowjack-Raymer, 2000). The results showed that intakes of carrots, whole wheat and whole grain bread, tossed salads were significantly lower in those with the lowest OPRs (10 or fewer) and POPRs (4 or fewer) when compared with those with fully dentate. Here, replaced teeth due to missing teeth were replaced by a fixed or removable prosthesis.

In conclusion, only a few studies have been done to assess relationship between dental status and eating or chewing difficulty by number of natural plus replaced teeth and number of occluding pairs of teeth, number of posterior occluding teeth and number of anterior occluding teeth for natural plus replaced teeth. In this thesis, natural plus replaced teeth typologies were used to test all relationships between dental status and eating difficulty.

2.3.2. The relationship between dry mouth and eating difficulty

Dry mouth, is a common chronic condition in elderly people (Sreebny and Zhu, 1996a; Sreebny and Zhu, 1996b). The prevalence of dry mouth in elderly population ranges from 10-38% (Gilbert et al., 1993; Locker, 1993; Locker, 1995; Sheiham et al., 1999; Thomson et al., 1993). Dry mouth is not a disease but can be a symptom of a disease. Dry mouth could affect chewing and swallowing because saliva plays an important role in lubrication and food bolus formation. However, the relationship between dry mouth and eating difficulty is not very clear.

The finding from the NDNS in the UK showed that there were differences in difficulty eating certain food between subjects with and without reported dry mouth.

However, after controlling for the effects of age, sex, social class and region of origin these differences were not significant in dentate people, but these differences in difficulty of eating roast potatoes, oranges, sliced cooked meats and cheese were statistically significant amongst edentate people. For example, 14% of subjects with dry mouth had some difficulty eating roast potatoes toast only 4% of those without dry mouth had the same limitation (14% vs. 4%), sliced cooked meats (17% vs. 7%), cheese (5% vs. 2%) and orange (18% vs. 6%). The effect of perceived dry mouth in edentate people was stronger than in dentate people. The reason "may be related to the role of saliva in stabilisation of the denture base in the mouth" (Steele et al., 1998). In the Florida Dental Care study, Foerster et al (1998) reported that perceived dry mouth was strongly associated with chewing difficulty in both unadjusted and adjusted models. People with dry mouth were 2.44 (1.45, 4.10) times higher risk of experiencing eating difficulty ($p < 0.01$). These finding were confirmed in other studies (Gilbert et al., 1993; Locker, 1993). On the other hand, Matear et al (2006) reported that dry mouth had a significant impact on quality of life but was not significantly related to impacts on chewing ability, morale and stress.

In conclusion, saliva is important in a chewing process and in digestion. Therefore, dry mouth (xerostomia) may cause some difficulty chewing and eating some foods.

2.4. Oral health-related quality of life measures

Quality of life is "concerned with the degree to which a person enjoys the important possibilities of life" (Raphael et al., 1994). Quality of life is "a multidimensional construct of social and other factors" (Pearlman and Uhlmann, 1988) and is "often represented by human experiences, such as employment, poverty, living conditions, income, food intake, access to transportation, occupational status, satisfaction with work and leisure with daily living" (Guyatt et al., 1993; Locker, 1988; Patrick and Erickson, 1993). Oral health-related quality of life (OHRQoL) is defined as an individual's assessment of how the following affects their well-being: functional factors, psychological factors, social factors, and experience of pain/discomfort in related orofacial concern (Inglehart and Bagramian, 2002).

A variety of measures of the subjective impact of oral conditions on quality of life have been developed and used in oral health surveys (Slade, 1997). Among these measures of OHRQoL, three measures were frequently used to measure OHRQoL in elderly people, namely Oral Impacts on Daily Performances (OIDP), Oral Health Impact Profile (OHIP) and Geriatric Oral Health Assessment Index (GOHAI). This literature review will focus on these three measures.

The Oral Impacts on Daily Performances (OIDP) index was developed by Adulyanon and Sheiham (1997). The OIDP attempts to measure the frequency and the severity of oral impacts on individual's daily life in the last six months. The theoretical model of OIDP was adapted from the WHO International Classification of Impairments, Disability and Handicaps (1980) amended for dentistry by Locker (1988). Three different levels of oral health consequences were established in the theoretical model of OIDP (Figure 2.1). The first level refers to oral status including dental condition, oral impairment, which is measured by most clinical indices. The second level is "the intermediate impacts" which refers to the possible earliest negative impacts caused by oral status in the first level or functional limitation in the second level. The intermediate impacts include pain, discomfort, functional limitation, dissatisfaction with their appearance or pain, discomfort and vice versa caused by functional limitation. The third level is "the ultimate impacts" caused by any of the dimensions mentioned in the second level. It includes physical, psychological or social impact on ability to perform daily life. This level is equivalent to the disability and handicap dimensions in the WHO (1980) model. The OIDP focuses only on this level impact, namely ultimate impacts.

The OIDP index measures oral impacts in the ultimate level of oral health consequences and provides some advantages. For example, this approach covers all main impacts and avoids repeat scoring of the same impacts at each of the three levels. In addition, it can eliminate minor conditions, which do not lead to impacts on daily performance since only significant impacts are recoded. There are three dimensions including nine items of daily performances in OIDP index. The physical performances include eating and enjoying foods, speaking and pronouncing clearly, cleaning teeth, doing light physical activities and going out, for example, going to park for walking, shopping, visiting. The psychological performances include sleeping/relaxing, smiling, laughing and showing teeth without embarrassment, with your emotional state, for example becoming more easily upset than usual. The social performances are enjoying the contact of the other people, such as relatives, friends or neighbours.

The scoring system quantifies the impacts using frequency and severity scores. The multiplication of the frequency with the severity scores provides a performance score for each OIDP item. The total OIDP score is derived by the summation of these possible scores, divided by the maximum possible score and multiplied by 100 to provide percentage estimation. A higher score indicates greater oral impacts.

The OIDP index was translated into Thai (Adulyanon and Sheiham, 1997), Greek

(Tsakos et al., 2001b), Portuguese (de Oliveira and Sheiham, 2003), Norwegian (Astrom et al., 2005), French (Tubert-Jeannin et al., 2005), Kiswahili (Kida et al., 2006a) and successfully used to measure of OHRQoL in many studies (Astrom et al., 2005; Astrom et al., 2006; Gherunpong et al., 2004; Kida et al., 2006a; Kida et al., 2006b; Steele et al., 1998; Tsakos et al., 2001b; Tsakos et al., 2004; Tsakos et al., 2006; Tubert-Jeannin et al., 2005). Evidence from the aforementioned studies demonstrated that OIDP index is a valid and reliable measure of OHRQoL and a short, easy to use measure.

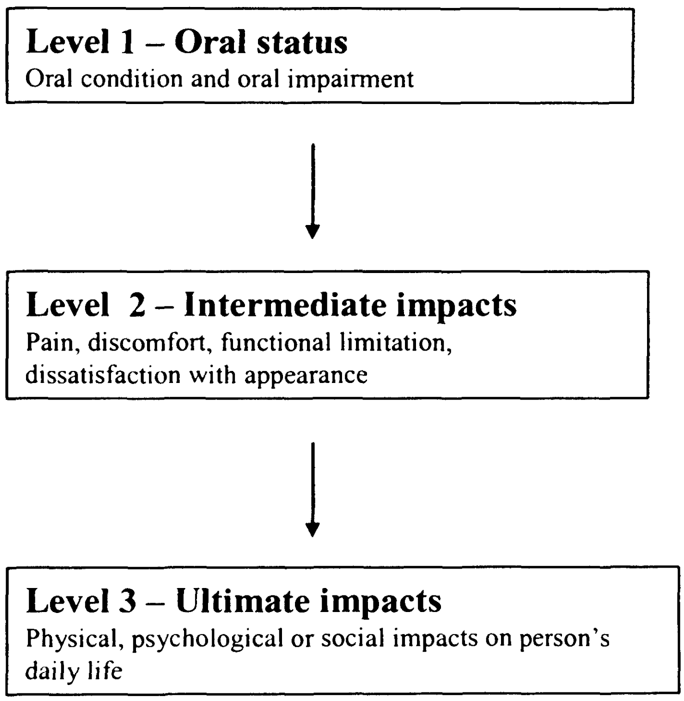


Figure 2.1 The theoretical model of consequences of oral impacts in developing the Oral impacts on Daily Performance (OIDP) index (Adulyanon & Sheiham, 1997).

The second measure of OHRQoL is the Oral Health Impact Profile (OHIP) (Slade and Spencer, 1994a). The OHIP was developed and evaluated in South Australia

(Slade and Spencer, 1994a), and has further been validated and applied in Canada (Locker and Slade, 1993) and applied without another validation process in the U.S. A. (Hunt et al., 1995). The OHIP aims to measure self-reported dysfunction, discomfort and disability impact on daily life. The original instrument's 49 items based on the Locker's conceptual framework for the classification of impairment, disability and handicap in oral health (Locker, 1988) covers functional limitations (e.g. loss of functions of particular body parts or systems), physical pain and psychological discomfort (e.g. restrictions or decrements in psychological well-being), physical disability (e.g. restrictions in activity or in usual social roles), psychological disability (e.g. distressing emotional or effective states and declines in cognitive function), social disability (e.g. ability to participate in community social life and in interactions with friends and family) and handicap (the disadvantage experienced by disabled or impaired people because they cannot or do not conform to societal or reference group expectations). The OHIP questionnaire of consists of the 49 questions about frequency on experiencing oral impacts. Answers are on a five-point Likert scale which respondents indicate the degree of impact for each items by follow scale: 0 = never or not applicable, 1 = hardly ever, 2 = occasionally, 3 = fairly often, 4 = very often. Overall OHIP and subscale scores can be computed by two methods, one simple and the other quite sophisticated. In general, the OHIP performed very well, in relation to its reliability and validity testing in different settings and populations (Slade, 1997). However, The OHIP, like any other index, has weaknesses. As its authors acknowledge, it is quite time consuming to administer, because of its 49 statements, and its weighting system is quite sophisticated. Apart from that, there were difficulties with the interviewer-administered version, while the self-administration resulted in considerable loss of information through uncompleted questionnaires (Slade, 1997). Furthermore, the conceptual distinctions between the different subscales, and between specific items in particular, are reasonably subtle. On the other hand, the OHIP is a composite and comprehensive measure of oral impacts, with established psychometric properties and strong theoretical support. Its conceptual strength is not only related to the sound underlying theoretical framework, but also to the fact that the different concepts of the model are addressed separately, thus facilitating the interpretation of scores and their relationships with clinical variables (Locker, 1992). In addition to that, it has been widely applied and performed adequately in different age groups and cultural settings. Furthermore, since OHIP is a rather long questionnaire with 49 items, it can take a long time to complete. For this reason, Slade developed a shortened version of OHIP (OHIP-14) that is considered to have good reliability, validity and precision (Slade, 1997).

The OHIP has been successfully tested for validity and reliability, translated into Chinese (Wong et al., 2002b), Finnish (Savolainen et al., 2005), French (Allison et al., 1999), German (John et al., 2002), Japanese (Ikebe et al., 2004), Malaysian (Saub et al., 2005), Portuguese (Ferreira et al., 2004), Sinhalese (Ekanayake and Perera, 2003), Swedish (Larsson et al., 2004), Spanish (Lopez and Baelum, 2006), and successfully used as an outcome measure of subjective oral health status and oral health-related quality of life.

The third measure is the Geriatric Oral Health Assessment Instrument developed by Atchison and colleagues (Atchison and Dolan, 1990). The GOHAI measures patient-reported oral functional problems in a simple to administer manner. It is also designed to estimate the degree of psychosocial impacts associated with oral diseases and is being tested as an outcome measure to evaluate the effectiveness of dental treatment. It was particularly designed to assess the oral health problems among elderly individuals. The index comprises 12 items covering three dimensions: physical function (including biting or chewing, speech and swallowing); psychosocial function (including worry or concern about the health, dissatisfaction with appearance, self-consciousness about oral health); pain or discomfort (including the use of medication to relieve pain or discomfort from the mouth). The index attempts to measure the frequency of common oral impacts using a six-point Likert type scale ranging from "never" (0) to "always" (5). It contains both positive and negative items and requires the recoding of the negative statements, in order to acquire a scale score where higher values are indicative of good oral health. The GOHAI score has a range of 0-60 and is calculated by adding the twelve item-scores. It has been successfully tested for validity and reliability, translated into Chinese (Wong et al., 2002a), French (Veyrune et al., 2005), Malaysian (Othman et al., 2006), Swedish (Hagglin et al., 2005), Spanish (Atchison et al., 1998) and successfully used as an outcome measure of subjective oral health status, oral functional problems and psychosocial impacts in both individual and population levels in a variety of settings, ages and ethnic groups (Kressin et al., 1997).

2.5. Factors affecting oral health-related quality of life

Health was defined as the "complete state of physical, mental, and social well-being and not merely the absence of infirmity" (WHO, 1980). This definition indicates three of dimension of well-being. Physical well-being related to one's ability to function normally in activities such as bathing, dressing, eating, and moving around. Mental well-being implies that cognitive faculties are intact and that there is no burden of fear, anxiety, stress, depression, or other negative emotions. Social well-being assumes the ability to societies, fulfilling roles as family member, friend, worker or citizen or in other ways engaging in interactions with others (Kirschstein, 2002). Their definition suggests "the need to encompass the concept of positive mental and physical well-being and not merely the absence of organic disease" (Cushing et al., 1986). Therefore, health related quality of life should be multidimensional. Oral health-related quality of life (OHRQoL) is a subset of health related quality of life (HRQoL), as expected, OHRQoL is multidimensional. Therefore, multiple factors affect a person's OHRQoL. It has been suggested that factors including age, sex, cultural background, social-economic status, dental clinical condition, dental attendance and dental anxiety may affect oral health related-quality of life (OHRQoL) (Astrom et al., 2006; John et al., 2002; Kelly M, 2000; Kida et al., 2006b; McGrath and Bedi, 2004; Steele et al., 2004; Tsakos et al., 2004, 2006). The findings from some studies indicate that age is an important factor affecting OHRQoL (Astrom et al., 2006; Carr et al., 2001; John et al., 2003; Steele et al., 2004). A study comparing two national samples showed that the prevalence of oral impacts on quality of life fell with increased age, which is independent from the effect on tooth loss (Steele et al., 2004). However, in a national survey of 2050 subjects aged 16-79 years and over in Germany, it was reported that age was not significantly related to OHRQoL after adjusting the effects of dental status (John et al., 2004). The relationship between sex and OHRQoL is not clear. The evidence from some studies (Astrom et al., 2006; Hassel et al., 2006; John et al., 2004; Steele et al., 2004) suggest that there is no significant relationship between sex and OHRQoL. However, there are contrary results (Atchison and Dolan, 1990). They found that sex was significantly related to OHRQoL. Cultural background has major affect on the psychosocial effects of dental disease on people. Each culture has its own system of health beliefs (Helman, 1991), differs in the way they think about health, and in how they define a health problem, has a collection of beliefs perceptions and ideas about health and illness, which underpin health–related behaviours (Kwan and Holmes, 1999). For example, many Chinese believed that it is natural for people to lose their teeth as they get older and they could do little to prevent it (Kwan and Holmes, 1999; Lind et al., 1987). A result from a survey in Taiwan, showed that tooth loss was considered to be a natural fate of ageing. Dental and periodontal problem were not a disease, but merely a symptom of pain (Hou et al., 1989). These culture backgrounds should affect a person's well-being and quality of life in physical, psychological and social ways.

However, dental clinical conditions may play a very important role on OHRQoL. In this section, the evidence from studies will be given for exploring the relationship. between OHRQoL and dental status, and eating difficulty.

2.5.1. Clinical dental status and oral health-related quality of life

Health is not considered only as absence of physical disease. Clinical measures are limited to evaluating oral health status and often fail to consider functional and psychosocial domainsions (Locker, 1989; Reisine and Locker, 1995; Sheiham and Spencer, 1997; Wilson and Cleary, 1995). The differences between clinical and perceived assessments have been discussed in some studies (Cushing et al., 1986; Reisine and Bailit, 1980; Srisilapanan and Sheiham, 2001b; Tervonen and Knuuttila, 1988). However, the relationship between the clinical indictors and oral health-related quality of life (OHRQoL) were investigated in numerous studies (Astrom et al., 2006; John et al., 2004; Leao and Sheiham, 1995; Locker and Miller, 1994; McGrath and Bedi, 2002; Slade and Spencer, 1994b; Srisilapanan and Sheiham, 2001a; Steele et al., 2004; Tsakos et al., 2004; Tsakos et al., 2006).

In a study to measure quality of life using OIDP, Astrom et al, (2006) reported that the number of missing teeth were significantly associated with OHRQoL. Apart from the number of teeth, some studies have investigated the relationship between positions of teeth as well.

Locker and Slade (1994) reported that the number of missing teeth, followed by the number of functional units and the number of posterior functional units were significantly related to oral impacts when they tested the OHIP in relation to clinical indicators of tooth loss and periodontal disease.

A longitudinal and a cross-sectional survey were carried out in Brazil to investigate the relationships between satisfaction with the mouth and the number, position and condition of teeth (Elias and Sheiham, 1999). The number, position and condition of teeth were measured by clinical examination while a questionnaire was developed to assess satisfaction with the mouth, including subjective assessment of appearance, pain, communication, function, comfort, satisfaction and "total satisfaction". They found that there was a direct relationship between number of teeth and total satisfaction. The higher the number of teeth, the higher was the probability of satisfaction. There was a positive relationship between the probability of satisfaction and number of teeth until about 23 teeth. This trend was also observed for the number of premolar pairs. The higher the number of premolar of pairs the higher was the probability of satisfactions, until three premolar pairs. After that there were very few changes. For molar pairs, satisfaction was not related to the number of molar pairs. Of the different DMFT components, missing teeth was more associated with satisfaction than other components (decay teeth and filled teeth) (Elias and Sheiham, 1999).

A much clearer view about the relationship between clinical indicators of dental status and subjective measure of oral health-related quality of life was obtained from Tsakos and colleague's studies (Tsakos et al., 2004; Tsakos et al., 2006). Tsakos et al (2004) analysed the data from a cross-sectional survey in an elderly Greek population in Athens, Greece. The number of teeth, filled teeth, the presence of unfilled anterior spaces, the number of OPs and the number of POPs had significant associations with oral impacts in the dentate group. For example, 45.7% of participants with 1-10 natural teeth reported oral impacts and 42.5% of subjects with 11-20 natural teeth experienced oral impacts, while subjects with 21 or more teeth had significantly lower prevalence of OIDP (28.5%). In the adjusted models, people with 1-10 teeth were 2.1 times more likely, and those with 11-20 teeth were 1.8 times more likely to experience oral impacts than those with 21 or more teeth. The number of OPs, as well as number of POPs had very strong relationship with oral impacts. After adjusting for the effects of age, sex, and education, subjects with 0-8 OPs were 1.7 times more likely to report oral impacts when compared with those with 9-16 OPs. There were similar results for POPs. Subjects with 0-3 POPs were 1.6 times more likely to experience oral impacts when compared with those with 4-10 POPs (Tsakos et al 2004).

In Tsakos's study, unfilled anterior spaces were calculated. There were significant relationships between the number of unfilled anterior spaces and OHRQoL. Subjects with unfilled anterior spaces were 2.9 times more likely to experience oral impacts than those without. The authors suggest that unfilled anterior spaces were related to appearance and could be expected to affect many OIDP items, such as smiling, social contacts and emotional stability apart from the obvious difficulties with eating and speaking.

A similar analysis on the data from a national representative sample of the British older population (the NDNS in the UK) Tsakos et al (2006) found some different results. No significant relationship was found between the prevalence of oral impacts and POPs, and unfilled anterior spaces. The possible reason for this was "the prevalence of oral impacts is too low to demonstrate a statistically significant relationship" and a "different culture".

The results from the above-mentioned studies indicate that among a variety of different clinical measures, number of teeth, and number of occluding teeth, were particularly important factors affecting oral health-related quality of life. This conclusion was also confirmed by other studies (Astrom et al., 2006; McGrath and Bedi, 2002; Srisilapanan and Sheiham, 2001a; Steele et al., 2004). In a study to test the relationship between age and tooth loss and oral health-related quality of life in two national samples, Steele et al (2004), reported that tooth loss was independently associated with the summed OHIP scores in both countries. However, this relationship was not simple but appeared to have a plateau in the trend. For example, in the UK, subjects with 1-16 teeth had lowest mean OHIP scores while in Australia, the OHIP scores were much worse in subjects with 1-25 teeth, but did not differ significantly among the subgroups with 1-8, 9-16, 17-20 or 21-24 teeth.

Apart from number of teeth and number of occluding pairs, other clinical indicators such as decayed teeth, decayed root, filled teeth, tooth mobility, periodontal disease, and dry mouth can affect oral health-related quality of life. However, different results were obtained from different studies. For example, Slade et al (1996) reported that missing teeth, retained root fragments, root-surface decay, periodontal pockets and problem-motivated dental visits were associated with higher levels of oral impacts in a study of older adults aged 65 years and over in South Australia, Ontario, and North Carolina. In addition, Gooch et al (1989) found that there were significant associations between oral impacts and decayed teeth and worsening periodontal disease. Srisilapanan and Sheiham (2001a) reported that the OIDP score was significantly associated with mobile teeth, but not with either decayed teeth or decay roots in a study of elderly Thai people aged 60-74 years. Tsakos et al (2004, 2006) found that filled teeth were significantly related to the OIDP scores but no significant association existed between OIDP and tooth decay, root caries and tooth mobility in Greece, while oral impacts had no significant association with decayed teeth, filled teeth or decayed roots in British subjects. These different results may indicate that "clinical disease affecting subjective perceptions of well-being can be influenced by the nature of the disease, as well as expectation, preferences, financial, social and psychological resources " (Locker, 1992).

2.5.2. Eating difficulty and oral health-related quality of life

Oral impacts includes the inability to open the mouth wide, bite, chew, taste, speak, or swallow; limitations in psychosocial functions, such as personal contact and role performance or self-confidence. One very significant impact of the mouth on the quality of life is the impact on eating and enjoying food. Apart from the number of teeth, which, as shown above, affects what people eat, the impacts of the mouth on quality of life affects eating. If there is pain or discomfort from the teeth, certain foods and drinks which cause the pain may be avoided. Furthermore, in the OIDP model, eating difficulty is an intermediate impact. As functional status is a key domain of OHRQoL, eating impact should be closely related to OHRQoL. Therefore, it would be interesting to see how the impacts affect food choice and how prevalent were impacts relating to eating, to know how people feel about their months and how the mouth affects daily living. The review that follows gives a brief overview of the relationship between difficulty eating or chewing and the most widely used measures of oral health-related quality of life.

Since eating difficulty reflects the subject's self-perceived difficulty eating different foods, it may be closely related to not just to physical health but also to subject's overall satisfaction with their daily life. Locker (1992) presented a model for oral health. In this model, oral disease leads to impairment, which leads to functional limitation, for example, difficulty eating or chewing. Either of these may lead to physical, psychological or social disabilities. The model suggested that reduced chewing ability eventually influenced the OHRQoL of people.

Smith and Sheiham (1979) found that 30% of their samples aged 65 years and over had difficulty chewing. In order to eat food easily, 12% changed their meals or their food preparation methods, for example they cooked it for longer. Locker and Slade (1993) reported that 30.5% of their samples were unable to eat one or more indicator foods. One fifth reported they were prevented by their oral status from eating foods they would like to consume. Lowered enjoyment of food was found in 14.2% and taking longer for their meal in 15% of older people. In addition, some people (5.2%) avoided eating with other people due to their chewing problem.

In another study, Locker et al (2001) used both GOHAI and OHIP-14 to investigate eating problems. They found that eating problems were the most common impact in older people. Nearly half of the subjects had trouble eating or chewing food. The next most common GOHAI impact was discomfort during eating (40.4%). For the OHIP measure the most common item was uncomfortable to eat foods.

Sheiham et al (2001) reported the prevalence of oral impacts of dental and oral disorders and their effects on eating among older people in NDNS in the UK. The findings were that the most common oral impact was eating. For example, for the free-living group, 11% of edentate and 7% of dentate reported their eating was affected by oral status. These figures were 4% of edentate and 24% of dentate living in institutions. Those people who reported an eating related oral impact were more likely to have had difficulty eating most of 16 food items than in those without such an oral impact.

The results from the aforementioned studies indicate that eating difficulty or eating impact were very prevalent in elderly people. As functional limitations, such as eating, chewing is a key domain of OHRQoL, difficulty eating or chewing was a very important factor affecting OHRQoL. Studies about the relationship between chewing ability and quality of life in elderly populations supported this conclusion. For example, Miura et al (2000) found that when using the mastication score and the Philadelphia Geriatric Center (PGC) morale score to measure chewing ability and quality of life, the mean PGC score was significantly lower in people with a low mastication score than in those with a normal mastication score (10.95 vs. 11.84). In addition, people who were satisfied with their chewing ability had higher PGC morale score than those who were dissatisfied with their chewing ability. This study indicated that chewing ability was significantly related to quality of life in elderly Japanese residents (Miura et al., 2000).

More recently, Takata (2006) reported another study in 823 older Japanese people aged 80 years. Fifteen Japanese foods were used to test chewing ability. Quality of life was measured using questionnaires with several items including: satisfied with daily life (yes/no); satisfied with social interactions (yes/no); the face-scale score for assessing patient mood (1 = 1-6 score, 2 = 10-20 score, a higher score indicates more negative mood) and Activities of daily life (ADL) score (independent/dependent). After adjusting for sex, spouse status and ADL status, subjects who were able to chew 0-4 and 5-9 indicator foods were 2.7 and 2.1 times more likely to be dissatisfied with their physical condition when compared with those who were able to chew 15 indicator foods. Similarly, unhappy mood after meals was significantly higher in people who could chew less than 15 indicator foods than in those who were able to chew 15 foods. The prevalence of dissatisfaction with daily life was 3.4 times higher in subjects who were able to chew 0-4 foods than that in those able to chew 15 foods. Dissatisfaction with interaction involving family or friends also was prevalent in people who were able to chew fewer than ten indictor foods. The individuals able to chew 0-4 indicator foods had higher the face-scale score which indicated more negative mood. Takata concluded that self-assessed chewing ability was significantly associated with quality of life (Takata et al., 2006).

2.5.3. Dry mouth and oral health-related quality of life

Since dry mouth (xerostomia) can cause cracked lips, unquenchable thirst, soreness, a burning sensation, reduced ability to speak, chew, swallow, taste, sleep, caries and gingivitis (Pankhurst et al., 1996a; Pankhurst et al., 1996b; Porter et al., 2004) it may produce serious negative effects on the person's quality of life. In some studies to measure quality of life in patients with dry mouth, the results showed that the quality of life decreased in patients with dry mouth compared with healthy volunteers

(Belenguer et al., 2005; Hay et al., 2001; Rostron et al., 2002; Strombeck et al., 2000).

Some studies used measures of OHRQoL, such as the OHIP, OIDP and GOHAI, with a measure of xerostomia to see how seriously xerostomia impacts on OHRQoL in Sjögren's syndrome patients. A study to measure the impact of dry mouth on OHRQoL in patients with Sjogren's syndrome was carried out in Hong Kong using the SF-36 measure of quality of life (QOL) and the OHIP measure of OHRQoL. The findings suggest that dry mouth had a significant negative impact on perceived health and well-being in Sjogren's syndrome patients when using the SF-36 but their OHIP summary scores did not differ significantly from that of control group. The sensitivity of the OHIP for this study population was questioned (McMillan et al., 2004).

Another study in 85 patients with xerostomia was conducted by Baker (2006). It was reported that the prevalence of impacts was higher for OIDP (97.6%) and OHIP (94.1%) in this study population. This higher prevalence of oral impacts was related to some symptoms caused by xerostomia such as physical discomfort and /or pain related to dry mouth, soreness, burning sensation, difficulty chewing, eating, swallowing, speaking, tasting and sleeping. In this study, Wilson and Cleary's conceptual model (Wilson and Cleary, 1995) was used to build their questionnaire. Both clinical and non-clinical data were collected. Clinical indicators included salivary flow, clinical signs and salivary grand condition. Self-perceived data included patient reported symptom status (Xerostomia Inventory), perceived functioning (Speech Function), OHRQoL (the OHIP and OIDP), perceived global oral health (a single-item question) and psychological well-being (depression and anxiety measure). They also found both OHIP and OIDP were highly correlated with patients' perceptions of their dry mouth symptom but only weakly associated with the clinical presentation (salivary flow, number of clinical signs). This indicates that perceived dry mouth significantly affected OHRQoL in people with xerostomia (Baker et al., 2006).

Locker (2003) reported that xerostomia index scores were significantly associated with all oral health quality of life outcomes in an elderly population. Similar results were found in a study by Gerdin and colleagues (2005). Both objective and subjective dry mouth were measured and OHIP was used as a measure of OHRQoL. Both objective and subjective dry mouth are significantly associated with OHRQoL, however, these are each related to different aspects of quality of life. Objective dry mouth was related to "painful aching in the mouth" and "has been self-conscious" while subjective dry mouth was more related to "trouble pronouncing words", "ease of taste has worsened" "has been irritable with people" as well as with the total OHIP summary scores (Gerdin et al., 2005). This finding supported the conclusion by Locker (1993) that older people with subjective oral dry mouth are more likely to have a problem chewing one or more foods and experience problems with daily life, such as eating and communicating and are more likely to be dissatisfied with their oral health.

In conclusion, with the extension of life span, people are paying more attention to their quality of life. Many factors, like employment, living conditions, income, food intake, and satisfaction with work and leisure with daily living can affect quality of life. However, health is the most important factor for quality of life. Oral health problems can result in pain and discomfort and can impact on eating, communication, appearance, and consequently lead to embarrassment, social problem and lower self-esteem in various ways. Therefore, oral health, particularly dental status, has a very close association with quality of life.

2.6. Oral health-related quality of life in elderly people

Populations of 65 years or older are rapidly increasing in the world. Health workers should focus on elderly quality of life as well as on extending the length of life. Walls and Steele (2004) stated in their review that oral function in older individuals is influenced by two key variables: the number and distribution of remaining natural teeth and the quantity and quality of saliva present. Both of these variables may be altered in older people compared with the younger. In addition, these key variables may affect oral health-related quality of life in elderly people.

Several studies on old people's quality life used the different measurements of oral health which are mentioned above (Locker and Slade, 1993; Locker et al., 2001; Locker et al., 2002; Nuttall et al., 2001; Srisilapanan and Sheiham, 2001a; Tsakos et al., 2001a; Tsakos et al., 2004; Tsakos et al., 2006). For example, Locker and Slade (1993) found that social impacts, particularly in eating, affected elderly populations. Also, in a survey of elderly Floridians, Gilbert et al (1993) found that 3% of the population had trouble sleeping because of pain or discomfort from dental problems. Locker et al (2001) used GOHAI to measure the oral health–related quality of life in the older people aged from 52 to 100 years. Forty-five percent of participants had trouble biting/chewing food, 40% had discomfort when eating, 36% were worried or concerned about oral health, 33% limited kinds or amounts of food and 33.3% were unhappy with appearance. The findings indicate that oral impacts seriously affected the quality of life among older people. In the same year, Locker and colleagues (2001) used both GOHAI and OHIP-14 to assess the oral health-related quality of life on aged population mainly living in a geriatric care centre. They found only 8.4% had a GOHAI of zero and 30.3% had an OHIP-14 score of zero using additive count methods. These indicate that oral impacts were higher in elderly people with some medical condition. Furthermore, 30.2% of subjects complained of had discomfort in eating food, 17.3% were self-conscious and in 16.0% the diet was unsatisfactory. This study suggested that oral disorders have a significant impact on the well-being and life satisfaction of elderly people.

In the 1998 Adult Dental Health survey, in which one third of subjects were aged 55 years and over, more than half (51%) dentate subjects reported their oral health had affected them in some way in the past 12 months. "Pain" was the most common impact and "Dental pain" affected 40% of dentate people occasionally or more often. Also, oral status had psychological effect on person's daily life, with 27% of subjects reporting feeling of self-conscious or tenseness because oral health. 18% of subjects felt nervous or were embarrassed about their dental conditions (Nuttall et al., 2001).

The OIDP was used in different elderly people with different cultural backgrounds in different counties. Generally, the prevalence of oral impacts was much higher in developing countries. For example, a study conducted by Srisilapanan in Chiang Mai, Thailand showed that about 52.8% had at least one impact of the OIDP. The most common impact was eating impact (Srisilapanan and Sheiham, 2001a). Similar results were reported in a study in older Tanzanians (Kida et al., 2006b). The respective prevalence of oral impacts was 51.2% and 62.1% in urban and rural areas. Eating impact following by cleaning teeth were the main problems in this study.

In developed countries, the prevalence of impacts was lower compared with the developing countries, but still showed that many older people had oral impacts on their daily life. 39% of dentate and 47% of edentate in Greece and 12.3% of dentate and 16% of edentate in Britain experienced oral impacts affecting their daily life in the last six months. Both samples in Britain and Greece were aged 65 years and over (Tsakos et al., 2001a). Recently, Astrom et al (2006) reported the finding from a study of a representative sample with 2,000 residents aged from 16 to 79 years in Norway. The prevalence of OIDP was 18.4% with the prevalence of eating impact being 11.3% in the older people group (67-79 years).

Most of the existing OHRQoL indicators have initially been validated in English-speaking countries. OHRQoL had been translated into some other languages in a few studies. Two studies were about assessment of the impacts of oral disease among elderly in Hong Kong (McMillan et al., 2003; Wong et al., 2002b). Both studies translated OHIP into Chinese (Cantonese), one used the OHIP-14, another used the OHIP. They reported that oral impacts in the elderly Chinese people in Hong Kong were high. For example, food catching was the most common negative impact and was reported by 57% of subjects. Twenty-three percent of subjects had difficulty chewing (McMillan et al., 2003; Wong et al., 2002b).

In conclusion, since older people had more oral disease and oral disorders, as expected, oral health appears to impact on older people's daily life. The most common oral impact is eating impact.

2.7. Overall Summary

In recent decades there has been an increased interest in the relationship between dental status and diet choice. Unfortunately, many studies failed to clearly classify various kinds of dental conditions. For instance, they reported the number of teeth based on counts of natural teeth only, or used counts of a combination of natural plus replaced teeth, or counts of natural teeth ignoring the presence of fixed or removable prostheses or quality of prostheses. In addition, many studies simply used as "the dentate" ignoring number or position of teeth or used "edentulous" with no consideration about patterns of denture wearing.

The present study is therefore designed to clearly evaluate whether the natural teeth, replaced teeth and position of teeth affect eating difficulty. In addition the effects of xerotomia (dry mouth) and oral impacts on oral health-related quality of life was assessed.

Chapter 3

3. Hypothesis, objectives and conceptual model

3.1. Hypothesis

The hypothesis for this study is that clinical dental status significantly affects eating difficulty and oral health-related quality of life in an older Chinese population in Guangxi province, China.

3.2. Objectives

To develop an Index of Eating Difficulty for the measurement of eating difficulty among a sample of older Chinese people in Guangxi province, China.

To assess the prevalence and severity of eating difficulties and the relationship between clinical dental status and eating difficulties among a sample of older Chinese people in Guangxi province, China.

To assess the prevalence and severity of oral impacts on oral health-related quality of daily life (OIDP) and the relationship between clinical dental status and oral health-related quality of daily life among a sample of older Chinese people in Guangxi province, China.

To assess the relationship between dry mouth and eating difficulty, and oral health-related quality of life among a sample of older Chinese people in Guangxi province, China.

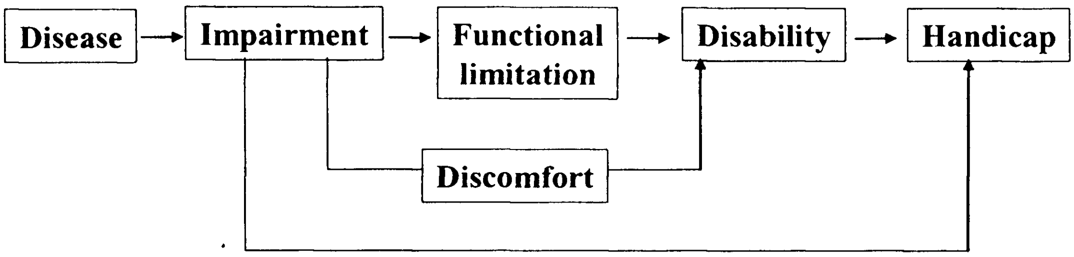
To assess the relationships between eating difficulties and the overall OIDP score and the prevalence of OIDP eating impact among a sample of older Chinese people in Guangxi province, China.

3.3. Conceptual models

There are three models for this study. The first is Locker's model (Figure 3.1) This model is one which Locker modified from a generic model of disease and its consequences by the World Health Organization's International Classification of Impairments, Disabilities, and Handicaps (WHO, 1980) to an oral health context (Locker, 1988). In this model, disease can lead to impairment, defined as any anatomical loss or abnormality. Impairment may then lead to functional limitation, described as a loss of function of body parts or systems. Another consequence of impairment could be pain and discomfort, either physical or psychological. Disability is any limitation in or lack of ability to perform activities of daily life. A final consequence is handicap, characterized by the experience of disadvantage because impaired and disabled people do not or cannot confirm to the expectations of society or the social groups to which they belong (Locker, 1988). For this thesis, diseases are defined as decay, periodontal disease or trauma, which leads to a loss of teeth. Impairment is missing teeth. The functional limitation is eating difficulty. Discomfort caused by eating some hard foods. Disability is defined as not being able to eat some hard foods. Handicap is tooth loss which makes people feel embarrassed and avoid eating with others or eating slowly and therefore becoming embarrassed.

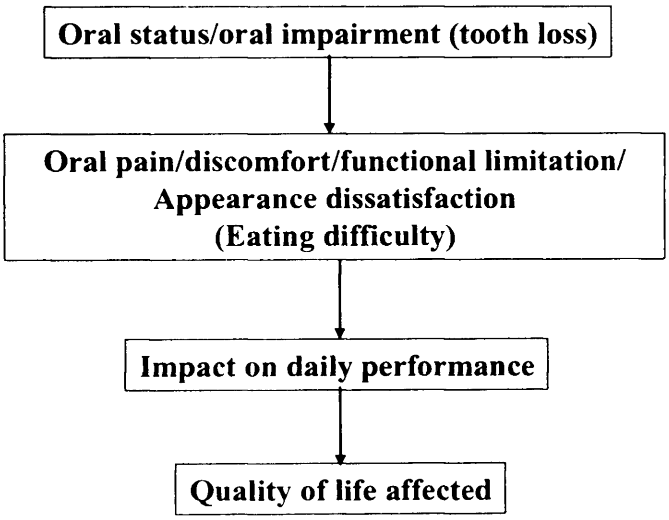
The first model was incorporated into Model 2 (Figure 3.2). It is an elaborated OIDP model based on Adulyanon and Sheiham's OIDP model. In this model, the first level is oral status and oral impairments which refers to clinical indices, such as tooth loss. Oral impairment can lead to intermediate impacts, namely oral pain, discomfort, functional limitation, and appearance dissatisfaction. These intermediate impacts can affect daily activities and behaviours (e.g. eating, speaking, sleeping, maintaining usual emotional state, meeting people). Therefore these physical, psychological, social disability and handicaps may result in a lower quality of life (Adulyanon and Sheiham, 1997).

Model 3 (Figure 3.3) is a plan of analysis model. In this model, the main measures of clinical dental status are number of teeth, number of occluding pairs of teeth ("teeth" means natural teeth or natural plus replaced teeth), number of unfilled spaces which were assessed by a clinical dental examination. Dry mouth, which is a perception, was also assessed. Other information on oral health measures was from subjective measures of individual's perceptions about their oral health. Subjective measure can assess the extent to which oral disease, disorders and conditions compromise the functional, social, psychological and behavioural well-being of an individual (Bowling, 2001). In addition, subjective measures of oral health can provide important information how oral disease affects the daily lives of people (Gilbert et al., 1998). In this thesis, General Eating Difficulty (GED) is a general measure of eating difficulty using single-item questions. Ease of Eating certain Foods (EEF) was used to assess the ability to eat 16 specific foods items. The Index of Eating Difficulty (IED) is a measure of the severity of eating difficulties. Dissatisfaction with Chewing Ability (DCA) is an individual's overall assessment of their chewing ability. OIDP eating impact referred to the prevalence of the respective OIDP items that assessed the impact of oral condition on the eating difficulty experienced by respondents in the past 6 months. These five measures can provide different types of information on eating difficulty. Oral health-related quality of life would be measured using the OIDP index.



Source: WHO, 1980; Locker, 1988.

Figure 3.1 Components of the WHO model.



Base Adulyanon & Sheiham 1997

Figure 3.2 Elaborated OIDP model.

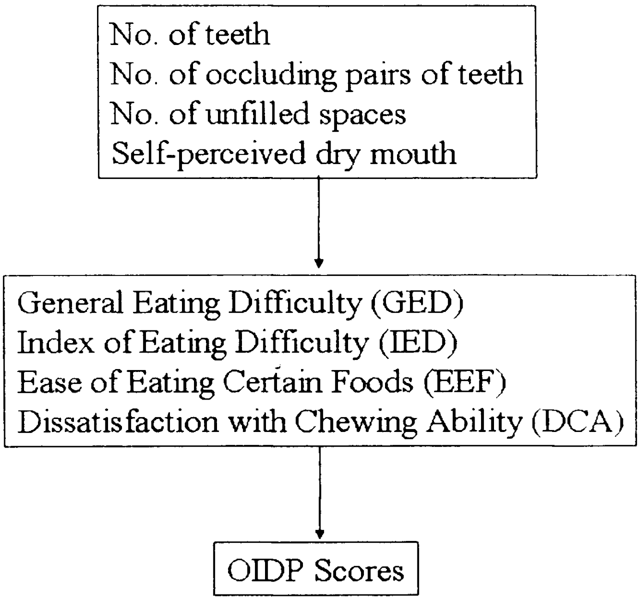


Figure 3.3 Plan of analysis model for this thesis.

Chapter 4

4. Methodology

4.1. Introduction

This chapter describes the methodological procedures applied in the present study and covers all of the important methodological issue, such as study design, sampling, data collection and data analysis.

4.2. Study design

The study was a cross-sectional exploratory study based on an interview survey of opinions on eating difficulty and oral health-related quality of life (OHRQoL) and a clinical dental examination among a sample of elderly people in Guangxi province, China.

4.3. Pilot study

The first pilot study was conducted in Nanning city, Guangxi in 2003. The aim of this study was to get indicator foods to establish the Index of Eating difficulty (the detail for the first pilot study see the appendix 1). The second pilot study was carried out in the same city, from September to October 2004. It was carried out by one examiner and one trained interviewer. The training of the interviewer was undertaken by the main examiner. The purpose of the second pilot study was to test practicality of all instruments, to measure the time required for the clinical examination and the administration of the overall questionnaire, to become familiar with the procedure of the clinical examination and questionnaire and to carry out preliminary tests for the reliability and validity of the Index of Eating Difficulty and the Oral Impacts on Daily Performances (OIDP) questionnaires.

The sample consisted of 205 people (103 female and 102 male) aged 60-80 years old, 194 were dentate and 11 edentulous. These subjects came from different groups in the population. Some were elderly people who came to the routine check-ups centre of the First Affiliated Hospital of Guangxi Medical University, some were patients of the Stomatology Hospital of Guangxi Medical University and general patients of the First Affiliated Hospital of Guangxi Medical University, while others were volunteers.

Prior to the pilot study, all the versions of questionnaires self-perceived general health and oral health questionnaire, different measures of eating performance questionnaire, and the OIDP questionnaires underwent a two-way translation (from English to Chinese and backwards). These procedures were checked by a dentist in Hong Kong who was not involved in the study and a Chinese professional who came from Mainland China but had been living in the UK for more than ten years to see whether the questionnaires were translated properly. Both of them could use English very well.

In the second pilot study, the main examiner (the author) had a short informal conversation with the subjects after the clinical examination and the interview. The contents of conversation included understanding, feasibility, acceptance and comprehensiveness of the questionnaire. The participants were asked whether all the concepts involved in the questions were fully comprehensible and whether they thought or had experienced something regarding or related to their teeth and mouth, which was not mentioned during the interview. They were also asked whether the construction of the Index of Eating Difficulty was reasonable. According to this conversation, minor modifications were made to the questionnaires. The study showed that the methodology was feasible for the main study.

The Index of Eating difficulty (IED), which is a new index based on Chinese foods, was developed in the present study. In order to establish IED, two pilot studies were carried out before the main study. In the first pilot study, 39 Chinese foods including meats, grains, vegetables, fruits, and snacks were chosen from 250 kinds of daily food foods based on the recommends by two Chinese nutritional experts. These 39 foods were considered as common eaten by people who living in Guangxi. Then, 70 subjects were asked to rate each type of food in relation to frequency eating and food texture. Frequency of eating was divided into three categories (very frequently, frequently, and not frequently). Food texture was divided into four categories (hard, medium, soft, sticky foods or food with seeds). Next, a list of 16 representative foods with different textures was obtained from the results of the investigation. This list of 16 indicator foods included different food texture, cooking methods, and frequency of eating based on the criteria: one or two foods were selected from each box except sticky or foods with seeds box. The cooking methods and nutritional experts' comments also were considered. This 16 indicator foods were classified into seven groups of foods (Table 1.6 in Appendix 1). Foods with similar textures were grouped together. This second questionnaire including these seven groups of foods was tested on 205 elderly people in the second pilot study. Subjects were asked to indicate whether they could eat each of seven groups of foods. The order of the questions had been decided by using random numbers. In the analysis, all seven groups of foods were arranged by frequency of "yes" responses and the pattern of responses was examined. Two groups of foods incuding steamed bread, soft rice, rice porridge, boiled fish and tofu in water - provided little or no discrimination between respondents, since over 99 percent of all responses reported they could chew them. In addition, some people answered "have not tried" to cooked sliced beef. Therefore, only five groups of foods were used to design a questionnare and develop a new Index of Eating Difficulty (Table 1.7 in Appendix 1). The Index of Eating Difficulty was used in the main study. Throughout the whole pilot study, an informal detailed discussion was conducted involving a panel of academics, some experienced dentists and some eligible elderly people, in order to improve understanding of the content of the questionnaire (for details see the Appendix 1).

The OIDP was originally developed in English. The OIDP has been used in Britain, Greece, Thailand, Norway, Tanzania, Brazil and Uganda (Gherunpong et al., 2004; Sheiham et al., 2001b; Srisilapanan and Sheiham, 2001a; Tsakos et al., 2001a; Tsakos et al., 2004), but has never been used on Chinese people before. The index should be subjected to the cross-cultural translation and adaptation process into Chinese in order to use it in the study. Sensitivity to culture and appropriate words were considered. The draft of the Chinese OIDP version was initially tested on an opportunitic sample of 15 people. After this test, an informal detailed discussion was conducted involving a panel of academics, three experienced dentists and some eligible elderly people, in order to explore the understanding of the content of the questionnaire. In the second pilot study, this new Chinese version of OIDP was retested on 205 elderly people. Any language changes and wording were translated into English and back to Chinese. This final version was then translated back into English by two persons whose first language is English and who were not involved this study.

4.4. Main study

4.4.1. Sample selection

4.4.1.1. Study area

The sample consisted of elderly people aged 55 years and over living in Nanning, Guangxi Province, China. Nanning is the capital city of Guangxi province and has a population of almost 6.5 millions. About 15% of the population is aged 55 years and over (http://www.moh.gov.cn/tjxxzx/dcyyj/ztyj).

Study area: Nanning city, Guangxi province of China

4.4.1.2. Age of the sample: rational for selection

The sample includes adults aged 55 years and over. The reasons for selecting that age range are:

Old people are more likely to have tooth loss and are also vulnerable to dietary restrictions for other reasons (disability, medical or social condition). The evidence from many studies showed that tooth loss has been associated with changes in diet in older people.

The life expectancy of Chinese people is 74 years for women and 70 years for men (http://www3.who.int/whosis/country/compare, 2004).

According to government regulations, professional women working for government institutions and companies are required to retire at the age of 55 years while men retire at the age of 60. Female blue-collar workers retire at the age of 50 while men retire at 55 years. Most people aged 55 and over begin to start a new life and some lifestyles would be changed. Retired life is very different from the other periods of the life. So this study focused on this age group as it represents retired people.

4.4.1.3. Sampling procedures

The sample in this study is not a representative sample because the main objective is to test the relationships between the clinical dental status and eating difficulty, and oral health-related quality of life. Non-random methods were used to obtain a sufficiently large sample of elderly people from different social classes to assess the relationships between the clinical dental status and eating difficulty, and oral health-related quality of life in Chinese elderly people.

Routine check-ups for the elderly people are organised by 10 hospitals in Nanning every year. About 70% of old people aged 55 years and over get these routine check-ups. The government has no special policy to decide which hospital people should go to for routine check-ups. It is usual for the head of company and the head of factory to choose one hospital to do routine check-ups for their employees and ex-employees. Two top hospitals have advanced equipment, technology and well-trained staff compared with other hospitals. So people are more likely to go to these two hospitals. About 40% of people who have routine check-ups go to the First Affiliated Hospital of Guangxi Medical University and 40% of them go to the Guangxi Province Hospital. The rest (20%) go to the other 8 hospitals.

The sample in this study was selected from people who had routine check-ups in the First Affiliated Hospital of Guangxi Medical University. For elderly people going for routine check-ups, the hospital sent a notice including examination information and appointment time. So they could be contacted via that route. All of the sample in this study were free-living adults aged 55 years and over. People excluded were those living in long-stay residential accommodation, nursing homes or those in hospital at the time of the survey. One of the selection criteria is ability to comprehend the questions. Mentally handicapped subjects were excluded from the study. The cognitive functioning of the subject was assessed using the Orientation-Memory-Concentration Test which consists of five very simple questions with obvious answers (Katzman et al, 1983) (Appendix 4). Subjects were excluded from the study if they failed to answer correctly two or more of those questions.

4.4.1.4. Sample size calculation

Sample size depends on the aims, nature and scope of a study. In the present study, the main objective was to test the hypothesis, namely "the clinical dental status significantly affects eating difficulty and oral health-related quality of life in an older Chinese population". Minimum sample size for hypothesis testing was calculated on the basis of the hypothesis for comparison of two proportions of eating difficulty or chewing difficulty in different groups with different dental status using the following formula (Kirkwood and Sterne, 2003).

Formula

$$n = \frac{\{\mu \sqrt{[\pi_1(1-\pi_1)+ \pi_2(1-\pi_2)]} + \upsilon \sqrt{[2\pi(1-\pi)]}\}^2}{(\pi_2-\pi_1)^2}$$

Where $\pi = \frac{(\pi_1+\pi_2)}{2}$

n = required minimum sample size in each group.

π_1 π_2 = proportions of interest

μ = one–sided percentage point of the normal distribution corresponding to 100% power, in this study, the power = 80%, $\mu = 0.84$

υ = percentage point of the normal distribution corresponding to the (two-sided) significance level, in this study, significance level = 5%, $\upsilon = 1.96$.

The proportions of interest (π_1 π_2) were obtained from the second pilot study. The sample number was calculated in each possible group (Table 4.1).

Table 4.1 Sample size calculations.

	The proportions of eating difficulty		**The proportions of chewing difficulty**	
Group	π_1 π_2	n in each group	π_1 π_2	n in each group
Group1: 0 OPs Group2: 1-10 OPs	$\pi_1 = 83\%$ $\pi_2 = 62\%$	75	$\pi_1 = 72\%$ $\pi_2 = 59\%$	190
Group1: 1-10 OPs Group2: 11-22 OPs	$\pi_1 = 62\%$ $\pi_2 = 32\%$	45	$\pi_1 = 59\%$ $\pi_2 = 21\%$	28
Group1: 0 POPs Group2: 1-4 POPs	$\pi_1 = 81\%$ $\pi_2 = 58\%$	64	$\pi_1 = 69\%$ $\pi_2 = 53\%$	122
Group1: 1-4 POPs Group2: 5-16 POPs	$\pi_1 = 58\%$ $\pi_2 = 35\%$	65	$\pi_1 = 53\%$ $\pi_2 = 26\%$	45

*OPs: Number of Occluding Pairs of natural teeth

POPs: Number of Posterior Occluding Pairs of natural teeth

Considering that not many edentulous people were in the study while some dentate people had some natural teeth but no opposing pairs of natural teeth (OPs), the estimation of sample size was based on comparing the proportions of eating difficulty or chewing difficulty in subjects (including edentulous and some dentate) with 0 OPs to those with 1-10 OPs. Hereby, a score of two is given for each occluding pair of molars the maximum number of OPs of natural teeth was 22 and the maximum number of POPs of natural teeth was 16 (including third molar).

Required minimum sample size in each group was 190 (Table 4.2)

In this study, there were three age groups and two sexes.

The total sample size was:

$N = 190 \times 3 \times 2 = 1140$ (Table 4.2)

Table 4.2 The total sample size.

Age group	Male	Female	Total sample
55-64	190	190	380
65-75	190	190	380
76+	190	190	380
Total sample	570	570	1140

Based on these assumptions and estimates, a minimum of 1140 subjects were required to satisfy the requirements of having 80% power of demonstrating a statistically significant difference at the 5% level.

In surveys, two problems may arise that lead to a loss of participants from the planned sample, namely districts with a mobile population and participants who are absent on the day of the examination (Pine et al., 1997). To minimize the problem, a number bigger than requested for the initial sample calculation was selected, and the study was over-sampled by 10% considering loss of subjects or data may occur during of the study. The final sample size of this study was 1,245.

4.4.2. Study implementation

4.4.2.1. Permission

The protocol and outline of study was submitted to the Ethical Committee and the Ministry of Public Health in Guangxi Province, China for the approval of human research and the permission was obtained for this study.

The First Affiliated Hospital of Guangxi Medical University and the Stomatology Hospital of Guangxi Medical University were contacted to get permission and co-operation. Also, the Stomatology Hospital of Guangxi Medical University and Guangxi Medical School were contacted for permission to get dentists and dental students to participate in this study.

In the check-ups centre, two letters, namely the information letter (Appendix 2) and consent letter (Appendix 3) was given to eligible subjects by the officer of the check-ups centre when they registered. The information letter was addressed by the research supervisor (Prof. Sheiham) and contained a brief explanation of the purpose of the study and the procedure of the study. This letter could help subjects understand the study and cooperate with the researchers. The subjects were told they should sign the consent letter and go to the dental examination room to join the study if they agreed to participate.

4.4.2.2. Training and calibration

The field work for the study was undertaken by four examiners (the main examiner and three other dentists), one interviewer and two recorders. All examiners were experienced dentists who worked in the same hospital, namely Stomatology Hospital of Guangxi Medical University. The interviewer is a dental assistant working for our research team. The two recorders were dental students from the dental school of

Guangxi Medical University. The main examiner carried out 690 examinations (56.2%), while the 3 remaining dentists examined 539 subjects (43.8%).

The training of dentists combined with the recorder's training was carried out by the main examiner in three stages according to dental clinical criteria and the study protocol. First, they discüssed and consulted each other, aiming to make sure that everyone agreed and understood clearly all criteria used. Secondly, they practiced taking clinical measurements on dental patients aged 60 years and over and volunteers for this practice in the Stomatology Hospital of Guangxi Medical University. In this session, the dentists learned how to examine and score the conditions and familiarized themselves with the procedures and the appropriate order of the clinical examination, and how to call out the scores to the recorders. The recorders practiced with each dentist. Third, the calibration exercise took place and methods used were based on WHO (1997). For inter-examiner reliability tests, 66 subjects were examined by each examiner. Intra-examiner reliability tests were conducted during the data collection period. A total 103 subjects were random selected for intra-reliability.

Reliability of the questionnaires was tested based on repeated interviewer-administration of questionnaire to 106 subjects after one week's interval throughout the whole main study.

4.4.2.3. The interview and examination procedures

The interviews and examinations took place consecutively. First, general information was completed on questionnaires by the subjects. Then the interviewer carried out the cognitive test (Appendix 4) and identified the persons who were eligible for the study according the result of the cognitive test. The interview lasted about 20 minutes. During the interview, the subject was asked whether he/she had a history of valvular heart disease, heart by-pass or replacement prosthetic joints surgery. In case of such a history of medical contra-indications to gingival probing the examiners were instructed to limit the periodontal examination to the assessment of tooth mobility only and not do gingival probing. No subject had this problem in the study.

After the interview, the clinical examination was carried out by two examiners. Usually the main examiner and another dentist worked on each examination day. The dentists wore disposable masks, caps, gloves and protective glasses during examination. The disposable plane mouth mirror and a blunt probe were used. The WHO periodontal probe was used for periodontal data collection. Instruments were sterilised at the end of the day in the Stomatology Hospital of Guangxi Medical University.

4.4.3. Data collection

Data on current oral health were gathered by a direct clinical oral examination and subjective data was abtained by a face-to-face interview. There wete four main categories of data in the questionnaire: sociodemographic data, general health status, oral health status, and oral impacts (Appendix 4).

4.4.3.1. Clinical data

The aims of this study were to measure eating difficulty and oral health-related quality of life in relation to clinical dental status. For the dentate subjects, the oral examination involved assessment of the temporomandibular joint, soft tissues pathology, restored and unrestored tooth spaces, tooth contacts, coronal and root caries, tooth mobility, pocket depth, loss of attachment, and presence and condition of dentures. For the edentulous subjects, the oral examination focused on presence and condition of dentures, temporomandilar joint assessment and soft tissues assessment. The clinical diagnostic indicators for all assessments were based on the modified version of the British National Diet and Nutrition Survey (NDNS) for people aged 65 and over (Steele et al., 1998). The details of dental examination form and diagnostic criteria are presented in Appendix 6 and 7.

4.4.3.2. Questionnaire data

Sociodemographic information

The sociodemographic information included age, sex, marital status, education level, present and past occupation, family income and self-assessment social class. Age was at last birthday. Education level, occupation, family income and self-assessment social class were assessed and used for measure of social class, because there is no definitive classification of social class for people in China. Educational level, occupation, income and self-assessment social class can provide some information related to social class. Socio-economic background in terms of education, occupation and income was reported in many studies (Borrell et al., 2004; Du et al., 2000; Hu et al., 2005; Sanders and Spencer, 2004; Yu et al., 2002). Education referred to years of formal school education. Educational level was divided into six categories: no education (illiterate), 1-6 years (primary school), 7-9 years (middle school), 10-12 years (high school), 13-19 years (college and university), 19 and over years (postgraduate). The past occupation included eight categories:

Professionals - including doctors, lawyers, teachers, and managers

Administrators - officers who work for the government.

Clerks - people who work in the office or a company with skilled manual occupations

Business - people working in shop but not managers, e.g. shop assistant, seller

Services: including hairdressers, bus drivers, cooks, waiters, and tailors.

Peasant or fishermen

Workers: including skilled and unskilled workers, e.g. factory worker, builder.

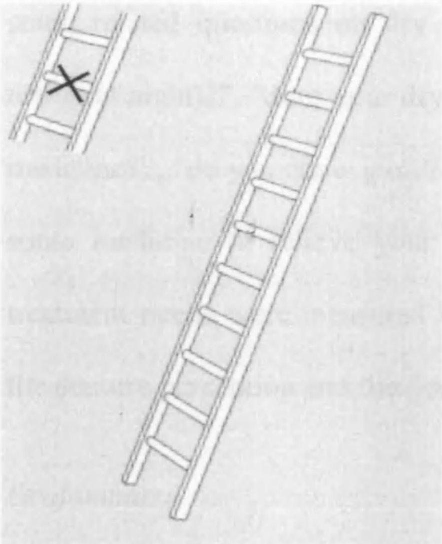
Other occupation

Both categories of educational level and occupation were adapted from those used in the second national oral health survey in China (Wang et al., 2002).

Income level was according to the self-reported average monthly income per capita of the participants' family.

Self-assessed social class was measured by using the MacArthur Scale of Subjective Social Status (Adler et al., 2000) for older people in the UK. They were shown a drawing of a ladder with 10 rungs which was described as follows: "Think of this ladder as representing where people stand in our society. At the top of the ladder are the people who are the best off – those who have the most money, most education and best jobs. At the bottom are the people who are the worst off – who have the least money, least education, and the worst jobs or no jobs. The higher up you are on this ladder, the closer you are to the people at the very top and the lower you are, the closer you are to the people at the very bottom." They were then asked put an X on the rung which best represented where they thought that they stood on the ladder (ELSA, 2002 http://www.data-archive.ac.uk/). The scale, whose test-retest reliability has been demonstrated (Operario D et al., 2004), has been used in many research studies of health (Goodman et al., 2001; Goodman et al., 2003; Kopp et al., 2004; Singh-Manoux et al., 2003).

Example:



General health status

General health status information included general health perceptions, physical disability, and medicine history. General health perceptions were measured by asking each subject whether his/her general health was excellent, very good, good, fair or poor. Physical disability was ascertained by asking whether they had or had not a long-standing illness, disability or infirmity. Medical history reported the medicines that the subject was taking within the last 14 days by using an interviewer-administered questionnaire.

Perceptions of oral health status

There were four kinds of information in this section: oral health perceptions, self-perceived dry mouth, denture perceptions, and perceived treatment need. Oral health perception was assessed by self-rated oral health, subjects indicated their oral health as excellent, very good, good, fair or poor. Dry mouth was ascertained by self-report assessment of each subject on dry mouth (yes/no). Subjects were also asked some related questions on dry mouth, such as "when you feel dry mouth (during eating/at night)?", "does your dry mouth cause difficulty in chewing/ swallowing/taking medicine?", "do you chew gum/suck hard sweet or mints/sip water or other liquids/take some medicine to relieve your dry mouth". Denture perception and self-perceived treatment needs were measured by self-reported assessment on their perception about the denture perception and the dental treatment needs.

Oral impacts

1. Eating difficulty:

Five measures were used to assess eating difficulty and eating impacts in this study.

The first measure is General Eating Difficulty (GED)[1]. GED was measured using a single-item question involving self-rating of general eating difficulty. The following scale was used: 1 = "no difficulty", 2 = "a little difficulty", 3 = "a fair amount of difficulty", 4 = "a great amount of difficulty".

The second measure was Dissatisfaction with Chewing Ability (DCA)[2] which measured people's levels of dissatisfaction with chewing ability. Subjects were asked a single question to rate overall dissatisfaction with chewing ability using the following

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[1] Throughout this thesis the term General Eating Difficulty (GED) refers to the answer to Q1 in Part 4 (Eating) of questionnaires (see Appendix 4)

[2] Throughout this thesis the term Dissatisfaction with Chewing Ability (DCA) refers to the answer to Q2 in Part 4 (Eating) of questionnaires (see Appendix 4)

scale:

1 = "very satisfied", 2 = "satisfied", 3 = "dissatisfied", 4 = "very dissatisfied".

The third measure was Index of Eating Difficulty (IED)[3]. The IED is a five-item index, described here. It is derived from the questions: are you able to eat -

Eatq1: whole apple or corn on the cob, or something very similar to that.

Eatq2: cooked sliced pork or cooked green vegetable, or something very similar to that.

Eatq3: boiled chicken or duck, or something very similar to that.

Eatq4: salted roasting chicken or roast pork ribs or roast duck or chicken, or something very similar to that.

Eatq5: cooked cucumber or lotus root or cooked carrots, or something very similar to that.

The subjects were asked to select from three answers (1-yes; 0-no; 2-have not tried). The food categories for which a subject was unable to eat was coded to give an index code as shown in Table 4.3.

The coding was as follows:

IED = 0: people can eat one or more foods in each of 6 categories (Table 4.3).

IED = 1: people can eat one or more foods listed in categories 2 to 5 but cannot eat

[3] Throughout this thesis the term Index of Eating Difficulty refers to the answer to Q3 (1-5) in Part 4 (Eating) of questionnaires (see Appendix 4)

foods in category 6 (Table 4.3).

IED = 2: people can eat one or more foods in categories 2 to 4 but not 5 and 6 (Table 4.3).

IED = 3: people can eat one or more foods in categories 2 and 3 but not 4 to 6 (Table 4.3).

IED = 4: people can only eat one or more foods in category 2 (Table 4.3).

IED = 5: people cannot eat any of the foods listed in any of the categories in Table 4.3.

Table 4.3 Index of Eating Difficulty (IED).

Category	Difficulty eating foods	IED
1	None of foods listed	5
2	Cooked sliced pork, cooked green vegetable	4
3	Cooked cucumber or lotus root, cooked carrots	3
4	Boiled chicken or duck	2
5	Whole apple, corn on the cob	1
6	Salted roasting chicken, roast pork ribs, roast duck or chicken	0

Note: If person could eat one food and not all of the foods in one category then they are given that category code.

Based on the frequency distribution of IED categories in this sample, subjects were classified into two groups: IED = 1-5 and IED = 0. People in a higher IED category had a higher level of eating difficulty (Appendix 1).

The fourth measure is Ease of Eating certain Foods (EEF)[4] using the list of 16 foods obtained from the first pilot study. That included same foods used in the IED question

[4] Throughout this thesis the term Ease of Eating certain Foods (EEF) refers to the answer to Q4 in Part 4 (Eating) of questionnaires (see Appendix 4)

plus cooked sliced beef, steamed bread, soft rice, rice porridge, boiled fish and tofu in water which were not used in the IED questions. Subjects were asked to rate the amount of difficulty they had eating certain food listed. The answers were coded: 1 = "could eat easily", 2 = "could eat with some difficulty", 3 = "could not eat at all".

The final measure is OIDP eating impact which refers to the OIDP item on difficulty eating. It is a measure of the impact of oral condition on eating difficulty.

For detail of questions on eating difficulty methods in this section see Appendix 4.

2. Oral Impacts on Daily Performances

The Oral Impacts on Daily Performances (OIDP) developed by Adulyanon and Sheiham (1997) and modified by Tsakos et al (Tsakos et al., 2001b) is a social-dental indicator to measure the ultimate oral impacts on the person's ability to perform certain daily activities. Nine performances included eating, speaking, cleaning teeth, light physical activities, going out, relaxing/sleeping, smiling, emotional stability and social contact were used in this study. The participants were asked to give the frequency and severity of impacts, ranging from 0 to 5 for each measure, as an indication of how much the impact affected their daily living. The score represents the total impact and was calculated by multiplying the frequency with the severity scores. The total score was the sum of all the performance scores for an individual. For the questions used and scoring methods, see Appendix 4 and Appendix 5.

In order to make the questionnaire of OIDP easier to understand by the elderly people, the modifications related to the clarification of the content, with some examples given for each daily activity performed conducted are given below:

Eating and enjoying food: the examples were biting an apple, drinking cold or hot drinks or eating hot foods.

Speaking and pronouncing clear: say some word beginning with an "S"

Cleaning teeth: brushing you teeth or rinsing your teeth with cold or hot water

Light physical activities: the examples were cooking or cleaning your room.

Going out: the examples were going to the park for walk, shopping, visiting friend or relatives.

Relaxing (including sleeping): the examples were watching TV for relaxing.

Smiling, laughing and showing your teeth without embarrassment: did not need to change.

Maintain usual emotional state without being irritable: the examples were becoming more easily upset than usual, crying easily, being sad, and being more irritable.

Enjoying the contact of other people, such as relatives, friends or neighbours: did not need to change.

The subjects who reported oral impacts were also asked whether the impact on any of the performance above was due to their dental condition, such as tooth loss, dental pain, decay, sensitive teeth etc.

4.4.4. Data entry, processing and construction of the variable

All clinical and questionnaire forms were checked daily after the examination and interview in order to make sure that every box was completed, and that all variables had been entered corrected. Any unclear or missing data were sorted out. Data were double entered and checked by Epi-software.

The next section describes the types of outcome variables and explanatory variables as well as the potential confounding variables.

4.4.4.1. Outcome variables

Six variables were selected to investigate the relationship between clinical dental status and eating difficulty and oral health-related quality of life. The variables and the respective categories are given in Table 4.4 and a construction of these measures is given below.

Table 4.4 Outcome variables used in the statistical analysis.

Outcomes variables	Categories
General Eating Difficulty (GED)	No eating difficulty
	Eating difficulty
Dissatisfaction with Chewing Ability (DCA)	Satisfied
	Dissatisfied
Index of Eating Difficulty (IED)	IED = 0
	IED = 1-5
Ease of Eating certain Foods (EEF)	No difficulty eating certain foods
	Difficulty eating certain foods
Binary OIDP	No impact
	Impact
OIDP eating impact	No eating impact
	Eating Impact

General Eating Difficulty (GED)

A rating scale was used to measure General Eating Difficulty. The question was: "in general, how well are you able to bite, chew, and swallow food that you eat nowadays?" Each category was given a numerical code:

1 = No difficulty

2 = A little difficulty

3 = A fair amount of difficulty

4 = A great amount of difficulty

Only a few people had a fair amount of difficulty or a great amount of difficulty. There was no point putting them into different groups by GED, therefore, the variable GED was analysed as a dichotomised variable and recoded according to four answers to this question.

0 = No eating difficulty (codes 1)

1 = Eating difficulty (codes 2, 3 and 4)

Dissatisfaction with Chewing Ability (DCA)

A single question was used to measure dissatisfaction with chewing ability. The question was: "how satisfied are you with your ability to chew overall?"

The answers were:

1 = Very satisfied

2 = Satisfied

3 = Dissatisfied

4 = Very dissatisfied

5 = Don't know

The choice of the cut-off point was determined by the conceptual distinction between satisfaction and dissatisfaction and by the fact that there were few subjects who answered "very satisfied" or "very dissatisfied" to this question. Therefore, the variable DCA was calculated as a dichotomised variable according to four answers to this question.

0 = Satisfied (codes 1 and 2")

1 = Dissatisfied (codes 3 and 4)

5 = Missing data

Index of Eating Difficulty (IED) and OIDP scores

The choices of the cut-off points for the categorisation of the outcome variables were determined through a conceptual approach, while the distribution of IED and OIDP scores were also used. For IED, the conceptual approach implied for the basic categorization subjects had an IED (IED = 1-5) or not (IED = 0). This point was also reinforced by the distribution of IED. As the majority of subjects (84.2%) had an IED = 0, the value of "zero" for IED should be used as a cut-off point for the categorisation of the variable. For the scores of OIDP, the conceptual approach implied that the basic categorisation of the samples would be between subjects that experienced oral impacts that affected their daily life and those that did not. This point was also reinforced by the distribution of OIDP scores. As 40% of participants had OIDP scores equal to zero, the value of "zero" for the OIDP score was used as a cut-off point for the categorisation of this variable as well.

The next issue referred to the decision whether there should be another cut-off point as well. This implies determining whether the new variable should be dichotomous or categorical with more than two categories. Conceptually, there would be no justification for choosing a second cut-off point, like the rationale presented for the choice of "zero". Apart from that, the frequency distribution of IED showed that there were very few subjects with IED over zero, thus not allowing for a further categorisation of this variable. The results of distribution of OIDP scores showed that most subjects had OIDP scores under 20, less than 5% of subjects had OIDP scores over 20, thus not strongly implying for a further categorization of this variable. Consequently, a second cut-off point could not be justified either conceptually or statistically. That meant that both variables (IED and OIDP scores) would be dichotomised with "zero" as the cut-off point.

Ease of Eating certain Foods (EEF)

A rating scale was used to measure EEF. The question was "could you eat items easily, with some difficulty or not at all" for every food item.

The answers were:

1 = could eat easily

2 = could eat with some difficulty

3 = could not eat at all

This variable was calculated as a dichotomous variable according three answers:

0 = No difficulty eating certain foods (code 1)

1 = Difficulty eating certain foods (code 2 and code 3)

OIDP eating impact

OIDP eating impact referred to the prevalence of the respective OIDP item that assessed the impact of oral condition on the eating difficulty experienced by the respondents in the past 6 months. This variable was calculated as a dichotomous variable.

0 = No Eating Impact

1 = Eating Impact

4.4.4.2. Explanatory variables

The explanatory variables are those variables of central interest, those related to or influencing the outcome variable. In the present study, four main groups of explanatory variables, namely numbers of teeth, numbers of occluding pairs, and numbers of unfilled spaces and self-perceived dry mouth were investigated. The variables selected as explanatory variables in the present study are presented in Table 4.5.

Table 4.5 Explanatory variables used in the statistical analysis.

Explanatory variables[5]	Categories
Number of natural teeth	1 = 26-28 natural teeth
	2 = 21-25 natural teeth
	3 = 1-20 natural teeth
Number of natural plus replaced teeth	1 = 26-28 natural plus replaced teeth
	2 = 21-25 natural plus replaced teeth
	3 = 1-20 natural plus replaced teeth
Number of Occluding Pairs of natural teeth (OPs)	1 = 16-18 OPs
	2 = 11-15 OPs
	3 = 0-10 OPs
Number of Posterior Occluding Pairs of natural teeth (POPs)	1 = 10-12 POPs
	2 = 5-9 POPs
	3 = 0-4 POPs
Number of Anterior Occluding Pairs of natural teeth (AOPs)	1 = 6 AOPs
	2 = 4-5 AOPs
	3 = 0-3 AOPs
Number of Occluding Pairs of natural plus replaced teeth (OPRs)	1 = 16-18 OPRs
	2 = 11-15 OPRs
	3 = 0-10 OPRs
Number of Posterior Occluding Pairs of natural plus replaced teeth (POPRs)	1 = 10-12 POPRs
	2 = 5- 9 POPRs
	3 = 0- 4 POPRs
Number of Anterior Occluding Pairs of natural plus replaced teeth (AOPRs)	1 = 6 AOPRs
	2 = 4- 5 AOPRs
	3 = 0-3 AOPRs
Unfilled spaces including (unfilled posterior spaces and unfilled anterior spaces)	1 = 0 unfilled spaces
	2 = 1-2 unfilled spaces
	3 = 3+ unfilled spaces
Self-perceived dry mouth	1 = No dry mouth
	2 = Dry mouth

[5] The definition of all types of the occluding pairs in this thesis were:

OPs: Occluding Pairs of natural teeth

POPs: Posterior Occluding Pairs of natural teeth

AOPs: Anterior Occluding Pairs of natural teeth

OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Anterior Occluding Pairs of natural plus replaced teeth

The number of teeth

The number of teeth was calculated as the number of natural teeth and the number of natural plus replaced teeth. The number of natural teeth was numbers of natural teeth of each dentate person including people with replaced teeth (excluding third molars). The number of natural plus replaced teeth was the numbers of natural plus replaced teeth of each dentate person (excluding third molars). In this study, the replaced teeth were defined as missing teeth being replaced by a fixed or removable prosthesis (i.e., a pontic, removable partial denture). A fixed or removable prosthetic replacement was considered to exist when it was visible in the mouth. In the case of removable appliances not being worn at the time of examination, the replacement was considered to exist when the subjects reported that an appliance existed and they wore it. The subjects were classified according to frequency distribution of the variable into three groups by number of natural teeth: 1 = 26-28, 2 = 21-25, 3 = 1-20 natural teeth. Similarly, the subjects were divided into three groups by numbers of natural plus replaced teeth: 1 = 26-28, 2 = 21-25, 3 = 1-20 natural plus replaced teeth.

The number of Occluding Pairs

The number of Occluding Pair of natural teeth (OPs) was a pair of natural teeth opposing each other (excluding third molars). Because a score of two is given for each occluding pair of molars the maximum number of OPs of natural teeth is 18. The subjects were divided according to frequency distribution of the variable into three groups by the numbers of OPs: 1 = 16-18, 2 = 11-15, 3 = 0-10 OPs. Similarly, the subjects were divided three groups by numbers of Occluding Pairs of natural plus replaced teeth (OPRs): 1 = 16-18, 2 = 11-15, 3 = 0-10 OPRs.

The number of Posterior Occluding Pairs

The number of Posterior Occluding Pairs of natural teeth (POPs) was a pair of premolars and molars opposing each other. The maximum number of POPs was 12. The subjects were divided into three groups by numbers of POPs: 1 = 10-12, 2 = 5-9, 3 = 0-4 POPs. Similarly, the subjects were divided into three groups by the numbers of Posterior Occluding Pairs of natural plus replaced teeth (POPRs): 1 = 10-12, 2 = 5-9, 3 = 0-4 POPRs.

The number of Anterior Occluding Pairs

The number of Anterior Occluding Pairs of natural teeth (AOPs) was a pair of incisors and canines opposing each other. The maximum number of AOPs was 6. The subjects were divided into three groups by number of AOPs: 1 = 6, 2 = 4-5, 3 = 0-3 AOPs. Similarly, the subjects were divided into three groups by numbers of Anterior Occluding Pairs of natural plus replaced teeth (AOPRs): 1 = 6, 2 = 4-5, 3 = 0-3 AOPRs.

The number of unfilled spaces

Unfilled spaces between teeth are due to missing teeth not being replaced by a fixed or removable prosthesis. Unfilled spaces include unfilled anterior spaces and unfilled posterior spaces. All unfilled spaces variables (unfilled spaces, unfilled anterior spaces and unfilled posterior spaces) were categorized into three groups for statistical analysis: 1 = 0, 2 = 1-2, 3 = 3+ unfilled spaces.

Self-perceived dry mouth

Self-perceived dry mouth was measured using a question which the response was as yes/no. The participants were divided into two groups:

0 = No dry mouth

1 = Dry mouth

4.4.4.3. Potential confounding variables

Potential confounder variables are defined as the factors associated with but not affected by both explanatory variable and outcome variable (Rothman and Greenland, 1998). Confounding can lead to an overestimate or underestimate of the true association between the explanatory variable and outcome and can even change the direction of the observed effect (Hennekens and Buring, 1987). Therefore, the effects of the confounding variables should be adjusted for in order to get the true relationship between explanatory variable and the outcome variables. The variables selected as potential confounders in the present study are presented in Table 4.6.

Table 4.6 Confounders selected for statistical analysis.

Confounder	Categories
Age	55-64 yrs
	65-74 yrs
	75+yrs
Sex	Male
	Female
Occupation	Non manual
	Manual
Self-assessed social class	High
	Low
Self-perceived general health	Good or better
	Fair or less

The variables were as follows:

Age: Age ranged from 55 to 100 years older. For the statistical analysis, age was classified into three groups: 1 = 55-64 years older, 2 = 65-74 years older and 3 = 75+

years older.

Sex: Sex was coded as: 1 = Male and 2 = Female.

Occupations: The questions on the past occupation of subjects had 8 answers, which were professionals, administrator, worker, clerks, services, business, peasants, and others.

The categories were reduced to two categories:

1 = Non–manual (professionals, administrator)

2 = Manual (worker, clerks, services, business, peasants, and others)

Levels for self-assessed social class: Levels for self-assessed social class ranged between 1-10 which reflects how high their social class was in their opinion (Appendix 4). Using the median as a cut-off point, a dichotomous variable was defined and coded as:

1 = High self-assessed social class (score = 5-10)

2 = Low self-assessed social class (score = 1-4).

Self-perceived general health: A rating scale was used to rate the self-perceived general health. The question was "in general, would you like to say your general health is?" The five answers were:

1 = Excellent

2 = Very good

3 = Good

4 = Fair

5 = Poor

This variable was reduced to two categories and coded as:

1 = Good or better (codes 1 and 2 and 3)

2 = Fair or less (codes 4 and 5)

4.4.5. Data analysis

The analysis was carried out by using the Statistical Package for Social Sciences (SPSS 14.0). There were four stages in data analysis. Firstly, the reliability and validity tests for the Index of Eating Difficulty (IED) and the OIDP index were assessed. Secondly, descriptive analysis was conducted to identify sample distribution, demographic background, oral health status and the prevalence of the outcome variables. Thirdly, Univariate statistical analysis was used to investigate unadjusted relationships between the outcome and the explanatory variables. Finally, multiple logistic regressions were used to test adjusted relationships between the outcome and the explanatory variables.

4.4.5.1. The reliability and validity tests

The reliability of a scale is a fundamental way to reflect the amount of error, random and systematic, inherent in any measurements (Streiner and Norman, 1995). Two frequently used indicators of a scale's reliability are test-retest reliability and internal consistency. The test-retest reliability of a scale is assessed by administering it to the same people, on the same difference occasions, and calculating the correlation between two scores obtained. It refers to the reproducibility or consistency of the instruments. Intraclass Correlation Coefficient (ICC), unweighted kappa and weighted kappa can be used to test test-retest correlations. High test-retest correlations indicate a more reliable measure (Pallant, 2003).

The second aspect of reliability that can be assessed is internal consistency. This is the degree to which the items that make up the scale are all measuring the same underlying attribute. Internal consistency can be measured a number of ways. The commonly used statistics are the inter-item correlation, the corrected item-total correlation and Cronbach's coefficient alpha (Pallant, 2003).

The validity of a scale refers to the degree to which it measures what it is supposed to measure. Unfortunately there is no one clear-cut indicator of scales validity (Pallant, 2003). However, many different approaches can be used to assessing validity in different situation. Usually, face and content validity, criterion validity and construct validity are used to test the validity of a scale. The terms face validity and content validity are technical descriptions of the judgement that a scale looks reasonable. Both face and content validity refers to a subjective judgement by experts and some empirical persons whether the scale appears appropriate for the intended purpose (Streiner and Norman, 1995). Criterion validity refers to the correlation of a scale with some other measure that is accepted as the "gold standard", while construct validity involves testing a scale score, not against a single criterion, but in terms of theoretically derived hypotheses concerning the nature of underlying variable and construct and is a way of assessing validity by investigating its relationship with other constructs. If other scales of the same or similar attributes are available, criterion validity should be tested. If no such other measure exists, construct validity testing becomes even more important. In the absence of criterion, some evidence of construct validity should be available (Streiner and Norman, 1995).

Testing the Index of Eating Difficulty (IED)

There are three kinds of scaling responses, namely nominal variable, ordinal variable and interval variable (Streiner and Norman, 1995). Generally speaking, rating scales, where the response is on a five-point or seven-point scale, are not considered interval level measurements since we can never be sure that the distance between "strongly disagree" and "disagree" is the same as between "agree" and " strongly agree" (Streiner and Norman, 1995). In psychological and attitudinal research, some techniques, such as

Guttman scaling, have been developed to combine individual items into scales and indices (McIver and Carmines, 1981). The Guttman scaling is a means of analysing the underlying characteristics of several items in order to examine how closely a set of items corresponds with the idea of cumulativeness (Petersen, 1989). Guttman scales are unlikely to have interval scale properties but ordinal scale (Streiner and Norman, 1995). Guttman scaling has been widely used in the area of attitude measurement in survey research (Leake, 1990; Petersen, 1989).

The IED is a new index, which has not been used before. It is necessary to establish its reliability and validity. The purpose of the present study was to develop and evaluate the Guttman Scaling-Index of Eating Difficulty (IED). The IED is based on certain Chinese foods, whether people could ordinarily eat them. The IED were computed by summing the responses to every item they were able to eat. If people could eat, the answer was "yes" which is coded as 1. Conversely, if people could not eat food, the answer was "no" which is coded as 0. Then the order of frequency of "yes" responses was arranged and the patterns of responses were examined.

There are two important properties, namely reproducibility and scalability to test the reliability of the index. The Coefficient of Reproducibility (CR) is a measure of the extent to which a responses scale is a predictor of the respondent's pattern. The formula for this coefficient is CR = 1.0 – (no. errors) / [(no. items) × (no. respondents)] (Streiner and Norman, 1995). CR can vary between 0 and 1, and should be higher than 0.9 for the scale to be reliable. The Coefficient of Scalability (CS) is truly unidimensional and cumulative. The formula for this coefficient is CS = 1.0 – (no. errors) / Maximum errors. CS also vary 0 to 1, and should be at least 0.6 (Streiner and Norman, 1995).

The validity of IED was tested as well. The face and content validity was tested by comments from two experts of dentistry, one expert on nutrition and one expert on statistics. Then administration of questionnaire was test on 205 Chinese elderly in the second pilot study. Informal discussions took place, aiming to improve the understanding of the content of the questionnaire. Since no other "gold standard" index existed, three other measures - General Eating Difficulty (GED), Dissatisfaction with Chewing ability (DCA) and OIDP eating impact were used to test construct validity. The IED is a dichotomous variable. Therefore, the Chi-Squared test was used.

106 subjects were involved for test–retest reliability. Weighted kappa was calculated on Index of Eating Difficulty because IED was an ordinal variable.

Testing the OIDP index

The Oral Impacts on Daily Performances (OIDP) index (Adulyanon and Sheiham, 1997) has been widely used. However, every time a scale is used in a new context or with a different group of people, it is necessary to re-establish its psychometric properties (Streiner and Norman, 1995). In this study, the OIDP was applied in Mainland China for the first time. Therefore, it was necessary to retest its psychometric properties, which refer to reliability and validity. Reliability, in terms of rest-retest reliability and internal consistency were tested, while validity, in terms of face, content, construct validity was also assessed in the present study.

Related to internal consistency, three measures, the inter-item correlation, item-total correlations and Cronbach's alpha (α) Coefficient (Cronbach, 1951), which is based on the average correlation among the items and the number of items in the scale (Streiner and Norman, 1995), were used in this study.

There were two stages related to the assessment of the face and content validity of the

OIDP index. In the first stage, a panel of Chinese experts in dentistry, two epidemiologists and a medical statistician gave the comments on the face and content validity before the second pilot study. Second stage, OIDP was tested on subjects in the second pilot study. Informal detailed discussion, some wording modifications and the comprehensiveness of the OIDP index implied in order to explore the relevance and understand of the content of the questionnaire. All changes were done before the main study. Construct validity was tested by investigation of relationship of OIDP scores and self-perceived dental treatment, self-perceived oral health and self-perceived general health using Kruskal-Wallis tests.

106 subjects were re-interviewed for test –retest reliability throughout the whole process of study. Weighted kappa was calculated on the OIDP categories and ICC for OIDP scores.

The assessment of the reliability and the validity of the OIDP index refer to the total sample including edentate people and dentate people.

4.4.5.2. Descriptive analysis

Descriptive results were conducted in order to identify the main patterns of data. This included information about sample distribution, demographic background, dental status, eating difficulty, oral impact, self-perceived dry mouth, and self-perceived general health. The number of teeth, number of occluding pairs and number of unfilled spaces which were continued data but not normally distributed while sociodemographic data were categorical variables. Therefore, the non-parametric statistical test (Mann-Whitney for binary variables, Kruskal-Wallis for variables with more than two categories) was used for the relationship between clinical dental status and sociodemographic variables.

4.4.5.3. Univariate analysis

Before performing a logistic regression, it is necessary to carry out univariate analysis to explore the patterns of relationships between the variables. The results of univariate analysis guided the decision for which variables to include and adjust for in the multiple logistic analysis

The Chi-Squared test was used to determine if two categorical variables are related. Index of Eating Difficulty (IED), General Eating Difficulty (GED) and Dissatisfaction with Chewing Ability (DCA), OIDP eating impact and self-perceived dry mouth are dichotomous variables (yes/no). Therefore, the Chi-Squared test could be used to explore the relationships between IED, GED, DCA, OIDP eating impact, and self-perceived dry mouth and sociodemographic factors, and dental status. For dichotomous explanatory variables (such as sex, occupation, self-assessed social class), the Chi-Squared test was used. For those explanatory variables that had more than two categories (like age group, number of teeth, number of occluding pairs and number of unfilled spaces), the Chi-Squared test for trend was used.

Mann-Whitney and Kruskal-Wallis tests are appropriate to test the significance of the association between a categorical variable and a continuous variable. The OIDP scores were continuous variables and not normally distributed. Therefore, the same non-parametric statistical tests (Mann-Whitney for binary variables, Kruskal-Wallis for variables with more than two categories) were used to compare the scores on different groups of explanatory variables.

Simple logistic regression analyses were also used as part of the univariate analysis to test the unadjusted relationships between potential explanatory variables and the outcome of interest.

A p value equating to 0.05 is considered statistically significant. When comparing each of the three groupings of the numbers of teeth, the numbers of occluding pairs and the numbers of unfilled spaces with each other, modified Bonferroni correction was used to adjust the alpha value (Keppel, 1991). Here, alpha was set at less than 0.05.

4.4.5.4. Multiple logistic regression

This section investigated the relationships between clinical dental status and Index of Eating Difficulty (IED), General Eating Difficulty (GED), Dissatisfaction with Chewing Ability (DCA), binary OIDP and OIDP eating impact. It also explored the relationship between eating difficulty and oral health-related quality of life (OIDP). Due to GED, DCA and OIDP eating impact were a dichotomous variable, IED was an ordinal variable and OIDP scores were not normally distributed. The investigation of the way that these outcome variables were associated with explanatory variables should be done using the logistic and not the linear regression. When multiple logistic regression analyses were run, a set of adjustment variables were entered into the model along with one clinical variable. Subsequently, different regression analyses were carried out for each clinical variable.

For the regression models, p-values were obtained from the Wald test, and estimated odds ratios and their 95% confidence limits were determined. Here alpha was set at 0.05.

The outcome measures (IED, GED, DCA, OIDP eating impact, Binary OIDP) could be influenced by non-clinical and clinical variables simultaneously. In order to trace the true relationships between the eating difficulty, oral health-related quality of life and the clinical variables, the initial results would have to be adjusted. As the different clinical measures were used alternately, the adjustment process would help to avoid confounding by non-clinical variables.

The rate of tooth loss increases with age (Marcus et al., 1996). In addition, age was associated with oral health-related quality of life (Steele et al., 2004). The results from the second national survey of oral health status in China showed that men had more remaining natural teeth than women (Wang et al., 2002). The results from the initial analysis in this study showed that occupation and self-assessed social class were associated with eating difficulty and oral impacts. Therefore, sociodemographic factors (including age, sex, occupation and self-assessed social class) were adjusted in the first adjusted model. Furthermore, studies showed that self-perceived general health was related to chewing ability (Miura et al., 2005) and well-being (Murata et al., 2006). The second adjusted model was adjusted by age, sex, occupation and self-assessed social class plus self-perceived general health. For exploring the relationships between eating difficulty and OIDP scores, and OIDP eating impact, one more adjusted model was needed in order to include clinical variables. This model, apart from the effects of age, sex, occupation and self-assessed social class, self-perceived general health, it also adjusted for the numbers of OPs, OPRs and self-perceived dry mouth, since the latter aforementioned variables were also significantly related to eating difficulty and oral health-related quality of life.

Chapter 5

5. Results

5.1. Introduction

This chapter presents the findings of this study. Firstly, general results including response rate and the results from reliability and validity tests are presented. Secondly, descriptive results are displayed in section 5.3. This includes details about the sample and frequency distribution of the variables in the study. Then the results from univariable and logistic regression analyses looking at the relationships of clinical dental status and eating difficulty, and oral health-related quality of life are presented on section 5.4 and 5.5. Next, the results regarding the relationships between eating difficulty and OIDP scores, and OIDP eating impact are displayed in section 5.6. Finally, a summary of the main findings is presented in Section 5.7.

5.2. General Results

5.2.1. Response rate

1465 people aged 55 years and over were sent appointments for medical check-ups by the hospital administration at the centre where the older people normally went for their routine check-ups. Of the 1465, 1276 subjects went for their routine medical check-ups, a response rate of 87.1%. All 1276 subjects were asked to have a dental examination and complete a questionnaire. 1230 agreed to take part in this dental study, a response rate of 96.4%. The final sample was reduced to 1229, because one person did not pass the cognitive test.

5.2.2. Reliability of clinical data

Both inter- and intra-examiner reliability of tooth spaces measurement, tooth contacts and DMFT for tooth crown and root caries were assessed. To assess inter-examiner reliability 66 subjects were each examined by 4 examiners with the main examiner acting as the gold standard. To assess intra-examined reliability 103 subjects (approximately 10% of the samples) were examined twice by the same examiner, with the two sessions taking one week apart. Cohen's unweighted kappa coefficients of agreement (Cohen, 1960) were then calculated to compare each of the other 3 examiners with the main examiner and to compare each examiners scores at one time with their scores of the same participants a week later. The kappa scores for inter-examiner and intra-examiner agreement were very high (Table 5.1a-5.1b).

Table 5.1a Kappa scores for inter-examiner variability in clinical data: comparison with the gold-standard examiner.

	Kappa scores		
Examiner(s) agreement	**Tooth spaces**	**Tooth contacts**	**DMFT**
Inter-examiner			
The main examiner-examiner 1	0.89	0.84	0.88
The main examiner-examiner 2	0.87	0.83	0.85
The main examiner-examiner 3	0.89	0.85	0.81

Table 5.1b Kappa scores for intra-examiner variability in clinical data

	Kappa scores		
Examiner(s) agreement	**Tooth spaces**	**Tooth contacts**	**DMFT**
Intra-examiner			
The gold examiner	0.94	0.94	0.93
Examiner 1	0.94	0.94	0.90
Examiner 2	0.92	0.95	0.83
Examiner 3	0.93	0.95	0.81

5.2.3. Reliability of questionnaires

For the test-retest reliability of the questionnaire, a re-interview session was carried out in the routine check-ups centre of the hospital. 106 subjects were re-interviewed one week after the initial interview. Subjects were re-interviewed about general and oral health, self-perceived dry mouth, different measures of eating performance and the Oral Impacts on Daily Performances (OIDP) index.

The weighted kappa for questions on self-perceived general health and oral health was 0.88, the unweighted kappa for self-perceived dry mouth was 0.90 and the weighted kappa for eating performance measures was 0.89. The results in relation to the test-retest reliability of the IED and the OIDP index are presented in subsection 5.2.4-5.2.5.

5.2.4. Reliability and validity of Index of Eating Difficulty (IED)

Table 5.2 presents details of the construction of Index of Eating Difficulty. Since no subjects answered "have not tried", the responses to each item fall into two categories, namely "yes" (code 1), indicating ability to eat the foods, and "no" (code 0) indicating inability to eat the foods listed. This analysis refers to 1227 respondents since 2 people did not answer these questions.

Table 5.2 arranges the foods in ascending order of positive responses, from the most difficult to the least difficult to eat, namely from salted roasting chicken, roast pork ribs, roast duck or chicken to cooked sliced pork or cooked green vegetable. The patterns of responses to the items showed a typical Guttman scaling. The response patterns in A, C, E, F, G, and H have perfect Guttman scalability. This means when people selected one food on the left, foods to the right were also selected. However, B and D patterns, which deviated from the cumulative patterns, are considered as an error. There were a total of 33 errors in this study.

For the Guttman scaling, two important indices reflect how much an actual scale deviates from perfect cumulativeness. They are the coefficient of reproducibility and the coefficient of scalability which related to reliability testing of the index (Streiner and Norman, 1995) (For details see Methods). In this study, the coefficient of reproducibility was 0.99. This figure was well over 0.90, which is the recommended minimum acceptable level. The coefficient of scalability was 0.89, which is well above the minimum acceptable value of 0.6 (Menzel, 1953).

Table 5.3 presents the validity of the index when compared to three other measures of eating difficulty contained in other parts of the interview. The results showed that there were highly significant relationships between IED and General Eating Difficulty (GED) Dissatisfaction with Chewing Ability (DCA) ($p < 0.001$) and OIDP eating impact ($p < 0.001$). For test-retest reliability of IED, the weighted kappa was 0.89.

Table 5.2 Construction of Index of Eating Difficulty (IED) (N = 1227).

IED		Pattern of Reponses of Item						Errors	
		Eatq4	Eatq1	Eatq3	Eatq5	Eatq2	Frequency	In pattern	Total
0	A	1	1	1	1	1	994	0	
	B	1	0	1	1	1	30	1	30
1	C	0	1	1	1	1	53	0	0
	D	0	1	0	1	1	3	1	3
2	E	0	0	1	1	1	69	0	0
3	F	0	0	0	1	1	42	0	0
4	G	0	0	0	0	1	8	0	0
5	H	0	0	0	0	0	28	0	0
Total		1024	1050	1146	1191	1199	1227	2	33

*Eatq1: able to eat whole apple or corn on the cob, or something very similar to that.

Eatq2: able to eat cooked sliced pork or cooked green vegetable, or something very similar to that.

Eatq3: able to eat boiled chicken or duck, or something very similar to that.

Eatq4: able to eat salted roasting chicken or roast pork ribs or roast duck or chicken, or something very similar to that.

Eatq5: able to eat cooked cucumber or lotus root, or cooked carrots, or something very similar to that.

Table 5.3 Validity test for Index of Eating Difficulty (IED) (N = 1227).

Variables / categories	N	IED=1-5 N (%)	†p-Value
General Eating Difficulty			< 0.001
No difficulty	609	0 (0.0)	
Difficulty	618	203 (32.8)	
Dissatisfaction with Chewing Ability			< 0.001
Satisfied	720	22 (3.1)	
Dissatisfied	507	181 (35.7)	
OIDP eating impact			< 0.001
No impact	532	32 (6.0)	
Impact	695	171 (24.6)	

† Chi-Squared test

5.2.5. Reliability and validity of the OIDP index

The results of reliability tests showed that the inter-item correlation coefficients among the scores of the 9 items of OIDP index ranged from 0.04 for the relationship between "light physical activities" and "cleaning", to 0.70 for the relationship between "going out" and "light physical activities" (Table 5.4). None of the correlations were negative, which means homogeneity of the items was not in question.

The corrected item-total correlations ranged from 0.30, for the item on "light physical activities" to 0.47 for the item on "social contacts" (Table 5.5). They were all above the minimum recommended level of 0.20 for including an item in a scale (Kline, 1986).

The standard item alpha was 0.72 (Table 5.5). It was over the recommended minimum value of 0.70 (Streiner and Norman, 1995) and well over another recommended minimum value of 0.5 (Woodbury, 1950; Cronbach, 1951; Ebel, 1951). The alpha coefficients did not increase when any one of the items was deleted.

For the test-retest reliability, the weighted kappa was 0.86 for the OIDP categories and the Intraclass Correlation Coefficient (ICC) was 0.91 for the OIDP scores. The construct validity tests refer to the 9-items version of the OIDP index (Table 5.6). The results show that people who perceived a need for dental treatment had much higher OIDP scores than those that did not think they needed treatment ($p < 0.001$). Also there were highly significant relationships between OIDP scores and self-perceived oral health ($p < 0.001$) and self-perceived general health ($p < 0.001$). The higher the level of self-perceived oral health and self-perceived general health, the lower the OIDP scores (Table 5.6)

Table 5.4 Reliability analysis of OIDP index: OIDP items correlation matrix in dentate and edentate people (N = 1229).

OIDP items	Eating	Speaking	Cleaning	Light physical activities	Going out	Relaxing /Sleeping	Smiling	Emotional stability	Social contact
Eating	1.00								
Speaking	0.28	1.00							
Cleaning	0.35	0.12	1.00						
Light physical activities	0.09	0.23	0.04	1.00					
Going out	0.08	0.21	0.10	0.70	1.00				
Relaxing (sleeping)	0.26	0.11	0.15	0.27	0.23	1.00			
Smiling	0.17	0.31	0.09	0.11	0.13	0.42	1.00		
Emotional stability	0.20	0.15	0.12	0.51	0.40	0.36	0.07	1.00	
Social contacts	0.25	0.32	0.14	0.11	0.16	0.25	0.65	0.28	1.00

Table 5.5 Reliability of OIDP items: corrected item-total correlation.

OIDP items	Corrected Item-Total Correlation	Alpha if Item Deleted
Eating	0.44	0.61
Speaking	0.39	0.59
Cleaning	0.31	0.61
Light physical activities	0.30	0.63
Going out	0.31	0.63
Relaxing (Sleeping)	0.34	0.61
Smiling	0.37	0.60
Emotional stability	0.37	0.61
Social contacts	0.47	0.57

Standardized item Alpha = 0.72

Table 5.6 Validity tests for the OIDP index (N = 1229).

Variables	N	Mean Rank (OIDP scores)	†p -Value
Self-perceived dental treatment need			< 0.001
Yes (4-5)	489	761	
Maybe (3)	288	631	
No (1-2)	452	445	
Self-perceived oral health			< 0.001
Very Good	28	309	
Good	81	429	
Fair	627	540	
Poor	770	770	
Self-perceived general health			< 0.001
Very Good	72	440	
Good	194	527	
Fair	734	619	
Poor	229	731	

† Kruskal-Wallis tests

5.2.6. Summary

The response rate was high, 96.4%. The unweighted kappa statistics of inter-examiner and intra-examiner reliability were very good. The kappa ranged from 0.89 to 0.81 for inter-examiner agreement and from 0.95 to 0.81 for intra-examiner agreement. The kappa for reliability of the questionnaire was also good, with the weighted kappa being 0.88 for oral health and self-perceived general health and the unweighted kappa being 0.90 for self-perceived dry mouth.

Reliability and validity of the IED and the OIDP indices were tested. Both indices indicated very good levels of reliability and validity.

5.3. Descriptive results

This section presents the results related to sociodemographic characteristics and clinical dental status of the respondents.

5.3.1. Demographic and social characteristics of the sample

Of the 1229 in the study population, 51.7% were female and 48.3% males. One quarter of the subjects had completed university education, 42.7% had finished middle and high school, while a quarter had only finished primary school or had no formal education. 48.6% had been in non-manual and 51.4% in manual occupations (Table 5.7). 29.3% had earned a high income ($\geq$1000 Yuan/month), 32.1% people had a middle income (500-1000 Yuan/month), and 38.6% had earned a low income (< 500 Yuan/month). 49.3% reported that they were lower social class and 50.7% reported they were higher social class (Table 5.7).

5.3.2. Dental characteristics

5.3.2.1. Clinical dental status

The majority of subjects (97%) were dentate. Only 33 participants were edentate. Therefore most of the analyses in this report are based on the 1196 dentate people. Among people with natural teeth, 596 of the 1196 had 26-28 natural teeth (excluding third molars). 77.9% had 21 or more natural teeth and 22.1% of subjects had 20 or fewer natural teeth (Table 5.8). 69.2% had at least 11 OPs, 74.2% had at least 5 POPs and 82.9% had at least 4 AOPs (Table 5.8).

73.1% of dentate subjects had 26-28 replaced plus natural teeth, 18.6% had 21-25 replaced plus natural teeth and 8.3% had 20 or less replaced plus natural teeth. 81.7%

had at least 11 OPRs and 84.4% had at least 5 POPRs. 90.4% of people had at least 4 AOPRs. About one in six people had 0 to 10 OPRs and 0 to 4 POPRs. Just one in ten people had 3 or less AOPRs (Table 5.8).

In dentate people, 42.7% had no unfilled spaces and 45.5% had no unfilled posterior spaces. 83.4% people had no unfilled anterior spaces. About a quarter of people had at least 3 or more unfilled spaces or unfilled posterior spaces but only 6.1% had 3 or more unfilled anterior spaces (Table 5.8).

The frequency distributions of the main clinical variables were skewed. Therefore, the minimum, maximum and a number of percentiles - 5%, 25%, 50% (median), 75%, and 95% - were used instead of the means (Table 5.9).

The number of natural teeth ranged from 1 to 28 teeth, with a median of 25 teeth while number of natural plus replaced teeth ranged from 1 to 28 teeth with median of 27 teeth. The median DMFT was 4. Few people had decayed and filled teeth, less than 5% of the sample had more than 2 decayed teeth, or more than 4 filled teeth. The number of missing teeth ranged from 0 to 27 teeth with a median of 3 teeth. The number of teeth that had increased mobility (grade 1 or more) ranged from 0 to 20, but less than 5% the subjects had more than 5 mobile teeth (Table 5.9). In this thesis, DMFT did not include root caries.

The medians for OPs, POPs and AOPs were 14, 9, and 6 pairs of teeth respectively. When considering replaced missing teeth, people had a higher number of occluding pairs for natural plus replaced teeth. The medians of OPRs, POPRs and AOPRs were 16, 10, and 6 pairs respectively (Table 5.9).

Unfilled spaces between teeth were due to missing teeth not being replaced by a fixed or removable prosthesis. The number of unfilled spaces ranged from 0 to 27 with a median of 1. Less than 5% of subjects had more than 11 unfilled spaces. The median of unfilled posterior spaces was 1. The majority of subjects had no unfilled anterior spaces, less than 5% had more than 3 unfilled anterior spaces (Table 5.9).

A total of 526 (44.0%) dentate people had a prosthesis. 49 subjects (4.1%) wore partial dentures in both jaws, 43 subjects (3.5%) wore only a partial denture(s) in the upper jaw and 29 subjects (2.3%) wore only a partial denture (s) in the lower jaw. 125 (10.5%) subjects had bridge(s) in both jaws. 126 subjects (10.5%) had a bridge only in the upper jaw and 73 subjects (6.1%) had a bridge in the lower jaw (Table 5.10).

Of the 33 edentulous subjects, 30 (91%) wore complete dentures in both jaws, 1 (3%) wore a complete denture in the upper jaw only, while only 2 (6%) subjects did not wear any denture at all (results not presented).

5.3.2.2. The relationships between clinical dental status and sociodemographic factors

This section presents the results on the relationships between clinical dental status and sociodemographic factors.

There were significant differences in DT ($p = 0.004$), MT ($p < 0.001$) and DMFT ($p < 0.001$) but not FT ($p = 0.4$) by age group. Older people were more likely to have decayed and missing teeth. There were significant differences in MT ($p = 0.02$) and FT ($p < 0.001$) but not DT ($p = 0.17$) and DMFT ($p = 0.60$) by sex. There were significant differences in DT ($p = 0.002$) and FT ($p < 0.001$) but not MT ($p = 0.80$) and DMFT ($p = 0.36$) by occupation. There were significant differences in DT ($p = 0.02$), FT ($p < 0.001$) but not MT ($p = 0.87$) and DMFT ($p = 0.69$) by self-assessed social class. People from manual occupation or lower self-assessed social class were more likely to have caries when compared to those from non-manual occupation or higher self-assessed social class. The proportion and number of missing teeth were strongly associated with age. About 80% of people had missing teeth. Slightly more males and people from manual occupations had missing teeth compared to females and people with non-manual occupations. People reporting lower social class had more missing teeth compared to people reporting high social class. Females, people with non-manual occupations and with higher self-assessed social class had higher mean filled teeth than male, those with manual occupation and lower self-assessed social class, but these differences were not significant (Table 5.11).

There were significant differences in both number of natural teeth and number of natural plus replaced teeth by age group ($p < 0.001$). The number of teeth decreased as age increased (Table 5.12). There were also significant differences in the numbers of natural plus replaced teeth, but not in the numbers of natural teeth, by sex ($p = 0.02$), occupation ($p = 0.02$), and education ($p < 0.001$). Females, people with non-manual occupations and people with high education had slightly more natural plus replaced teeth compared with males, people in manual occupations and people with low education respectively (Table 5.12). This indicates that women, people from non-manual occupations and higher self-assessed social class were more likely to replace their missing teeth. There was no significant difference in both numbers of natural teeth and numbers of natural and replaced teeth by personal income and self-assessed social class (Table 5.12).

There were significant differences by age in numbers of OPs, POPs, AOPs OPRs, POPRs, and AOPRs ($p < 0.001$). As age increased, numbers of OPs, POPs, AOPs, OPRs, and AOPRs by sex (p = 0.02 for both tests) by occupation (p = 0.05 and p = 0.02). Females and people with non-manual occupations had more OPRs and AOPRs compared to males and people with manual occupations but the clinical differences were small and the differences were less than 0.5. There were no significant differences in OPs, POPs, AOPs, and POPRs by sex and occupation, and no significant differences in OPs, POPs, AOPs, OPRs, POPRs, and AOPRs by self-assessed social class (Table 5.13-14).

There were significant differences in the numbers of unfilled spaces, unfilled posterior spaces, and unfilled anterior spaces by age ($p < 0.001$). With all of these increased as age increased (Table 5.15). Older people were more likely to have unfilled spaces (including unfilled posterior spaces, and unfilled anterior spaces). There were also significant differences in unfilled spaces (p = 0.02) and unfilled anterior spaces (p = 0.001) by sex and unfilled spaces (p = 0.03) and unfilled posterior spaces (p = 0.008) by occupation. Males had more unfilled spaces and unfilled anterior spaces compared to females. People with manual occupations had more unfilled spaces and unfilled posterior spaces when compared to people with non-manual occupations (Table 5.15).

Similar results were obtained when data were analysed separately for people with only natural teeth and people with natural plus replaced teeth, by selected sociodemographic factors (Table 8.2-4 in Appendix 8).

About 30% of the dentate subjects had one or more bridges and 15.2% of subjects wore removable partial denture(s) (Table 5.16). The percentage of people with more than one bridge, removable partial dentures, both bridge(s) and partial denture(s) or full removable dentures increased as age increased. People from non-manual occupations and higher self-assessed social class were more likely to have a bridge or removable partial denture(s) and less likely to have more than one bridge when compared with people from manual occupations or lower self-assessed social class. There were large clinical differences in the percentage of people with more than one bridge or removable partial dentures by age. For example, 23.2% of subjects aged 75 years and over, 18.5% of subjects aged 65-74 years and only 7.5% of subjects aged 55-64 years had more than one bridge or removable partial denture although these differences were not significant. The same was true for occupation and self-assessed social class. A large clinical difference in the percentage of people with a bridge, more than one bridge or removable partial denture(s) existed, by these characteristics. However, there was no significant difference in the percentage of people with different types of prostheses, by age, sex, occupation and self-assessed social class (Table 5.16).

5.3.3. Subjective measures

5.3.3.1. Distribution of subjective measures

The main subjective measures used in this study included self-perceived general health, self-perceived dry mouth, General Eating Difficulty (GED), Dissatisfaction with Chewing Ability (DCA), Index of Eating Difficulty (IED), Ease of Eating certain foods (EEF), the Oral Impacts on Daily Performances (OIDP), OIDP eating impact.

The majority of subjects reported that their general health was fair (59.5%). Only 263 (22.0%) said that it was good or better, while the remaining 18.5% assessed their general health as poor (Table 5.17).

GED was reported by 51.8% of subjects. The majority of those with GED had little eating difficulty. Very few people (3.9%) perceived they had a great amount of eating difficulty (Table 5.17). 3.3% of subjects reported that they were "very satisfied", 55.4%

were "satisfied", 39.0% were dissatisfied and 2.4% were very dissatisfied with their chewing ability (Table 5.17).

Self-perceived dry mouth was reported by 459 (38.4%) participants (Table 5.17). Among people with self-perceived dry mouth, 59.6% felt dry mouth at night, 26.3% felt dry mouth at other times of the day, only 10.2% felt dry on waking. The majority of people (97.2%) reported that their dry mouth did not cause difficulty chewing, swallowing or taking medicine. Most people (82.0%) relieved their dry mouth by sipping water or other liquids (Table 5.18).

The IED ranged from 0 to 5 with a median of 0, which 84.2% of people reported (results not presented). Table 5.19 shows the distribution of the subjects in the categories of the IED. 84.2% of subjects could eat one or more foods in each of 6 categories. 4.8% subjects could eat whole apple or corn on the cob/boiled chicken or duck/cooked cucumber or lotus root, or cooked carrots/cooked sliced pork, or cooked green vegetable. 5.1% could eat boiled chicken or duck/cooked cucumber or lotus root, or cooked carrots/cooked sliced pork, or cooked green vegetable. 3.3% could eat cooked cucumber or lotus root or cooked carrots/cooked sliced pork or cooked green vegetables, 0.4% people could only eat cooked sliced pork or cooked green vegetables. 2.2% could not eat any of the foods listed (Table 5.19).

In relation to the EEF, 48.2% subjects could eat salted roast chicken, roast pork ribs, roast duck or chicken with some difficulty or not at all. 36% had difficulty eating apples, about 30.2% had difficulty eating boiled chicken or duck, cooked sliced beef. 24.7% had difficulty eating cooked sliced pork while 18.1% had difficulty eating cooked carrots, cucumber, and green vegetables (Table 5.23).

The OIDP scores ranged from 0 to 80, with a median of 4.4 (results not presented). 56.7% of people had OIDP eating impact (Table 5.29).

5.3.3.2. Distribution of subjective measures by self-perceived general health and sociodemographic factors

The percentage of people with self-perceived dry mouth increased as age increased but this was not significant. There was a significant relationship between self-perceived dry mouth and self-perceived general health ($p < 0.001$). People reporting their general health as "fair or less" were more likely to have self-perceived dry mouth when compared with people with "good or better" general health. However, there were no significant relationships between the prevalence of self-perceived dry mouth and sex, occupation, and self-assessed social class (Table 5.20).

There were significant differences in IED, GED and DCA by age. Older people were more likely to have an IED between 1 and 5, and positive GED and DCA. There were also differences in IED and DCA by occupation, self-assessed social class. People with manual occupations and people with low self-assessed social class were more likely to have an IED between 1 and 5 ($p < 0.001$ for both tests) and high risk of having DCA ($p < 0.001$ and $p = 0.03$). People who perceived general health as "good or better" had lower risk of having positive GED ($p < 0.001$) and DCA ($p = 0.004$). No significant differences in IED, GED, DCA existed by sex (Table 5.21).

There were significant differences in OIDP scores by occupation ($p = 0.004$), self-assessed social class ($p < 0.001$) and self-perceived general health ($p < 0.001$), but no significant differences by age ($p = 0.28$) or sex ($p = 0.73$) (Table 5.22). People from non-manual occupations, with high self-assessed social class and with "good or better" general health were more likely to have lower OIDP scores when compared with people from manual occupations, low self-assessed social class and with "fair and less" general health. The median of OIDP was zero in people with "good or better" general health while the median of OIDP was 4.4 in those with "fair or less" general health (Table 5.22).

There were significant differences in the percentages of people with an OIDP eating impact by age ($p = 0.02$) and general health ($p < 0.001$). Older people were more likely to have an OIDP eating impact. People perceived "fair or less" general health were more likely to experience OIDP eating impact. There were no significant differences in OIDP eating impact by sex, occupation, and self-assessed social class (Table 5.22).

5.3.4. Summary

A total of the 1229 old people aged 55 years and over participated in the study. Only 33 were edentate. In the 1196 dentate people, 669 people had only natural teeth and 527 had both replaced teeth and natural teeth. The mean numbers of natural teeth was 23.2 while the mean numbers of natural plus replaced teeth was 25.7. DMFT was 6.3, with MT 4.8 and very few people had filled teeth (FT = 0.9) and decayed teeth (DT = 0.6). The mean numbers of OPs, the mean numbers of OPRs and the mean numbers of unfilled spaces were 12.4, 14.2 and 2.4 respectively.

Five measures, Index of Eating Difficulty (IED), General Eating Difficulty (GED), and Ease of Eating certain foods (EEF), Dissatisfaction with Chewing Ability (DCA), and OIDP eating impact were used to measure eating difficulty. The OIDP index was used to measure oral health related quality of life. A total of 459 subjects (38.4%) reported dry mouth. GED and DCA were reported by 51.8% and 41.4% respectively. 15.8% subjects had an IED between 1 and 5. OIDP eating impact was reported by 56.7% people. The OIDP scores ranged from 0 to 80, with a median of 4.4.

Older people, people with manual occupations, those with lower self-assessed social class and those reporting their general health as "fair or less" were more likely to have eating difficulty and OIDP eating impact. People with manual occupations, those with lower self-assessed social class and people with "fair or less" general health were more likely to have higher OIDP scores.

5.4. The relationship between clinical dental status and eating difficulty

5.4.1. Clinical dental status and ability to eat certain foods

Subjects were asked to rate the amount of difficulty they had eating certain foods including 16 individual food items chosen to establish any relationship between clinical dental status and eating difficulty. The list of foods had been selected in the first pilot study (Appendix 1).

The number of teeth affected ability to eat certain foods. People with more teeth were more likely to be able to eat certain hard foods without difficulty. About 80% of people with 1-20 natural teeth had some difficulty or could not eat salted roast chicken, roast pork ribs, roast duck or chicken at all. Only about 29% of people with 26-28 had a similar limitation in eating these foods (Table 5.23). 75.0% of people with 1-20 natural teeth had some difficulty or could not eat whole apples, while only 14.8% people with 26-28 natural teeth had a similar limitation (Table 5.23).

The numbers of OPs, POPs, AOPs, OPRs, POPRs, and AOPRs had similar trends in relationships, as for the number of teeth, in ease of eating certain foods (Table 5.23). For example, people with more POPs were less likely to have difficulty eating most hard food listed (Figure 5.1). The differences were highly significant for all foods listed except rice porridge, boiled fish and tofu in water which were easily eaten by everybody. After adjusting for the effects of age, sex, occupation, self-assessed social class and self-perceived general health, these differences were maintained significant (Table 5.24).

There were significant relationships between the number of unfilled spaces and ability to eat certain foods. As the number of unfilled spaces increased, the percentage having difficulty with some foods increased markedly (Table 5.23). The differences were highly significant for all foods listed except rice porridge, boiled fish and tofu in water (Table 5.23). These significant trends did not change after adjusting for the confounding variables ($p < 0.001$ for all tests) (Table 5.24).

People with self-perceived dry mouth were more likely to report difficulty eating most hard foods and some softer foods than those without self-perceived dry mouth. There were significant differences in eating salted roast chicken, roast pork ribs, roast duck or chicken, boiled chicken or duck, cooked sliced beef and cooked sliced pork, cooked green vegetable, cooked cucumber or lotus root and cooked carrots ($p \leq 0.001$) and also for eating whole apples, or corn on the cob ($p < 0.01$) (Table 5.23, Figure 5.2) (p-value not presented). After adjusting for age, sex, occupation, self-assessed social class and self-perceived general health, the differences were maintained significant for salted roast chicken, roast pork ribs, roast duck or chicken and cooked sliced pork ($p < 0.01$), for boiled chicken or duck, cooked sliced beef and, cooked cucumber or lotus root and cooked carrots ($p < 0.05$) but not significant for eating whole apples, corn on the cob and cooked green vegetable (Table 5.24).

Similar results were obtained when data were analysed separately for people with only natural teeth and people with replaced teeth (Table 8.5-8 in Appendix 8).

5.4.2. Clinical dental status and Index of Eating Difficulty (IED), General Eating Difficulty (GED) and Dissatisfaction with Chewing Ability (DCA)

The number of natural teeth significantly affected the IED ($p < 0.001$). Similar results were obtained when data were analysed by number of natural plus replaced teeth ($p < 0.001$), numbers of OPs ($p < 0.001$), POPs ($p < 0.001$), AOPs ($p < 0.001$), OPRs ($p < 0.001$), POPRs ($p < 0.001$), AOPRs ($p < 0.001$) (Table 5.25). As number of teeth and numbers of OPs, POPs, AOPs, OPRs, POPRs, and AOPRs increased, the percentage of people with an IED between 1 and 5 decreased, namely people with more teeth or more OPs, POPs, AOPs, OPRs, POPRs, and AOPRs had less risk of having an IED between 1 and 5 (Table 5.25). The number of unfilled spaces showed similar trends and the IED was significantly related to unfilled spaces. People with more unfilled spaces, unfilled posterior spaces and unfilled anterior spaces had higher risk of having an IED between 1 and 5.

Furthermore, there were significant differences in the IED when comparing each pair of groups of all aforementioned variables that had three groups. For example, in the relationship between IED and number of teeth, there were significant differences for all possible comparisons: 1-20 teeth vs. 21-25 teeth; 1-20 teeth vs. 26-28 teeth; 21-25 teeth vs. 26-28 teeth ($p < 0.001$ for all 3 tests) (Table 5.25). Similar results were obtained from the data were analysed separately for people with only natural teeth and people with replaced teeth (Table 8.9-10 in Appendix 8).

The relationships between GED, as well as DCA and clinical dental status followed exactly the same patterns as for the respective relationship between IED and clinical dental status. There were significant differences for all measures of clinical dental status used, both overall as well as in relation to all possible differences between pairs of groups on the clinical dental status variables that contained three categories (Table 5.25). Similar results were also obtained from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.9-10 in Appendix 8).

Self-perceived dry mouth affected IED, GED and DCA and people with self-perceived dry mouth reported having more eating difficulty and less satisfaction with chewing ability than those without self-perceived dry mouth (Table 5.25).

5.4.3. Clinical dental status and Index of Eating Difficulty (IED) in the adjusted models

The results of the logistic regression analysis in the study of relationships between clinical dental status and IED are summarized in Table 5.26. Since the unadjusted relationships have already been previously reported, these sections will focus on the adjustment process and the reporting of the adjusted effects.

5.4.3.1. Number of teeth and IED

There were significant relationships between IED and both number of natural teeth and number of natural plus replaced teeth after adjustment for confounders ($p < 0.001$) (Table 5.26). After adjusting for the effect of age, sex, occupation, self-assessed social class and self-perceived general health, people with 1-20 natural teeth were 12.17 (95% CI = 7.45 - 19.89) times and those with 21-25 were 3.01 (95% CI = 1.81 - 4.99) times more likely to have an IED between 1 and 5 when compared to those with 26-28 natural teeth. Considering both natural and replaced teeth, people with 1-20 natural plus replaced teeth were 14.55 (95% CI = 8.75 - 24.18) times and those with 21-25 natural plus replaced teeth were 3.58 (95% CI = 2.39 - 5.36) times more likely to have an IED between 1 and 5 than people with 26-28 natural plus replaced teeth after adjusting for age, sex, occupation, self-assessed social class and self-perceived general health (Table 5.26).

Similar results were obtained from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.11-12 in Appendix 8).

5.4.3.2. Number of occluding pairs of teeth and IED

The relationship between the number of occluding pairs of teeth and IED was identical to that found for the number of teeth. That is, there were significant relationships between the numbers of occluding pairs of teeth and IED ($p < 0.001$). The significant relationships were maintained after adjusting for potential confounders ($p < 0.001$ for the two models, Table 5.26). There was a trend for the percentage of people with an IED between 1 and 5 to increase as the number of occluding pairs of teeth decreased. There was a statistically significant higher odds of an IED between 1 and 5 for those with 0-10 or 11-15 OPs (OR = 1.83, 95% CI = 1.05 - 3.39 and OR = 9.51, 95% CI = 5.72 - 15.84) compared with those with 16-18 OPs. Statistically significant differences existed between those with 0-4 POPs (OR = 8.82, 95% CI = 5.47 - 14.22) and those with 5-9 POPs (OR = 1.91, 95% CI = 1.13 - 3.24) compared to people with 10-12 POPs. The same was the case for those with less than 6 AOPs (OR = 2.85, 95% CI = 1.80 - 4.51 and OR = 7.51, 95% CI = 4.96 - 11.35) compared with those with 6 AOPs in Model 2 (Table 5.26).

A similar pattern existed in the relationships between the numbers of occluding pairs of natural plus replaced teeth and IED as for the numbers of occluding pairs of natural teeth (Table 8.13 in Appendix 8). Similar results were obtained from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.11-12 in Appendix 8).

5.4.3.3. Number of unfilled spaces and IED

Significant relationships existed between the numbers of unfilled spaces and IED in both unadjusted and adjusted model ($p < 0.001$) (Table 5.26). As the number of unfilled spaces, unfilled posterior spaces and unfilled anterior spaces increased the percentage of people with an IED between 1 and 5 increased. People with more than 2 unfilled spaces had 5.43 (95% CI = 3.58 - 8.23) times higher odds of experiencing an eating difficulty compared to people without unfilled spaces after controlling for confounders. The difference was statistically significant ($p < 0.001$) (Table 5.26). A similar pattern existed between people with more than 2 unfilled posterior spaces and those with 0 unfilled posterior spaces. As with unfilled anterior spaces, people with more than 2 unfilled anterior spaces had 13.98 (95% CI = 7.85 - 24.91) times, those with 1-2 unfilled anterior spaces had 4.17 (95% CI = 2.64 - 6.59) times higher odds of having an IED between 1 and 5 when compared to those with 0 unfilled ansterior spaces after controlling for all confounders (Table 5.26).

5.4.3.4. Self-perceived dry mouth and IED

Self-perceived dry mouth was significantly related to IED in both unadjusted and adjusted models. People reporting dry mouth had higher odds of having an IED between 1 and 5 when compared to people without dry mouth. The adjusted odds ratios, together with 95% confidence intervals were 1.51 (95% CI = 1.09 - 2.11) after adjusting for age, sex, occupation, self-assessed social class and self-perceived general health .

5.4.4. Clinical dental status and Dissatisfaction with Chewing Ability (DCA) in the adjusted models

5.4.4.1. Numbers of teeth and DCA

Significant relationships existed between DCA and both number of natural teeth and number of natural plus replaced teeth in both unadjusted and adjusted models ($p < 0.001$). There was a trend that as the number of natural teeth and the number of natural plus replaced teeth increased the probability of reporting dissatisfaction with chewing ability decreased. People with fewer teeth were more likely to be dissatisfied with their chewing ability. For example, people with 0-20 natural teeth had 5.64 (95% CI =3.99 - 7.98) times and people with 21-25 natural teeth had 2.53 (95% CI = 1.89 - 3.39) times higher odds of being dissatisfied with their chewing ability than people with 26-28 natural teeth after adjusting for sociodemographic factors and self-perceived general health (Table 5.27).

Similar results were obtained from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.14-15 in Appendix 8).

5.4.4.2. Number of occluding pairs of teeth and DCA

The number of occluding pairs of teeth was significantly associated with DCA in both unadjusted and adjusted models ($p < 0.001$). There was a trend for the odds of being dissatisfied with chewing ability to increase as the number of OPs decreased. When compared with people with 16-18 OPs, people with 11-15 OPs and those with 0-10 OPs had higher odds of dissatisfaction with chewing ability (OR = 2.14, 95% CI = 1.58 -

2.91, OR = 4.65, 95% CI = 3.38 - 6.41) after controlling for the effects of age, sex, occupation, self-assessed social class and self-perceived general health (Table 5.27). Similar results were obtained for the relationship between DCA and POPs, AOPs, OPRs, POPRs, and AOPRs (Table 5.27) (results for OPRs, POPRs and AOPRs are presented in Table 8.16 in Appendix 8).

Similar results were obtained from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.14-15 in Appendix 8).

5.4.4.3. Number of unfilled spaces and DCA

Significant relationships existed between the number of unfilled spaces and DCA ($p < 0.001$) (Table 5.27). A very clear trend existed in both unadjusted and adjusted models. That is, as the number of unfilled spaces increased the percentage of people who were dissatisfied with their chewing ability increased. For example, people with 1 to 2 unfilled spaces were 1.71 (95% CI = 1.27 - 2.29) times and those with 3 and more unfilled spaces were 5.80 (95% CI = 4.21 - 7.98) times more likely to report dissatisfaction with their chewing ability than those without unfilled spaces after adjusting for age, sex, occupation, self-assessed social class, and self-perceived general health (Table 5.27).

5.4.4.4. Self-perceived dry mouth and DCA

There was a significant relationship between self-perceived dry mouth and DCA. People with self-perceived dry mouth were 1.50 (95% CI = 1.18 - 1.92) times more likely to be dissatisfied with their chewing ability than people without self-perceived dry mouth in the adjusted models (Table 5.27).

The results for the relationships between different measures of clinical dental status and the prevalence of GED in the adjusted models were very close to the results for the respective relationships between clinical dental status and the prevalence of DCA (Table 5.28 and Table 8.17-5.19 in Appendix 8).

5.4.5. Summary

Clinical dental status was significantly related to eating difficulty. The number of teeth, number of occluding pairs, and number of unfilled spaces significantly affected eating difficulty. As the numbers of teeth (whether natural or replaced teeth) and the numbers of OPs, POPs, AOPs, OPRs, POPRs and AOPRs increased, the percentage of people who reported GED, DCA, an IED between 1 and 5 and difficulty eating certain foods decreased. After adjusting for age, sex, occupation, self-assessed social class and self-perceived general health, the significant relationships were maintained between all clinical measures and all measures of eating difficulty.

Self-perceived dry mouth had significant relationships to eating difficulty in both unadjusted and adjusted models, with people who had self-perceived dry mouth were more likely to report eating difficulties.

5.5. Oral Impacts on Daily Performances (OIDP)

5.5.1. Prevalence of OIDP impacts

718 (60%) of 1196 dentate people reported that oral impacts affected their daily life (Table 5.29). The most prevalent OIDP impact was eating impact, reported by 56.7% of dentate people. Next most prevalent OIDP impact was cleaning teeth, reported by 17.3% of dentate people, followed by relaxing (sleeping), which reported by 9.9% of dentate people. Impacts affecting light physical activities and going out had very low prevalence (Table 5.29).

5.5.2. Oral conditions causing oral impacts

The main causes of OIDP impacts were toothache (22.0%), tooth loss (19.1%), food catching (14.6%), sensitive teeth (13.4%), loose teeth (9.0%), swollen gums (5.7%), oral ulcer (4.8%) and ill-fitting denture (3.4%) (Table 5.30).

In relation to condition specific OIDP performances for eating impacts, food catching was the most common cause (20.9%), followed by tooth loss (19.3%), toothache (19.0%), loose teeth (15.5%), sensitive teeth (9.3%), and swollen gums (7.1%). For speaking impacts, tooth loss was the main cause (71.4%). Sensitive teeth (56.6%) caused mainly by cervical wear, was the main cause of cleaning impacts (61.9%). Tooth loss (48.4%) was the main cause of smiling impacts. Toothache was the main cause of many impacts including light physical activities (80.0%), going out (80.0%), emotional stability (70.8%), relaxing (sleeping) (65.8%), and social contact (31.8%) (Table 5.30).

5.5.3. The relationships between clinical dental status and OIDP scores and OIDP eating impact

There were significant differences in OIDP scores and OIDP eating impact by the number of natural teeth, the number of natural plus replaced teeth, the numbers of OPs, POPs, AOPs, OPRs, POPRs, and AOPRs ($p < 0.001$ for all tests) (Table 5.31). People with more teeth and more OPs, POPs, AOPs, OPRs, POPRs, AOPRs had lower OIDP scores and were less likely to report eating impacts when compared with people who had fewer teeth or fewer OPs, POPs, AOPs, OPRs, POPRs, AOPRs respectively (Table 5.31).

Similar results were obtained from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.20-21 in Appendix 8).

There were significant differences in OIDP scores and OIDP eating impact by the numbers of unfilled spaces, unfilled posterior spaces and unfilled anterior spaces ($p < 0.001$ for all tests) (Table 5.31). There was a trend for OIDP scores and the percentage of people who reported OIDP eating impact to increase as the number of unfilled spaces, as well as unfilled posterior spaces and unfilled anterior spaces increased (Table 5.31).

5.5.4. The relationships between clinical dental status and binary OIDP in the adjusted models

The results of the logistic regression analyses in the study of the relationships between clinical dental status and the binary OIDP are summarized in Table 5.32. Because the univariate analysis related to the relationships between sociodemographic factors, and self-perceived general health and the OIDP scores not binary OIDP, therefore, the results of the logistic regression analysis in relationships between sociodemographic factors and self-perceived general health and binary OIDP are also presented here.

5.5.4.1. Sociodemographic factors and binary OIDP

In the unadjusted logistic regression model there were no significant associations between binary OIDP and age, sex, occupation and self-assessed social class (Table 5.32). People with low self-assessed social class were more likely to report oral impacts on their daily life when compared to people with high self-assessed social class (OR = 1.24, 95% CI = 0.99 - 1.57). However, the difference was marginally not significant ($p = 0.07$) (Table 5.32).

5.5.4.2. Self-perceived general health and binary OIDP

There was a significant relationship between self-perceived general health and oral impacts ($p < 0.001$). People who perceived their general health status as "fair or less" had 2.17 (95% CI = 1.65 - 2.86) times higher odds of experiencing an oral impact than people who perceived their general health as "good or better" ($p < 0.001$) (Table 5.32).

5.5.4.3. Number of teeth and binary OIDP

Both number of natural teeth and number of natural plus replaced teeth were significantly related to prevalence of OIDP before and after adjusting for confounders ($p < 0.001$). There was a trend for the odds of reporting oral impacts to increase as the number of natural teeth and number of natural plus replaced teeth decreased. When compared with people who had 26-28 natural teeth, people with 1-20 natural teeth were 2.34 (95% CI = 1.62 - 3.24) times and those with 21–25 natural teeth were 1.50 (95% CI = 1.13 - 1.99) times more likely to report oral impacts after adjusting for age, sex, occupation, self-assessed social class and self-perceived general health (Table 5.32).

The trend was similar for the respective relationship with the number of natural plus replaced teeth. People with 1-20 natural plus replaced teeth were 2.89 (95% CI = 1.70 – 4.90) times, and those with 21-25 natural plus replaced teeth 1.61 (95% CI = 1.17 – 2.21) times more likely to report oral impacts compared with those with 26-28 natural plus replaced teeth after adjusting for age, sex, occupation, self-assessed social class and self-perceived general health (Table 5.32).

Similar results were obtained from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.22-23 in Appendix 8).

5.5.4.4. Number of occluding pairs of teeth and binary OIDP

The relationship between the number of occluding pairs of teeth and oral impacts was very similar to that found for the number of teeth. Overall, there were significant relationships between the different variables referring to the numbers of occluding pairs of teeth (OPs, POPs, AOPs, OPRs. POPRs, and AOPRs) and oral impacts ($p < 0.001$). The significant relationships were maintained after adjusting for potential confounders ($p < 0.001$ for both models) (Table 5.32). However, some of the differences between some groups of those ordinal variables were not statistically significant. There was a trend for the odds of reporting oral impacts to increase as the numbers of occluding pairs of teeth decreased (Table 5.32). People with 0-10 OPs were 2.06 (95% CI =1.51 - 2.82) times were more likely to report oral impacts compared with those with 16-18 OPs after adjusting for potential confounders. People with 11-15 OPs were 1.29 (0.97 - 1.72) times were more likely to report oral impacts when compared with those with 16-18 OPs after controlling for potential confounders. This result was not statistically significant. People with 0-4 POPs were 2.14 (95% CI =1.55 - 2.97) times, those with 5-9 POPs were 1.26 (95% CI = 0.95 - 1.66) times more likely to report oral impacts when compared with those with 10-12 POPs after adjusting for potential confounders. The former was statistically significant ($p < 0.001$) but the latter was not ($p = 0.11$). People with 0-3 AOPs had 2.00 (95% CI =1.42 - 2.81) times; those with 4-5 AOPs had 1.48 (95% CI =1.07 - 2.04) times higher odds of experiencing oral impacts when compared with those with 6 AOPs after adjusting for potential confounders (Table 5.32).

A similar pattern existed in relationships between the numbers of occluding pairs of natural plus replaced teeth and binary OIDP (Table 8.24 in Appendix 8).

Similar results from the data analysed separately for people with only natural teeth and people with replaced teeth (Table 8.22-23 in Appendix 8).

5.5.4.5. Number of unfilled spaces and binary OIDP

Significant relationships existed between the number of unfilled spaces and binary OIDP in both unadjusted and adjusted models ($p < 0.001$, Table 5.32). People with more unfilled spaces, unfilled posterior spaces and unfilled anterior spaces were more likely to have oral impacts. For example, people with more than 2 unfilled anterior spaces were 2.87 (95% CI =1.54 - 5.35) times and those with 1-2 unfilled spaces 1.65 (95% CI =1.09 - 2.49) times were more likely to experience oral impacts when compared to those respondents that did not have unfilled spaces in the adjusted model (Table 5.32).

5.5.4.6. Self-perceived dry mouth and binary OIDP

A significant relationship existed between self-perceived dry mouth and binary OIDP in both unadjusted and adjusted models ($p < 0.001$) (Table 5.32). People reporting dry mouth were more likely to have experienced oral impacts on their daily life when compared with people without dry mouth. After adjusting for the effects of age, sex, occupation and self-perceived general health, people with self-perceived dry mouth were 1.72 (1.34 – 2.21) times more likely to experience oral impacts than those without.

The results for the relationships between different measures of clinical dental status and the prevalence of OIDP eating impact in the adjusted models were very close to the results for the respective relationships between clinical dental status and the binary OIDP (Table 5.33 and Table 8.25-8.27 in Appendix 8)

5.5.5. Summary

The prevalence of OIDP was relatively high (60%) in a sample of older Chinese population in this study. The most common OIDP impact referred to eating impact. Toothache was the main condition causing oral impacts, while food catching was the main cause of the eating impact. There were significant relationships between clinical dental status (number of teeth, number of occluding pairs and number of unfilled spaces) and OIDP scores and the prevalence of OIDP eating impact in the unadjusted models. These significant relationships were maintained after adjustment for confounding factors.

Significant relationships also existed between self-perceived dry mouth and OIDP scores, binary OIDP and OIDP eating impact. People with self-perceived dry mouth were more likely to have higher OIDP scores and higher odds of experiencing eating impact.

5.6. The relationships between eating difficulty and OIDP scores and OIDP eating impact

This section presents the results from analyses of the relationships between eating difficulty and OIDP scores, and OIDP eating impact. There are three adjusted models in these analyses. The first two were mentioned before. In the third model, the numbers of OPs, OPRs and self-perceived dry mouth were included as adjusted potential confounders in order to eliminate their effect on the relationship of eating difficulty and oral impacts because OPs and POPs were important measures for clinical dental status in this study. In addition, clinical dental status and self-perceived dry mouth had significant relationships with OIDP scores and OIDP eating impact in this study.

Eating difficulty was significantly related to OIDP scores and OIDP eating impact. There were significant differences in OIDP scores and prevalence of OIDP eating impact by IED, GED and DCA. Subjects with an IED between 1 and 5, GED and DCA had higher OIDP scores and OIDP eating impact (Table 5.34). After controlling for potential confounding factors, the significant relationships were maintained between IED, GED, DCA and the binary OIDP and the prevalence of OIDP eating impact. People with an IED between 1 and 5 were 4.74 (95% CI = 2.91 - 7.72) times, those with GED were 7.50 (95% CI = 5.56 - 10.13), those with DCA were 6.54 (95% CI = 4.81 - 8.89) times more likely to report overall oral health impacts on their daily life after adjusting age, sex, occupation, self-assessed social class, self-perceived general health, the numbers of OPs, POPs and self-perceived dry mouth (Table 5.35). Similar trends were for the relationship between IED, GED, DCA and the prevalence of OIDP eating impact (Table 5.36).

In conclusion, there were significant relationships between eating difficulty and overall oral health impact on their daily life (OIDP) and OIDP eating impact in both unadjusted and adjusted models. People with eating difficulty reported more oral health impacts on their daily life. Eating difficulty significantly affected quality of life in Chinese older people in Guangxi.

5.7. Summary of the main findings

1. An Index of Eating Difficulty (IED) for measuring eating difficulty was developed and its reliability and validity was successfully tested.

2. 84.2% of people had an IED of zero, only 15.8% had an IED between 1 and 5. More specifically, 57 subjects (4.8%) had an IED of 1, 61 subjects (5.1%) had an IED of 2, 40 subjects (3.3%) had an IED of 3, 5 subjects (0.4%) had an IED of 4 and 26 subjects (2.2%) had an IED of 5. A higher index indicates higher levels of eating difficulty (Table 5.19).

3. General Eating Difficulty (GED) was reported by half of the subjects (51.8%). The majority of those with GED had only a little difficulty (34.3%). Very few people (3.9%) had a great amount of difficulty (Table 5.17).

4. Based on the Dissatisfaction with Chewing Ability (DCA), 58.7% were satisfied with their chewing ability and 41.3% subjects were dissatisfied (Table 5.17). Older people were more likely to report eating difficulty and be dissatisfied with their chewing ability (Table 5.17).

5. About 48% of subjects could eat salted roast chicken, roast pork ribs, roast duck or chicken only with some difficulty or not at all. 36% had difficulty eating apples, and about 30% had difficulty eating boiled chicken or duck, cooked sliced beef. 24% had difficulty eating cooked sliced pork while nearly 18% had difficulty eating cooked carrots, cucumber, and green vegetables (Table 5.23).

6. The ease of eating certain foods was influenced by the number of teeth, occluding pairs and unfilled spaces. People with more teeth were more likely to be able to eat certain hard foods without difficulty. Numbers of OPs, POPs, AOPs, OPRs, POPRs and AOPRs had similar trends in their relationships with ease of eating certain foods. The differences were highly significant for all foods listed except rice porridge, boiled fish and tofu in water which are very soft foods that everybody could eat easily (Table 5.23-24).

7. Clinical dental status was significantly related to GED and DCA. The prevalence of GED and DCA decreased with increases in the number of teeth and number of occluding pairs. With increasing the number of unfilled spaces, number of unfilled posterior spaces and number of unfilled anterior spaces, the probability of GED and DCA increased as well (Table 5.25).

8. There were significant relationships between clinical dental status and IED in both unadjusted and adjusted models. People who had more teeth, more occluding pairs and less unfilled spaces were less likely to have an IED between 1 and 5 when compared with those with fewer teeth, fewer occluding pairs and more unfilled spaces (Table 5.25-26).

9. The prevalence of OIDP in a sample of the older population in Guangxi province of China was high (60%). The most common impact was eating impacts (56.7%) (Table 5.29).

10. There were significant relationships between clinical dental status (numbers of teeth, occluding pairs of teeth and unfilled spaces) and the overall OIDP scores and the prevalence of OIDP eating impact in the unadjusted model. These significant

relationships were maintained after controlling for confounding factors (Table 5.31-33).

11. 38.4% of Chinese dentate people in a sample of Guangxi province had self-perceived dry mouth. Among dentate people, eating difficulty was influenced by self-perceived dry mouth. Those who perceived dry mouth had a significantly higher prevalence of IED, GED and DCA in both unadjusted and adjusted models. A significantly higher percentage of people with self-perceived dry mouth could not eat some foods or only eat them with some difficulty compared with those without self-perceived dry mouth. There were significant differences in eating salted roast chicken, roast pork ribs, roast duck or chicken, boiled chicken or duck, cooked sliced beef and cooked sliced pork, cooked green vegetable, cooked cucumber or lotus root and cooked carrots ($p \leq 0.001$) and also eating whole apples or corn on the cob ($p < 0.01$) in the unadjusted model (Table 5.23). After adjusting for confounders, these differences were not significant for eating whole apple, corn on the cob and cooked green vegetables (Table 5.24).

12. The significant relationships existed between self-perceived dry mouth and OIDP scores and OIDP eating impact. People with self-perceived dry mouth were more likely to have higher OIDP scores and higher odds of experiencing eating impact (Table 5.31-33).

13. There were significant relationships between eating difficulty and OIDP scores and the prevalence of eating impacts in both unadjusted and adjusted models (Table 5.34-36). People with eating difficulty were more likely to have higher OIDP scores and report more eating impact on their daily life.

Table 5.7 Distribution of sample by selected sociodemographic factors: dentate and edentate people (N = 1229).

	Frequency	Percent
Age		
55-64 years	483	39.3
65-74 years	546	44.4
75+ years	200	16.3
Sex		
Male	593	48.3
Female	636	51.7
Education		
High (13 and more years)	321	26.1
Middle (7-12 years)	525	42.7
Low (0-6 years)	383	31.2
Occupation		
Non-manual (Professional, administrator)	597	48.6
Manual (Worker, clerks, services, peasants, others)	632	51.4
Personal income		
High (≥1000 Yuan/month)	360	29.3
Middle (500-1000 Yuan/month)	395	32.1
Low (<500 Yuan/month)	474	38.6
Self-assessed social class		
High (5-10)	623	50.7
Low (1-4)	606	49.3
Total	1229	100.0

Table 5.8 Distribution of dentate population, by clinical dental status categories (N = 1196).

Natural teeth		Natural plus replaced teeth		Natural plus replaced teeth	
No. of teeth		**No. of teeth**		**Unfilled spaces**	
26-28	596(49.8)	26-28	874 (73.1)	0	511 (42.7)
21-25	336 (28.1)	21-25	223 (18.6)	1-2	363 (30.4)
1-20	264 (22.1)	1-20	99 (8.3)	3+	322 (26.9)
OPs		**OPRs**		**Unfilled posterior spaces**	
16-18	487 (40.7)	16-18	651 (54.4)	0	544 (45.5)
11-15	341 (28.5)	11-15	326 (27.3)	1-2	361 (30.2)
0-10	368 (30.8)	0-10	219 (18.3)	3+	291(24.3)
POPs		**POPRs**		**Unfilled anterior spaces**	
10-12	531(44.4)	10-12	446 (37.3)	0	998 (83.4)
5-9	356 (29.8)	5-9	564 (47.1)	1-2	125 (10.5)
0-4	309 (25.8)	0-4	186 (15.6)	3+	73 (6.1)
AOPs		**AOPRs**			
6	752 (62.9)	6	921 (77.0)		
4-5	215 (18.0)	4-5	160 (13.4)		
0-3	229 (19.1)	0-3	115 (9.6)		

OPs: Occluding Pairs of natural teeth

POPs: Posterior Occluding Pairs of natural teeth

AOPs: Anterior Occluding Pairs of natural teeth

OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Anterior Occluding Pairs of natural plus replaced teeth

Table 5.9 Frequency distribution of clinical variables in dentate people (N = 1196).

Clinical Variables	Range	Percentiles				
		5th	25th	**50th**	75th	95th
DMFT	1-28	0	2	4	9	20
Decayed teeth	0-12	0	0	0	1	2
Missing teeth	0-27	0	1	3	7	19
Filled teeth	0-11	0	0	0	1	4
Mobile teeth (Grade 1+)	0-20	0	0	0	1	5
No. of natural teeth	1-28	10	21	25	27	28
OPs	0-18	0	9	14	17	18
POPs	0-12	0	4	9	12	12
AOPs	0-6	0	4	6	6	6
No. of natural plus replaced teeth	1-28	17	25	27	28	28
OPRs	0-18	4	12	16	18	18
POPRs	0-12	1	7	10	12	12
AOPRs	0-6	2	6	6	6	6
Unfilled spaces	0-27	0	0	1	3	11
Unfilled posterior spaces	0-16	0	0	1	2	8
Unfilled anterior spaces	0-12	0	0	0	0	3

OPs: Occluding Pairs of natural teeth

POPs: Posterior Occluding Pairs of natural teeth

AOPs: Anterior Occluding Pairs of natural teeth

OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Anterior Occluding Pairs of natural plus replaced teeth

Table 5.10 Percentage of people with different types of prosthesis: dentate people (N = 1196).

Types of prostheses	N = 1196	
	Frequency	Percent
Upper removable partial only	43	3.5
Lower removable partial only	29	2.3
Upper and lower removable partial	49	4.1
Lower partial/upper complete	7	0.6
Upper partial/lower complete	6	0.5
Upper complete only	2	0.2
Lower complete only	0	0
Upper bridge only	126	10.5
Lower bridge only	73	6.1
Upper and lower bridges	125	10.5
Upper bridge /lower removable partial	17	1.4
Lower bridge /upper removable partial	30	2.5
Removable partial combined bridge in upper jaw only	2	0.3
Removable partial combined bridge in lower jaw only	4	0.8
Removable combined fixed denture in both jaws	0	0
Others	13	1.1
Total	526	44.0

Table 5.11 Mean DT, MT, FT and DMFT in dentate people, by selected Sociodemographic factors (N = 1196).

	DT Mean (Median)	† p-Value	MT Mean (Median)	† p-Value	FT Mean (Median)	† p-Value	DMFT Mean (Median)	† p-Value
Age		0.004		< 0.001		0.40		< 0.001
55-64 yrs (481)	0.5 (0.0)		2.5 (1.0)		0.9 (0.0)		3.9 (3.0)	
65-74 yrs (534)	0.5 (0.0)		5.4 (3.5)		0.9 (0.0)		6.9 (5.0)	
75+ yrs (181)	0.8 (0.0)		9.4 (8.0)		0.8 (0.0)		10.9 (9.0)	
Sex		0.17		0.20		< 0.001		0.60
Male (575)	0.5 (0.0)		4.9 (3.0)		0.7 (0.0)		6.1 (4.0)	
Female (621)	0.6 (0.0)		4.8 (2.0)		1.0 (0.0)		6.5 (4.0)	
Occupation		0.002		0.80		< 0.001		0.36
Non-manual (584)	0.5 (0.0)		4.7 (3.0)		1.1 (0.0)		6.3 (5.0)	
Manual (612)	0.7 (0.0)		5.0 (2.0)		0.7 (0.0)		6.3 (4.0)	
Self-assessed social class		0.02		0.87		< 0.001		0.69
High (5-10) (604)	0.5 (0.0)		4.7 (2.0)		1.0 (0.0)		6.2 5.0)	
Low (1-4) (592)	0.7 (0.0)		5.0 (3.0)		0.8 (0.0)		6.4 (5.0)	
Total (1196)	0.6 (0.0)		4.8 (3.0)		0.9 (0.0)		6.3 (4.0)	

† Kruskal-Wallis and Mann-Whitney tests

Table 5.12 Mean numbers of natural teeth and numbers of natural plus replaced teeth in dentate people, by selected sociodemographic factors (N = 1196).

	No. of natural teeth Mean (Median)	† p-Value	No. of natural plus replaced teeth Mean (Median)	† p-Value
Age		< 0.001		< 0.001
55-64 yrs (481)	25.5 (27.0)		26.7 (28.0)	
65-74 yrs (534)	22.6 (24.0)		25.5 (27.0)	
75+ yrs (181)	18.6 (20.0)		23.4 (26.0)	
Sex		0.23		0.02
Male (575)	23.1 (25.0)		25.5 (27.0)	
Female (621)	23.2 (26.0)		25.8 (27.0)	
Occupation		0.85		0.02
Non-manual (584)	23.3 (25.0)		26.0 (27.0)	
Manual (612)	23.0 (26.0)		25.3 (27.0)	
Education		0.44		< 0.001
High (10 years and over) (530)	23.4 (26.0)		26.2 (27.0)	
Low (0-9 years) (666)	23.0 (25.0)		25.2 (27.0)	
Personal income		0.65		0.23
High (> 1000 Yuan/month) (351)	22.9 (25.0)		26.0 (27.0)	
Middle (500-1000 Yuan/month) (385)	23.1 (25.0)		25.8 (27.0)	
Low (< 500 Yuan/month) (460)	23.4 (26.0)		25.3 (27.0)	
Self-assessed social class		0.82		0.19
High (5-10) (604)	23.1 (25.5)		25.9 (27.0)	
Low (1-4) (592)	23.0 (25.0)		25.4 (27.0)	
Total	23.2 (25.0)		25.7 (27.0)	

† Kruskal-Wallis and Mann-Whitney tests

Table 5.13 Mean numbers of OPs, POPs, AOPs* in dentate people, by selected sociodemographic factors (N = 1196).

	OPs Mean (Median)	† p-Value	POPs Mean (Median)	† p-Value	AOPs Mean (Median)	† p-Value
Age		< 0.001		< 0.001		< 0.001
55-64 yrs (481)	14.7 (16.0)		9.3 (10.0)		5.4 (6.0)	
65-74 yrs (534)	11.7 (13.0)		6.9 (8.0)		4.8 (6.0)	
75+ yrs (181)	8.4 (9.0)		4.8 (4.0)		3.6 (4.0)	
Sex		0.16		0.34		0.22
Male (575)	12.3 (14.0)		7.5 (8.0)		4.8 (6.0)	
Female (621)	12.5 (14.0)		7.6 (9.0)		4.9 (6.0)	
Occupation		0.79		0.64		0.47
Non-manual (584)	12.3 (14.0)		7.5 (9.0)		4.8 (6.0)	
Manual (612)	11.8 (14.0)		7.2 (8.0)		4.6 (6.0)	
Self-assessed social class		0.87		0.99		0.22
High (5-10) (604)	12.5 (14.0)		7.6 (8.0)		4.9 (6.0)	
Low (1-4) (592)	12.3 (14.0)		7.5 (9.0)		4.7 (6.0)	
Total (1196)	12.4 (14.0)		7.6 (9.0)		4.8 (6.0)	

*OPs: Occluding Pairs of natural teeth
POPs: Posterior Occluding Pairs of natural teeth
AOPs: Anterior Occluding Pairs of natural teeth
† Kruskal-Wallis and Mann-Whitney tests

Table 5.14 Mean numbers of OPRs, POPRs, AOPRs* in dentate people, by selected sociodemographic factors (N = 1196).

	OPRs Mean (Median)	† p-Value	POPRs Mean (Median)	† p-Value	AOPRs Mean (Median)	† p-Value
Age		< 0.001		< 0.001		< 0.001
55-64 yrs (481)	15.8 (18.0)		10.1 (12.0)		5.7 (6.0)	
65-74 yrs (534)	13.8 (15.0)		8.4 (10.0)		5.4 (6.0)	
75+ yrs (181)	11.1 (12.0)		6.7 (7.0)		4.5 (6.0)	
Sex		0.02		0.12		0.02
Male (575)	14.0 (16.0)		8.7 (10.0)		5.3 (6.0)	
Female (621)	14.4 (16.0)		8.9 (10.0)		5.5 (6.0)	
Occupation		0.05		0.07		0.02
Non-manual (584)	14.3 (16.0)		8.9 (10.0)		5.4 (6.0)	
Manual (612)	13.4 (16.0)		8.3 (10.0)		5.1 (6.0)	
Self-assessed social class		0.32		0.30		0.22
High (5-10) (604)	14.4 (16.0)		9.0 (10.0)		5.5 (6.0)	
Low (1-4) (592)	14.0 (16.0)		8.7 (10.0)		5.3 (6.0)	
Total (1196)	14.2 (16.0)		8.8 (10.0)		5.4 (6.0)	

*OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Anterior Occluding Pairs of natural plus replaced teeth

† Kruskal-Wallis and Mann-Whitney tests

Table 5.15 Mean numbers of unfilled spaces, unfilled posterior spaces, unfilled anterior spaces in dentate people, by selected sociodemographic factors (N = 1196).

	Unfilled spaces Mean (Median)	† p-Value	Unfilled posterior spaces Mean (Median)	† p-Value	Unfilled anterior spaces Mean (Median)	† p-Value
Age		< 0.001		< 0.001		< 0.001
55-64 yrs (481)	1.3 (0.0)		1.2 (0.0)		0.1 (0.0)	
65-74 yrs (534)	2.5 (1.0)		2.1 (1.0)		0.5 (0.0)	
75+ yrs (181)	4.6 (2.0)		3.2 (2.0)		1.3 (0.0)	
Sex		0.02		0.16		0.001
Male (575)	2.5 (1.0)		2.0 (1.0)		0.5 (0.0)	
Female (621)	2.2 (1.0)		1.8 (1.0)		0.4 (0.0)	
Occupation		0.03		0.008		0.11
Non-manual (584)	2.0 (1.0)		1.6 (1.0)		0.4 (0.0)	
Manual (612)	2.7 (1.0)		2.2 (1.0)		0.5 (0.0)	
Self-assessed social class		0.19		0.11		0.81
High (5-10) (604)	2.1 (1.0)		1.7 (1.0)		0.4 (0.0)	
Low (1-4) (592)	2.6 (1.0)		2.1 (1.0)		0.5 (0.0)	
Total (1196)	2.4 (3.9)		1.9 (1.0)		0.4 (0.0)	

† Kruskal-Wallis and Mann-Whitney tests

Table 5.16 Numbers and percentages of people with different types of prosthesis in dental people, by selected sociodemographic factors (N = 1196).

	N	Number of people with different types of prosthesis (%)				
		PS1* n (%)	PS2* n (%)	PS3* n (%)	PS4* n (%)	PS5* n (%)
Age						
55-64	481	80 (16.6)	36(7.5)	42 (9.3)	3 (0.6)	2 (0.5)
65-74	534	101 (18.7)	99(18.5)	92(17.0)	7 (1.3)	11(2.1)
75+	181	23 (12.7)	42(23.2)	49(26.5)	3(1.7)	9(4.9)
Sex						
Male	575	91 (15.7)	84 (14.6)	88(15.1)	6 (1.0)	8 (1.4)
Female	621	113(18.2)	93(15.0)	95(15.3)	7(1.1)	14(2.3)
Occupation						
Non- manual	584	105 (17.8)	78(13.4)	121(20.4)	8(1.4)	8(1.4)
Manual	612	99(16.2)	99(16.2)	62(10.3)	5(0.8)	14(2.3)
Self-assessed social class						
High (5-10)	604	114 (18.3)	77 (12.4)	111 (17.7)	11 (1.8)	12 (1.9)
Low (1-4)	592	90(14.7)	100 (16.5)	72 (11.7)	2 (0.3)	10(1.7)
Total	1196	204 (17.0)	177(14.8)	183(15.2)	13(1.1)	22(1.8)

* PS1 Bridge

PS2 More than one bridge

PS 3 Removable partial dentures

PS 4 Both bridge (s) and partial denture (s)

PS 5 Full removable denture(s)

Table 5.17 Distribution of subjective measures in dentate people (N = 1196).

Measures		N(%)
General Eating Difficulty	No difficulty	576 (48.2)
	A little difficulty	410 (34.3)
	A fair amount of difficulty	163 (13.6)
	A great amount of difficulty	47 (3.9)
Dissatisfaction with Chewing Ability	Very satisfied	39 (3.3)
	Satisfied	662 (55.4)
	Dissatisfied	466 (39.0)
	Very dissatisfied	29 (2.3)
Self-perceived general health	Excellent	14 (1.2)
	Very Good	58 (4.8)
	Good	191 (16.0)
	Fair	712 (59.5)
	Poor	221 (18.5)
Self-perceived dry mouth	No	737 (61.6)
	Yes	459 (38.4)

Table 5.18 Distribution of self-perceived dry mouth in dentate people with self-perceived dry mouth.

	Frequency (%)
No self-perceived dry mouth	737 (61.6)
Self-perceived dry mouth	459 (38.4)
Time of dry mouth	
Feel dry at night	274 (59.6)
Feel dry on waking	47 (10.2)
Feel dry at other time	121 (26.3)
Other	17 (3.9)
Difficulty caused by dry mouth	
Difficulty in chewing or swallowing or taking medication	12 (2.8)
No difficulty	447 (97.2)
Action to relieve dry mouth	
Sip water or other liquid	377 (82.0)
Nothing done	72 (15.7)
Other	10 (2.3)

Table 5.19 Distribution of dentate people, by Index of Eating Difficulty (IED) (N =1196).

Difficulty eating foods	Index	Frequency	Percent
None of foods listed	5	26	2.2
Cooked sliced pork, cooked green vegetable	4	5	0.4
Cooked cucumber or lotus root, cooked carrots	3	40	3.3
Boiled chicken or duck	2	61	5.1
Whole apple, corn on the cob	1	57	4.8
Salted roasting chicken, roast pork ribs, roast duck or chicken	0	1007	84.2
Total		1196	100

Table 5.20 Prevalence of self-perceived dry mouth, by selected sociodemographic factors and self-perceived general health (N = 1196).

Sociodemographic factors	Dry mouth (%)	† p-Value
Age		0.09
55-64 yrs (481)	36.4	
65-74 yrs (534)	38.2	
75+ yrs (181)	44.2	
Sex		0.15
Male (575)	36.2	
Female (621)	40.4	
Occupation		0.36
Non-manual (584)	37.0	
Manual (612)	39.7	
Self-assessed social class		0.53
High (5-10) (604)	37.4	
Low (1-4) (592)	39.4	
Self-perceived general health		< 0.001
Good or better (263)	25.1	
Fair or less (933)	42.1	
Total	38.4	

† Chi – Squared test and Chi-Squared for trend

5.21 The distribution of Index of Eating Difficulty (IED), General Eating Difficulty (GED) and Dissatisfaction with Chewing Ability (DCA), by selected sociodemographic factors and self-perceived general health (N = 1196).

Sociodemographic factors	IED = 1-5	†p-Value	GED	†p-Value	DCA	†p-Value
Age		< 0.001		< 0.001		< 0.001
55-64 yrs (481)	7.5		40.7		35.8	
65-74 yrs (534)	17.8		54.1		42.5	
75+ yrs (181)	32.0		74.6		53.0	
Sex		0.71		0.87		0.52
Male (575)	15.3		52.2		42.4	
Female (621)	16.3		51.5		40.4	
Occupation		< 0.001		0.62		< 0.001
Non-manual (584)	11.5		51.0		35.4	
Manual (612)	19.9		52.6		47.1	
Self-assessed social class		< 0.001		0.44		0.03
High (5-10) (604)	12.1		50.7		38.2	
Low (1-4) (592)	19.6		53.0		44.6	
Self-perceived general health		0.054		< 0.001		0.004
Good or better (263)	11.8		39.9		33.5	
Fair or less (933)	16.9		55.2		43.6	
Total	15.8		51.8		41.3	

† Chi-Squared test and Chi-Squared for trend

Table 5.22 Distribution of OIDP scores and OIDP eating impact, by selected sociodemographic factors and self-perceived general health (N = 1196).

	OIDP score			† p-Value	OIDP eating impact (%)	†† p-Value
	Median	Mean	SD			
Age				0.28		0.02
55-64 yrs (481)	4.4	5.6	7.2		53.8	
65-74 yrs (534)	4.4	6.0	8.0		56.7	
75+ yrs (181)	4.4	6.5	7.6		64.1	
Sex				0.73		0.27
Male (575)	4.4	5.8	7.9		58.4	
Female (621)	4.4	6.0	7.4		55.1	
Occupation				0.004		0.77
Non-manual (584)	4.4	5.0	6.3		56.2	
Manual (612)	4.4	6.8	8.7		57.2	
Self-assessed social class				< 0.001		0.17
High (5-10) (604)	4.4	5.1	6.5		54.6	
Low (1-4) (592)	4.4	6.8	8.5		58.8	
Self-perceived general health				< 0.001		< 0.001
Good or better (263)	0.0	3.9	6.3		43.0	
Fair or less (933)	4.4	6.5	7.9		60.6	
Total	4.4	5.9	7.6		56.7	

† Kruskal-Wallis and Mann-Whitney tests

†† Chi-Squared for trend and Chi-Squared test

Table 5.23 Percentage of people with difficulty eating certain foods*, by clinical dental status (N = 1196).

Clinical variables (n)**	Salted roast chicken	Roast pork ribs	Roast duck or chicken	Whole apple	Corn on the cob	Boiled chicken or duck	Cooked sliced beef
No. of natural teeth							
26-28 (596)	29.0	29.0	28.0	14.8	14.3	11.9	12.4
21-25 (336)	56.5	56.8	56.3	40.5	40.5	32.4	33.6
1-20 (264)	80.7	81.1	80.7	75.0	75.0	68.6	67.8
No. of natural plus replaced teeth							
26-28 (874)	38.3	38.4	37.5	24.9	23.7	19.8	20.5
21-25 (223)	68.6	69.1	68.6	57.0	56.5	48.4	48.0
1-20 (99)	88.9	88.9	88.9	86.9	86.9	80.8	80.8
OPs							
16-18 (487)	27.3	27.3	25.9	14.6	14.2	12.1	12.5
11-15 (341)	49.9	50.1	49.9	31.7	30.8	24.0	25.5
0 -10(368)	74.2	74.5	74.2	68.5	66.6	59.8	59.2
POPs							
10-12 (531)	28.8	28.8	27.5	16.0	15.3	12.6	13.0
5-9 (356)	52.0	52.2	52.0	36.0	35.1	28.4	29.8
0-4 (309)	77.0	77.3	77.0	70.6	68.9	62.5	61.8
AOPs							
6 (752)	36.6	36.6	35.8	20.9	20.5	17.2	17.6
4-5 (215)	56.3	56.3	55.8	47.4	46.0	39.1	40.9
0-3 (229)	78.6	79.0	78.6	75.1	72.5	64.6	63.8
OPRs							
16-18 (651)	31.2	31.2	30.1	18.0	17.4	14.0	14.7
9-15 (326)	60.1	60.7	60.4	46.3	44.2	37.1	37.4
0-10 (219)	80.8	80.8	74.4	74.4	74.0	68.0	67.6
POPRs							
10-12(686)	32.5	32.5	31.5	19.8	19.0	14.7	15.3
5-9 (324)	63.0	63.6	63.3	48.8	47.2	41.4	41.7
0-4 (186)	80.1	80.1	79.6	73.7	73.1	67.7	67.7
AOPRS							
6 (921)	36.6	36.7	35.8	20.9	20.5	17.2	17.6
4-5 (160)	66.9	67.5	67.5	59.9	58.0	52.2	52.2
0-3 (115)	84.3	84.3	83.5	84.3	82.6	73.0	72.2
Unfilled spaces							
0 (511)	32.7	32.9	31.9	20.5	19.4	16.6	17.2
1-2 (363)	46.3	46.3	45.5	31.3	29.8	24.2	25.1
3+ (322)	74.8	75.2	74.8	66.1	65.8	58.4	58.1
Unfilled posterior spaces							
0 (544)	34.2	34.4	33.5	22.1	20.8	17.6	18.2
1-2 (361)	48.5	48.5	47.6	34.9	33.8	27.4	28.3
3+ (291)	73.9	74.2	73.9	63.6	63.2	57.0	56.7
Unfilled anterior spaces							
0 (998)	42.3	42.5	41.6	28.6	27.5	23.0	23.5
1-2 (125)	68.8	68.8	68.8	61.6	60.8	55.2	56.0
3+ (73)	93.2	93.2	93.2	94.5	94.5	84.9	83.6
Self-perceived dry mouth							
No (737)	43.4	43.4	42.7	32.6	31.8	26.5	26.7
Yes (459)	55.8	56.2	55.3	41.6	40.3	36.2	36.8
Total	48.2	48.3	47.6	36.0	35.0	30.2	30.6

Table 5.23 Continued.

Clinical variables (n)	Cooked sliced pork	Cooked green vegetable	Cooked cucumber or lotus root	Cooked carrots	Steamed bread	Soft rice
No. of natural teeth						
26-28 (596)	9.7	5.4	4.4	3.7	1.0	0.7
21-25 (336)	25.6	18.5	18.2	15.8	2.7	1.2
1-20 (264)	57.2	46.6	47.3	41.3	10.6	5.7
No. of natural plus replaced teeth						
26-28 (874)	15.6	10.4	9.3	8.0	1.1	0.5
21-25 (223)	38.1	27.8	28.3	23.8	5.8	3.1
1-20 (99)	74.7	64.6	68.7	61.6	20.2	12.1
OPs						
16-18 (487)	9.9	6.2	5.1	4.5	1.2	0.8
11-15 (341)	18.2	11.7	11.7	9.4	0.9	0.3
0 -10(368)	50.3	39.9	39.9	35.5	9.2	4.9
POPs						
10-12 (531)	10.0	6.2	5.1	4.5	1.1	0.8
5-9 (356)	23.3	14.9	15.2	11.8	1.4	0.6
0-4 (309)	51.5	42.4	42.4	38.2	10.4	5.5
AOPs						
6 (752)	13.6	8.2	7.6	6.5	1.7	1.1
4-5 (215)	32.6	26.0	26.5	22.8	3.7	1.4
0-3 (229)	53.7	43.2	42.8	37.6	9.6	5.2
OPRs						
16-18 (651)	11.7	6.9	5.8	4.9	1.1	0.6
9-15 (326)	27.9	18.7	18.4	15.3	1.8	0.9
0-10 (219)	58.4	50.7	52.1	46.6	13.7	7.3
POPRs						
10-12(686)	12.2	7.3	6.3	5.4	1.2	0.7
5-9 (324)	31.5	22.5	22.5	19.1	2.8	1.2
0-4 (186)	58.6	50.5	51.6	45.7	7.4	7.5
AOPRS						
6 (921)	13.6	8.2	7.6	6.5	1.7	1.1
4-5 (160)	45.2	34.4	34.4	28.7	3.2	0.6
0-3 (115)	63.5	53.9	54.8	51.3	17.4	10.4
Unfilled spaces						
0 (511)	13.3	9.6	7.8	6.7	1.0	0.4
1-2 (363)	18.7	11.6	11.3	9.9	1.4	0.6
3+ (322)	49.4	39.1	40.7	35.4	10.2	5.9
Unfilled posterior spaces						
0 (544)	14.3	9.9	8.3	7.2	1.1	0.4
1-2 (361)	21.3	14.7	14.1	12.2	1.4	0.8
3+ (291)	48.1	37.8	39.9	34.7	11.0	6.2
Unfilled anterior spaces						
0 (998)	17.9	12.7	12.0	10.4	2.0	1.0
1-2 (125)	48.0	33.6	33.6	26.4	5.6	2.4
3+ (73)	76.7	65.8	68.5	64.4	21.9	13.7
Self-perceived dry mouth						
No (737)	20.4	15.3	14.8	12.6	3.7	2.3
Yes (459)	31.6	22.7	22.4	19.8	3.5	1.3
Total (1196)	24.7	18.1	17.7	15.4	3.6	1.6

* People with difficulty eating certain foods: participants who reported they could eat only with some difficulty or could not eat all various types of food.

** Chi-Squared for trend and Chi-Squared test was used to test significant but p-value was not presented.

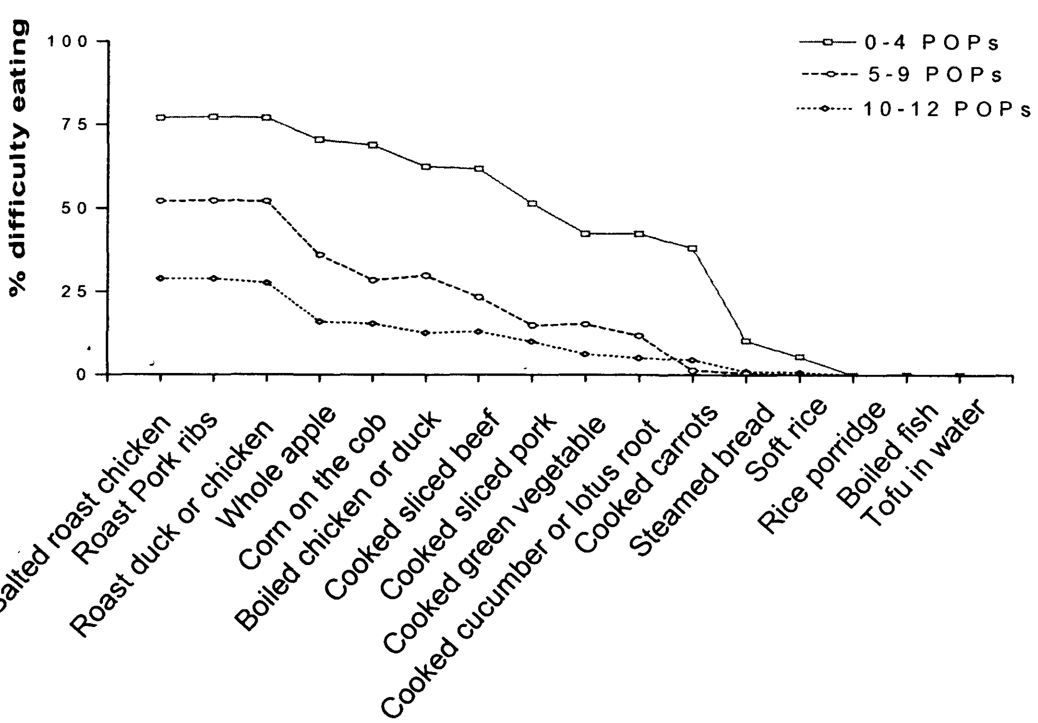

Figure 5.1 Percentage of dental people with difficulty eating certain foods, by number of POPs (N = 1196).

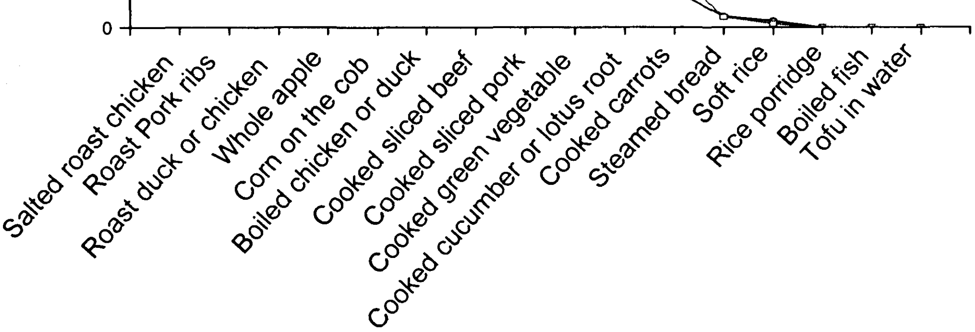

Figure 5.2 Percentage of dental people with difficulty eating certain foods, by self-perceived dry mouth (N = 1196).

Table 5.24 A summary of the statistically significant relationships between the percentage of participants who reported they could eat only with some difficulty or could not eat at all various types of foods and a range of measures of oral health in the adjusted model.**

Food items	1	2	3	4	5	6	7	8	9	10	11	12
Salted roast chicken	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s2
Roast Pork ribs	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s2
Roast duck or chicken	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s2
Whole apple	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	n.s.
Corn on the cob	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	n.s.
Boiled chicken or duck	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s1
Cooked sliced beef	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s1
Cooked sliced pork	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s2
Cooked green vegetable	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	n.s
Cooked cucumber or lotus root	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s1
Cooked carrots	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s3	s1
Steamed bread	s3	s3	s3	s3	s2	s3	s3	s3	s3	s3	s3	n.s.
Soft rice	s2	s2	s2	s.b	s1	s3	s3	s3	s3	s3	s3	n.s.
Rice porridge	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Boiled fish	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tofu in water	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

* n.s. = no statistically significant; s1 = $p<0.05$; s2 = $p<0.01$; s3 = $p < 0.001$

1. Number of natural teeth
2. Number of natural plus replaced teeth
3. Number of Occluding Pairs of natural teeth
4. Number of Posterior Occluding Pairs of natural teeth
5. Number of Anterior Occluding Pairs of natural teeth
6. Number of Occluding Pairs of natural plus replaced teeth
7. Number of Occluding Posterior pairs of natural plus replaced teeth
8. Number of Anterior Occluding Pairs of natural plus replaced teeth
9. Unfilled spaces
10. Unfilled posterior spaces
11. Unfilled anterior spaces
12. With and without self-perceived dry mouth

**Adjusted model: adjusted for age, sex, occupation, self-assessed social class and self-perceived general health.

Table 5.25 The distribution of Index of Eating Difficulty (IED), General Eating Difficulty (GED) and Dissatisfaction with Chewing Ability (DCA), by measures of oral health (N = 1196).

Clinical variables (n)	IED=1-5 (%)	† p-Value	GED (%)	† p-Value	DCA (%)	† p-Value
No. of natural teeth		< 0.001		< 0.001		< 0.001
26-28 (596)	4.5		32.4		26.7	
21-25 (336)	14.0		60.0		47.3	
1-20 (264)	43.6		84.1		67.0	
No. of replaced plus natural teeth		< 0.001		< 0.001		< 0.001
26-28 (874)	7.8		42.3		31.1	
21-25 (223)	25.6		72.2		61.9	
1-20 (99)	64.6		89.9		85.9	
OPs		< 0.001		< 0.001		< 0.001
16-18 (487)	4.5		31.0		25.5	
11-15 (341)	8.8		53.7		41.6	
0 -10(368)	37.2		77.7		62.2	
POPs		< 0.001		< 0.001		< 0.001
10-12 (531)	5.1		32.8		26.4	
5-9 (356)	10.7		55.9		43.3	
0-4 (309)	40.1		79.9		65.0	
AOPs		< 0.001		< 0.001		< 0.001
6 (752)	6.6		40.2		32.7	
4-5 (215)	19.5		57.2		47.4	
0-3 (229)	42.4		85.2		64.2	
OPRs		< 0.001		< 0.001		< 0.001
16-18 (651)	4.5		34.5		26.9	
9-15 (326)	16.6		65.3		48.8	
0-10 (219)	48.4		83.1		73.5	
POPRs		< 0.001		< 0.001		< 0.001
10-12(686)	5.2		36.4		27.8	
5-9 (324)	18.2		67.0		52.2	
0-4 (186)	50.5		82.3		72.6	
AOPRS		< 0.001		< 0.001		< 0.001
6 (921)	8.8		44.1		34.7	
4-5 (160)	30.0		69.4		55.6	
0-3 (115)	52.2		89.6		74.8	
Unfilled spaces		< 0.001		< 0.001		< 0.001
0 (511)	7.6		36.4		26.0	
1-2 (363)	8.0		50.7		38.3	
3+ (322)	37.6		77.6		69.3	
Unfilled posterior spaces		< 0.001		< 0.001		< 0.001
0 (544)	8.3		46.5		35.5	
1-2 (361)	9.1		68.8		62.4	
3+ (291)	38.1		95.9		86.3	
Unfilled anterior spaces		< 0.001		< 0.001		< 0.001
0 (998)	9.7		37.9		26.7	
1-2 (125)	32.8		53.2		41.3	
3+ (73)	69.9		76.3		69.1	
Self-perceived dry mouth		0.002		< 0.001		< 0.001
No (737)	5.4		47.6		37.0	
Yes (459)	24.6		58.6		48.5	
Total	15.8		51.8		41.3	

OPs: Occluding pairs of natural teeth; POPs: Posterior occluding pairs of natural teeth; AOPs: Anterior occluding pairs of natural teeth; OPRs: Occluding pairs of replaced and natural teeth: POPRs: Posterior occluding pairs of replaced and natural teeth; AOPRs: Anterior occluding pairs of replaced and natural teeth.

† Chi-Squared for trend and Chi-Squared test

Table 5.26 The relationships between clinical dental status and Index of Eating Difficulty (IED) in dentate people (N = 1196).

Clinical variables	IED=1-5 (n = 189) n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
Age							
55-64 yrs (481)	36 (7.5)	1.00					
65-74 yrs (534)	95 (17.8)	2.68 (1.78, 4.01)	< 0.001				
75+ yrs (181)	58 (32.0)	5.83 (3.67, 9.24)	< 0.001				
Sex							
Male (575)	88 (15.3)	1.00					
Female (621)	101 (16.3)	1.08 (0.79, 1.47)	0.65				
Occupation							
Non-manual (584)	67 (11.5)	1.00					
Manual (612)	122 (19.9)	1.92 (1.39, 2.65)	< 0.001				
Self-assessed social class							
High (5-10) (604)	73 (12.1)	1.00					
Low (1-4) (592)	116 (19.6)	1.77 (1.29, 2.44)	< 0.001				
Self-perceived general health							
Good and better (263)	31(11.8)	1.00					
Fair and less(933)	158 (16.9)	1.53 (1.01, 2.30)	0.04				
Self-perceived dry mouth							
No (737)	97 (13.2)	1.00		1.00		1.00	
Yes (459)	92 (20.0)	1.65 (1.21, 2.26)	0.002	1.54 (1.11, 2.14)	0.01	1.51 (1.09, 2.11)	0.01
No. of natural teeth							
26-28 (596)	27 (4.5)	1.00		1.00		1.00	
21-25 (336)	47 (14.0)	3.43 (2.09, 5.62)	< 0.001	3.02 (1.82, 5.01)	< 0.001	3.01 (1.81, 4.99)	< 0.001
1-20 (264)	115 (43.6)	16.27 (10.31, 25.67)	< 0.001	12.24 (7.49, 20.00)	< 0.001	12.17 (7.45, 19.89)	< 0.001
No. of natural plus replaced teeth							
26-28 (874)	39 (7.6)	1.00		1.00		1.00	
21-25 (223)	86 (14.7)	4.07 (2.76, 6.01)	< 0.001	3.61 (2.41, 5.40)	< 0.001	3.58 (2.39, 5.36)	< 0.001
1-20 (99)	64 (64.6)	21.67 (13.40, 35.05)	< 0.001	14.65 (8.81, 24.34)	< 0.001	14.55 (8.75, 24.18)	< 0.001
OPs							
16-18 (487)	22 (4.5)	1.00		1.00		1.00	
11-15 (341)	30 (8.8)	2.04 (1.56, 3.60)	0.01	1.85 (1.03, 3.30)	0.04	1.83(1.05, 3.39)	0.03
0 -10(368)	137 (37.2)	12.54 (7.78, 20.20)	< 0.001	9.08 (5.49, 15.04)	< 0.001	9.51(5.72, 15.84)	< 0.001
POPs							
10-12 (531)	27 (5.1)	1.00					
5-9 (356)	38 (10.7)	2.23 (1.33, 3.72)	0.02	1.91 (1.13, 3.24)	0.02	1.91 (1.13, 3.24)	0.01
0-4 (309)	124 (40.1)	12.49 (7.98, 19.57)	< 0.001	8.87 (5.50, 14.30)	< 0.001	8.82 (5.47, 14.22)	< 0.001
AOPs							
6 (752)	50 (6.6)	1.00		1.00		1.00	
4-5 (215)	42 (19.5)	3.41 (2.19, 5.31)	< 0.001	2.86 (1.81, 4.53)	< 0.001	2.85 (1.80, 4.51)	< 0.001
0-3 (229)	97 (42.4)	10.31 (6.99, 15.21)	< 0.001	7.53 (4.98, 11.39)	< 0.001	7.51 (4.96, 11.35)	< 0.001

Table 5.26 Continued

Unfilled spaces							
0 (511)	39 (7.6)	1.00		1.00		1.00	
1-2 (363)	29 (8.0)	1.05 (0.64, 1.73)	0.85	0.91 (0.55, 1.52)	0.73	0.91 (0.55, 1.52)	0.72
3+ (322)	121 (37.6)	7.29 (4.90, 10.83)	< 0.001	5.47 (3.61, 8.28)	< 0.001	5.43 (3.58, 8.23)	< 0.001
Unfilled posterior spaces							
0 (544)	45 (8.3)	1.00		1.00		1.00	
1-2 (361)	33 (9.1)	1.11 (0.70, 1.79)	0.65	0.97 (0.60, 1.57)	0.91	0.97 (0.60, 1.57)	0.89
3+ (291)	111 (38.1)	6.84 (4.65, 10.06)	< 0.001	5.09 (3.40, 7.62)	< 0.001	5.04 (3.37, 7.56)	< 0.001
Unfilled anterior spaces							
0 (998)	97 (9.7)	1.00		1.00		1.00	
1-2 (125)	41 (32.8)	4.53 (2.96, 6.96)	< 0.001	4.13 (2.62, 6.51)	< 0.001	4.17 (2.64, 6.59)	< 0.001
3+ (73)	51 (69.9)	21.53 (12.53, 37.03)	< 0.001	14.03 (7.88, 24.99)	< 0.001	13.98 (7.85, 24.91)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 5.27 The relationships between clinical dental status and Dissatisfaction and Chewing Ability (DCA) in dentate people (N = 1196).

Clinical variables	DCA (n = 495) n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
Age							
55-64 yrs (481)	172 (35.8)	1.00					
65-74 yrs (534)	227 (42.5)	1.33 (1.03, 1.71)	0.03				
75+ yrs (181)	96 (53.0)	2.03 (1.44, 2.87)	< 0.001				
Sex							
Male (575)	244 (42.4)	1.00					
Female (621)	251 (40.4)	0.92 (0.73, 1.16)	0.48				
Occupation							
Non-manual (584)	207 (53.4)	1.00					
Manual (612)	288 (47.1)	1.62 (1.28, 2.04)	< 0.001				
Self-assessed social class							
High (5-10) (604)	231(38.1)	1.00					
Low (1-4) (592)	264 (44.6)	1.30 (1.03, 1.64)	0.03				
Self-perceived general health							
Good and better (263)	88 (33.5)	1.00					
Fair and less(933)	407 (43.6)	1.54 (1.16, 2.05)	0.003				
Self-perceived dry mouth							
No (737)	273 (37.0)	1.00	1.00			1.00	
Yes (459)	222 (48.4)	1.59 (1.26, 2.02)	< 0.001	1.55 (1.22, 1.98)	< 0.001	1.50 (1.18, 1.92)	0.001
No. of natural teeth							
26-28 (596)	159 (26.7)	1.00		1.00		1.00	
21-25 (336)	159 (47.3)	2.47 (1.87, 5.86)	< 0.001	2.54 (1.90, 3.40)	< 0.001	2.53 (1.89, 3.39)	< 0.001
1-20 (264)	177 (67.0)	5.59 (4.08, 7.67)	< 0.001	5.66 (4.01, 8.01)	< 0.001	5.64 (3.99, 7.98)	< 0.001
No. of natural plus replaced teeth							
26-28 (874)	272 (31.1)	1.00		1.00		1.00	
21-25 (223)	138 (61.9)	3.59 (2.64, 4.88)	< 0.001	3.47 (2.54, 4.74)	< 0.001	3.42 (2.51, 4.68)	< 0.001
1-20 (99)	85 (85.9)	13.43 (7.50, 24.06)	< 0.001	11.86 (6.52, 21.56)	< 0.001	11.82 (6.49, 22.52)	< 0.001
OPs							
16-18 (487)	124 (25.5)	1.00		1.00		1.00	
11-15 (341)	142 (41.6)	2.09 (1.55, 2.81)	< 0.001	2.17 (1.60, 2.94)	< 0.001	2.14 (1.58, 2.91)	< 0.001
0 -10(368)	229 (62.2)	4.82 (3.50, 6.47)	< 0.001	4.69 (3.41, 6.46)	< 0.001	4.65 (3.38, 6.41)	< 0.001
POPs							
10-12 (531)	140 (26.4)	1.00		1.00		1.00	
5-9 (356)	154 (43.3)	2.13 (1.60, 2.83)	< 0.001	2.17 (162, 2.92)	< 0.001	2.17(1.61, 2.91)	< 0.001
0-4 (309)	201 (65.0)	5.20 (3.84, 7.04)	< 0.001	5.05(3.63, 7.02)	< 0.001	5.02 (3.61, 6.98)	< 0.001
AOPs							
6 (752)	246 (32.7)	1.00		1.00		1.00	
4-5 (215)	102 (47.4)	1.86 (1.37, 2.53)	< 0.001	1.76 (1.28, 2.41)	< 0.001	1.74 (1.26, 2.38)	0.001
0-3 (229)	147 (64.2)	3.69 (2.70, 5.03)	< 0.001	3.32 (2.39, 4.61)	< 0.001	3.30 (2.37, 4.58)	< 0.001

Table 5.27 Continued

Unfilled spaces							
0 (511)	133 (26.0)	1.00		1.00		1.00	
1-2 (363)	139 (38.3)	1.76 (1.32, 2.36)	< 0.001	1.70 (1.23, 2.28)	< 0.001	1.71 (1.27, 2.29)	< 0.001
3+ (322)	223 (69.1)	6.40 (4.70, 8.71)	< 0.001	5.86 (4.26, 8.06)	< 0.001	5.80 (4.21, 7.98)	< 0.001
Unfilled posterior spaces							
0 (544)	145 (26.7)	1.00		1.00		1.00	
1-2 (361)	149 (41.3)	1.93 (1.46, 2.57)	< 0.001	1.86 (1.39, 2.47)	< 0.001	1.86 (1.40, 2.48)	< 0.001
3+ (291)	201 (69.1)	6.15 (4.49, 8.40)	< 0.001	5.55 (4.02, 7.65)	< 0.001	5.49 (3.98, 7.58)	< 0.001
Unfilled anterior spaces							
0 (998)	345 (35.5)	1.00		1.00		1.00	
1-2 (125)	78 (62.4)	3.02 (2.06, 4.43)	< 0.001	2.84 (1.91, 4.21)	< 0.001	2.81 (1.89, 4.17)	0.001
3+ (73)	63 (86.3)	11.45 (5.81, 22.59)	< 0.001	9.54 (4.74, 19.17)	< 0.001	9.51 (4.73, 19.13)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 5.28 The relationships between clinical dental status and General Eating Difficulty (GED) in dentate people (N = 1196).

Clinical variables	GED (n = 620) n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
Age							
55-64 yrs (481)	196 (40.7)	1.00					
65-74 yrs (534)	289 (54.1)	1.72 (1.34, 2.20)	< 0.001				
75+ yrs (181)	135 (74.6)	4.27 (2.92, 6.25)	< 0.001				
Sex							
Male (575)	300 (52.2)	1.00					
Female (621)	320 (51.5)	0.98 (0.78, 1.22)	0.82				
Occupation							
Non-manual (584)	298 (51.0)	1.00					
Manual (612)	322 (52.6)	1.07 (0.85, 1.34)	0.58				
Self-assessed social class							
High (5-10) (604)	306 (50.7)	1.00					
Low (1-4) (592)	314 (53.0)	1.10 (0.88, 1.38)	0.41				
Self-perceived general health							
Good and better (263)	105 (39.9)	1.00					
Fair and less(933)	515 (55.2)	1.85 (1.40, 2.45)	< 0.001				
Self-perceived dry mouth							
No (737)	351 (54.1)	1.00		1.00		1.00	
Yes (459)	269 (74.6)	1.56 (1.23, 1.97)	< 0.001	1.50 (1.17, 1.91)	0.001	1.42 (1.11, 1.81)	0.005
No. of natural teeth							
26-28 (596)	193 (32.4)	1.00		1.00		1.00	
21-25 (336)	205 (61.0)	3.27 (4.27, 4.32)	< 0.001	3.05 (2.29, 4.06)	< 0.001	3.06 (2.30, 4.07)	< 0.001
1-20 (264)	222 (84.1)	11.03 (7.61, 16.00)	< 0.001	9.13 (6.18, 13.48)	< 0.001	9.20 (6.21, 13.62)	< 0.001
No. of natural plus replaced teeth							
26-28 (874)	370 (42.3)	1.00		1.00		1.00	
21-25 (223)	161 (72.2)	3.54 (2.56, 4.88)	< 0.001	3.23 (2.33, 4.49)	< 0.001	3.18 (2.28, 4.42)	< 0.001
1-20 (99)	89 (89.9)	12.07 (6.20, 23.50)	< 0.001	8.75 (4.44, 17.23)	< 0.001	8.67 (4.39, 17.13)	< 0.001
OPs							
16-18 (487)	151 (24.4)	1.00		1.00		1.00	
11-15 (341)	183 (53.7)	2.58 (1.94, 3.43)	< 0.001	2.43 (1.82, 3.26)	< 0.001	2.42 (1.80, 3.24)	< 0.001
0 -10(368)	286 (77.7)	7.76 (5.68, 10.60)	< 0.001	6.42 (4.62, 8.91)	< 0.001	6.42 (4.61, 8.94)	< 0.001
POPs							
10-12 (531)	174 (32.8)	1.00		1.00		1.00	
5-9 (356)	199 (55.9)	2.60 (1.97, 3.43)	< 0.001	2.39 (1.80, 3.18)	< 0.001	2.41 (1.81, 3.20)	< 0.001
0-4 (309)	247 (79.9)	8.17 (5.86, 11.39)	< 0.001	6.69 (4.72, 9.48)	< 0.001	6.71 (4.72, 9.53)	< 0.001
AOPs							
6 (752)	302 (40.2)	1.00		1.00		1.00	
4-5 (215)	123 (57.2)	1.99 (1.47,2.71)	< 0.001	1.75 (1.28, 2.40)	< 0.001	1.72 (1.26, 2.37)	0.001
0-3 (229)	195 (85.2)	8.54 (5.77, 12.65)	< 0.001	6.81 (4.55, 10.20)	< 0.001	6.81 (4.55, 10.20)	< 0.001

Table 5.28 Continued

Unfilled spaces							
0 (511)	186 (36.4)	1.00		1.00		1.00	
1-2 (363)	184 (50.7)	1.80 (1.37, 2.36)	< 0.001	1.75 (1.32, 2.32)	< 0.001	1.77 (1.33, 2.34)	< 0.001
3+ (322)	250 (77.6)	6.07 (4.41, 8.34)	< 0.001	5.13 (3.70, 7.11)	< 0.001	5.06 (3.64, 7.03)	< 0.001
Unfilled posterior spaces							
0 (544)	206 (37.9)	1.00		1.00		1.00	
1-2 (361)	192 (53.2)	1.86 (1.42, 2.44)	< 0.001	1.82 (1.38, 2.39)	< 0.001	1.83 (1.38, 2.41)	< 0.001
3+ (291)	222 (76.3)	5.27 (3.83, 2.28)	< 0.001	4.44 (3.19, 6.17)	< 0.001	4.38 (3.15, 6.10)	< 0.001
Unfilled anterior spaces							
0 (998)	464 (46.5)	1.00		1.00		1.00	
1-2 (125)	86 (68.8)	2.54 (1.70, 3.78)	< 0.001	2.24 (1.49, 3.38)	< 0.001	2.21 (1.46, 3.33)	< 0.001
3+ (73)	70 (95.9)	26.74 (8.38, 85.32)	< 0.001	17.98 (5.58, 57.93)	< 0.001	18.26 (5.56, 58.95)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 5.29 Prevalence of different types of OIDP in dentate people (N = 1196).

	Frequency	Percent
Prevalence of specific oral impacts		
Eating	678	56.7
Speaking	90	7.5
Cleaning teeth	207	17.3
Light physical activities	5	0.4
Going out	5	0.4
Relaxing (Sleeping)	119	9.9
Smiling	38	3.2
Emotion	47	3.9
Social contact	87	7.3
Prevalence of overall impacts	718	60.0

Table 5.30 Main oral conditions causing oral impacts (OIDP) in dentate people*.

Oral conditions	Eating n(%)	Speaking n(%)	Cleaning n(%)	Light physical activities n(%)	Going out n(%)	Relaxing /Sleeping n(%)	Smiling n(%)	Emotional Stability n(%)	Social Contact n(%)	Total n(%)
Food catching	289 (20.9)							1 (2.1)	1 (1.1)	291(14.6)
Tooth loss	267 (19.3)	65 (71.4)	4 (1.8)			2 (1.7)	15 (48.4)	6 (12.5)	21 (23.9)	380 (19.1)
Toothache	263 (19.0)	4 (4.4)	19 (8.7)	4 (80.0)	4 (80.0)	79 (65.8)	5 (16.1)	34 (70.8)	28 (31.8)	440 (22.0)
Loose teeth	215 (15.5)	1 (1.1)	2 (0.9)						3 (3.4)	221 (9.0)
Sensitive teeth	129 (9.3)	2 (2.2)	135 (61.9)					1 (2.1)		267 (13.4)
Swollen gums	98 (7.1)		14 (6.4)				1 (3.2)			113 (5.7)
Oral ulcer	60 (4.3)	4 (4.4)	14 (6.4)			2 (1.7)	1 (3.2)	2 (4.2)		83 (4.8)
Loose or ill-fitting dentures	43 (3.1)	11(12.1)	4 (1.8)	1(20.0)	1(20.0)		3 (9.7)	2 (4.2)	3 (3.4)	68 (3.4)
Decayed teeth	11 (0.8)	1 (1.1)	7 (3.2)				1(3.2)	1 (2.1)		21 (1.1)
Fractured teeth	2 (0.1)									2 (0.1)
A pain in jaw joint	2 (0.1)							1 (2.1)		3 (0.2)
Bad breath		2 (2.2)							24 (27.3)	26 (1.8)
Colour of teeth			1 (0.5)							1 (0.05)
Breeding gums			15 (6.9)							15 (0.8)
Tartar	1(0.07)		1(0.5)							1 (0.05)
Difficulty in open mouth			1(0.5)							1 (0.05)
dry mouth						37 (30.8)			1 (1.1)	38(1.9)
Improper filling or crown							5 (16.1)		7 (8.0)	12 (1.0)
Others	5 (0.4)	1(1.1)	1 (0.5)							7 (0.6)
Total	1385	91	218	5	5	120	31	48	88	1990

* Total adds up to more than 100% because some people gave more than one oral condition as the reason for the impact.

Table 5.31 The distribution of OIDP scores and OIDP eating impact, by measures of oral health (N = 1196).

Clinical variables	OIDP score			† p-Value	OIDP eating impact (%)	†† p-Value
	Median	Mean	SD			
No. of natural teeth				< 0.001		< 0.001
26-28 (596)	2.7	4.7	6.6		50.2	
21-25 (336)	4.4	5.8	7.0		58.9	
1-20 (264)	6.7	8.6	9.6		68.6	
No. of replaced and natural teeth				< 0.001		< 0.001
26-28 (874)	4.4	4.9	6.9		51.9	
21-25 (223)	4.4	7.4	8.3		66.8	
1-20 (99)	11.1	11.4	9.4		75.8	
OPs				< 0.001		< 0.001
16-18 (487)	3.6	4.8	6.6		49.9	
11-15 (341)	4.4	5.2	6.7		56.0	
0 -10(368)	6.7	8.0	9.1		66.3	
POPs				< 0.001		< 0.001
10-12 (531)	4.4	4.9	6.7		50.7	
5-9 (356)	4.4	5.3	6.6		56.2	
0-4 (309)	6.7	8.4	9.5		67.6	
AOPs				< 0.001		< 0.001
6 (752)	4.4	4.9	6.5		51.9	
4-5 (215)	4.4	6.8	8.2		61.9	
0-3 (229)	6.7	8.3	9.6		67.7	
OPRs				< 0.001		< 0.001
16-18 (651)	3.6	4.5	6.3		49.6	
9-15 (326)	4.4	6.5	8.3		62.6	
0-10 (219)	6.7	9.2	9.1		68.9	
POPRs				< 0.001		< 0.001
10-12(686)	3.6	4.6	6.5		49.7	
5-9 (324)	4.4	6.9	8.4		65.1	
0-4 (186)	6.7	9.0	9.0		67.7	
AOPRS				< 0.001		< 0.001
6 (921)	4.4	5.1	7.0		53.0	
4-5 (160)	4.9	7.4	8.2		65.0	
0-3 (115)	6.7	10.0	9.6		74.8	
Unfilled spaces				< 0.001		< 0.001
0 (511)	2.2	4.5	6.2		49.1	
1-2 (363)	4.4	5.5	7.6		55.9	
3+ (322)	6.7	8.6	8.9		69.6	
Unfilled posterior spaces				< 0.001		< 0.001
0 (544)	4.4	5.2	6.9		50.2	
1-2 (361)	6.7	8.3	9.1		56.8	
3+ (291)	8.9	12.0	10.8		68.7	
Unfilled anterior spaces				< 0.001		< 0.001
0 (998)	2.7	4.5	6.2		53.7	
1-2 (125)	4.4	6.0	8.4		68.8	
3+ (73)	6.7	8.5	8.5		76.7	
Self-perceived dry mouth				< 0.001		< 0.001
No (737)	4.4	5.0	7.3		51.2	
Yes (459)	6.7	7.4	7.9		65.6	
Total	4.4	5.9	7.6		56.7	

OPs: Occluding pairs of natural teeth; POPs: Posterior occluding pairs of natural teeth; AOPs: Anterior occluding pairs of natural teeth; OPRs: Occluding pairs of replaced and natural teeth: POPRs: Posterior occluding pairs of replaced and natural teeth; AOPRs: Anterior occluding pairs of replaced and natural teeth.

† Kruskal-Wallis and Mann-Whitney tests
† †Chi-Square for trend and Chi-Squared test

Table 5.32 The relationships between clinical dental status and binary OIDP in dentate people (N = 1196).

Clinical variables	OIDP> 0 (n = 718)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
Age							
55-64 yrs (481)	276 (57.4)	1.00					
65-74 yrs (534)	323 (60.5)	1.14 (0.89, 1.46)	0.32				
75+ yrs (181)	119 (65.7)	1.43 (1.00, 2.04)	0.05				
Sex							
Male (575)	351 (61.0)	1.00					
Female (621)	367 (59.1)	0.92 (0.73, 1.16)	0.49				
Occupation							
Non-manual (584)	344 (58.9)	1.00					
Manual (612)	374 (61.1)	1.10 (0.87, 1.38)	0.44				
Self-assessed social class							
High (5-10) (604)	347 (57.5)	1.00					
Low (1-4) (592)	371 (62.7)	1.24 (0.99, 1.57)	0.07				
Self-perceived general health							
Good and better (263)	119 (45.2)	1.00					
Fair and less(933)	599 (64.2)	2.17 (1.65, 2.86)	< 0.001				
Self-perceived dry mouth							
No (737)	401 (54.4)	1.00		1.00		1.00	
Yes (459)	317 (69.1)	1.87 (1.46, 2.39)	< 0.001	1.85 (1.45, 2.37)	< 0.001	1.72 (1.34, 2.21)	< 0.001
No. of natural teeth							
26-28 (596)	316 (53.0)	1.00		1.00			
21-25 (336)	211 (62.8)	1.50 (1.14, 1.97)	0.004	1.51(1.14, 2.00)	0.004	1.50 (1.13, 1.99)	0.004
1-20 (264)	191 (72.7)	2.32 (1.69, 3.17)	< 0.001	2.30 (1.64, 3.24)	< 0.001	2.34 (1.62, 3.24)	< 0.001
No. of natural plus replaced teeth							
26-28 (874)	487 (55.7)	1.00		1.00		1.00	
21-25 (223)	152 (68.2)	1.70 (1.25, 2.32)	0.001	1.66 (1.21, 2.28)	0.002	1.61 (1.17, 2.21)	0.004
1-20 (99)	79 (79.8)	3.14 (1.89, 5.22)	< 0.001	2.94 (1.74, 4.97)	< 0.001	2.89 (1.70, 4.90)	< 0.001
OPs							
16-18 (487)	257 (52.8)	1.00		1.00		1.00	
11-15 (341)	202 (59.2)	1.30 (0.98, 1.72)	0.07	1.31 (0.99, 1.75)	0.06	1.29 (0.97, 1.72)	0.09
0-10 (368)	259 (70.4)	2.13 (1.60, 2.83)	< 0.001	2.09 (1.53, 2.84)	< 0.001	2.06 (1.51, 2.82)	< 0.001
POPs							
10-12 (531)	285 (53.7)	1.00		1.00		1.00	
5-9 (356)	211 (59.3)	1.26 (0.96, 1.65)	0.10	1.26 (0.95, 1.66)	0.11	1.26 (0.95, 1.66)	0.11
0-4 (309)	222 (71.8)	2.20 (1.63, 2.98)	< 0.001	2.16 (1.56, 2.99)	< 0.001	2.14 (1.55, 2.97)	< 0.001
AOPs							
6 (752)	413 (54.9)	1.00		1.00		1.00	
4-5 (215)	140 (65.1)	1.53 (1.12, 2.10)	0.008	1.51 (1.10, 2.08)	0.01	1.48 (1.07, 2.04)	0.02
0-3 (229)	165 (72.1)	2.12 (1.53, 2.92)	< 0.001	2.02 (1.44, 2.83)	< 0.001	2.00 (1.42, 2.81)	< 0.001

Table 5.32 Continued.

Unfilled spaces							
0 (511)	269 (52.6)	1.00		1.00		1.00	
1-2 (363)	218 (60.1)	1.35 (1.03, 1.78)	0.03	1.35 (1.02, 1.77)	0.03	1.36 (1.03, 1.80)	0.03
3+ (322)	231 (71.7)	2.28 (1.70, 3.08)	< 0.001	2.19 (1.61, 2..98)	< 0.001	2.13 (1.56, 2.91)	< 0.001
Unfilled posterior spaces							
0 (544)	291 (53.5)	1.00		1.00		1.00	
1-2 (361)	220 (60.9)	1.36 (1.06, 1.78)	0.03	1.35 (1.03, 1.77)	0.03	1.36 (1.03, 1.79)	0.03
3+ (291)	207 (71.1)	2.14 (1.58, 2.91)	< 0.001	2.03 (1.49, 2.78)	< 0.001	1.99 (1.45, 2.73)	< 0.001
Unfilled anterior spaces							
0 (998)	572 (57.3)	1.00		1.00		1.00	
1-2 (125)	87 (69.6)	1.71 (1.14, 2.55)	0.009	1.68 (1.12, 2.52)	0.01	1.65 (1.09, 2.49)	0.02
3+ (73)	59 (80.8)	3.14 (1.73, 5.70)	< 0.001	2.86 (1.54, 5.30)	< 0.001	2.87 (1.54, 5.35)	0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, and self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, and self-perceived general health.

Table 5.33 The relationships between clinical dental status and OIDP eating impact in dentate people (N = 1196).

Clinical variables	Eating Impact (N=678)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
Age							
55-64 yrs (481)	259 (53.8)	1.00	0.06				
65-74 yrs (534)	303 (56.7)	1.12 (0.88, 1.44)	0.35				
75+ yrs (181)	116 (64.1)	1.53 (1.08, 2.18)	0.02				
Sex							
Male (575)	336 (58.4)	1.00					
Female (621)	342 (55.1)	0.87 (0.69, 1.10)	0.24				
Occupation							
Non-manual (584)	328 (56.2)	1.00					
Manual (612)	350 (57.2)	1.04 (0.83, 1.31)	0.72				
Self-assessed social class							
High (5-10) (604)	330 (54.6)	1.00					
Low (1-4) (592)	348 (58.8)	1.18 (0.94, 1.49)	0.15				
Self-perceived general health							
Good and better (263)	113 (43.0)	1.00					
Fair and less(933)	565 (60.6)	2.04 (1.55, 2.69)	< 0.001				
Self-perceived dry mouth							
No (737)	377 (51.2)	1.00		1.00		1.00	
Yes (459)	301 (65.5)	1.82 (1.43, 2.31)	< 0.001	1.80 (1.42, 2.30)	< 0.001	1.67 (1 32, 2.16)	< 0.001
No. of natural teeth							
26-28 (596)	299 (50.2)	1.00		1.00		1.00	
21-25 (336)	198 (58.9)	1.43 (1.09, 1.87)	0.01	1.42(1.08, 1.88)	0.01	1.41 (1.07, 1.89)	0.01
1-20 (264)	181 (68.8)	2.17 (1.60, 2.94)	< 0.001	2.10 (1.51, 2.93)	< 0.001	2.09 (1.49, 2.92)	< 0.001
No. of natural plus replaced teeth							
26-28 (874)	454 (51.9)	1.00		1.00		1.00	
21-25 (223)	149 (66.8)	1.86 (137, 2.54)	< 0.001	1.81 (1.32, 2.47)	< 0.001	1.76 (1.28, 2.41)	< 0.001
1-20 (99)	75 (75.8)	2.89 (1.79, 4.67)	< 0.001	2.69 (1.64, 4.41)	< 0.001	2.64 (1.60, 4.35)	< 0.001
OPs							
16-18 (487)	243 (49.9)	1.00		1.00		1.00	
11-15 (341)	191 (56.0)	1.28 (0.97, 1.69)	0.08	1.28 (0.96, 1.70)	0.09	1.25 (0.94, 1.67)	0.12
0 -10(368)	244 (66.3)	1.98 (1.49, 2.61)	< 0.001	1.90 (1.40, 2.57)	< 0.001	1.93 (1.38, 2.54)	< 0.001
POPs							
10-12 (531)	269 (50.7)	1.00		1.00		1.00	
5-9 (356)	200 (56.2)	1.25 (0.95, 1.64)	0.11	1.23 (0.94, 1.63)	0.14	1.23 (0.93, 1.62)	0.15
0-4 (309)	209 (67.6)	2.04 (1.52, 2.73)	< 0.001	1.96 (1.43, 2.69)	< 0.001	1.94 (1.41, 2.67)	< 0.001
AOPs							
6 (752)	390 (51.9)	1.00		1.00		1.00	
4-5 (215)	133 (61.9)	1.51 (1.10, 2.05)	0.01	1.47 (1.07, 2.01)	0.02	1.43 (1.04, 1.97)	0.03
0-3 (229)	155 (67.7)	1.94 (1.42, 2.66)	< 0.001	1.82 (1.31, 2.53)	< 0.001	1.78 (, 1.29,2.50)	< 0.001

Table 5.33 Continued

Unfilled spaces							
0 (511)	251 (49.1)	1.00		1.00		1.00	
1-2 (363)	203 (55.9)	1.31 (1.00, 1.72)	0.047	1.31 (1.00, 1.72)	0.052	1.31 (0.99, 1.71)	0.048
3+ (322)	224 (69.6)	2.37 (1.76, 3.18)	< 0.001	2.26 (1.67, 3.07)	< 0.001	2.03 (1.48, 2.76)	< 0.001
Unfilled posterior spaces							
0 (544)	273 (50.2)	1.00		1.00		1.00	
1-2 (361)	205 (56.8)	1.30 (1.00, 1.71)	0.052	1.30 (0.99, 1.70)	0.06	1.31 (1.00, 1.73)	0.06
3+ (291)	200 (68.7)	2.18 (1.62, 2.94)	< 0.001	2.07 (1.52, 2.81)	< 0.001	2.05 (1.50, 2.80)	< 0.001
Unfilled anterior spaces							
0 (998)	536 (57.7)	1.00		1.00		1.00	
1-2 (125)	86 (68.8)	1.90 (1.28, 2.83)	0.002	1.85 (1.23, 2.77)	0.003	1.82 (1.21, 2.74)	0.004
3+ (73)	56 (76.7)	2.84 (1.63, 4.96)	< 0.001	2.54 (1.43, 4.53)	0.002	2.55 (142, 4.75)	0.002

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, and self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, and self-perceived general health.

Table 5.34 The distribution of OIDP scores and OIDP eating impact, by Index of Eating Difficulty (IED), General Eating Difficulty (GED) and Dissatisfaction with Chewing Ability (DCA) (N = 1196).

Measures of Eating difficulty	OIDP			†p-Value	OIDP eating impact (%)	††p-Value
	Median	Mean	SD			
IED				< 0.001		< 0.001
0	4.4	4.6	6.0		51.3	
1-5	8.9	12.8	11.0		85.2	
GED				< 0.001		< 0.001
No	0.0	2.7	4.7		38.8	
Yes	6.7	8.9	8.6		82.0	
DCA				< 0.001		< 0.001
No	0.0	3.2	4.8		33.5	
Yes	6.7	9.8	9.1		78.2	

†Mann-Whitney tests

††Chi-Squared test

Table 5.35 The relationships between eating difficulty and binary OIDP in dentate people (N = 1196).

Measures of Eating difficulty	OIDP>0 (n=718) n (%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value	***Adjusted OR (95% C.I.)	† p-Value
IED									
0 (1007)	553 (54.9)	1.00		1.00		1.00		1.00	
1-5 (189)	165 (83.3)	5.64 (3.61, 8.80)	< 0.001	5.58 (3.53, 8.81)	< 0.001	5.62 (3.55, 8.91)	< 0.001	4.74 (2.91, 7.72)	< 0.001
GED									
No (576)	215 (37.3)	1.00		1.00		1.00		1.00	
Yes (620)	503 (81.1)	7.22 (5.55, 9.39)	< 0.001	7.69 (5.84, 10.13)	< 0.001	7.49 (5.68, 9.88)	< 0.001	7.50 (5.56, 10.13)	< 0.001
DCA									
No (701)	303 (43.2)	1.00		1.00		1.00		1.00	
Yes (495)	415 (83.8)	6.81 (5.14, 9.03)	< 0.001	6.89 (5.19, 9.19)	< 0.001	6.85 (5.12, 9.16)	< 0.001	6.54 (4.81, 8.89)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

*** Adjusted model 3: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health, OPs, OPRs and self-perceived dry mouth.

Table 5.36 The relationships between eating difficulty and OIDP eating impact in dentate people (N = 1196).

Measures of Eating difficulty	Eating impacts N=678 n (%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value	***Adjusted OR (95% C.I.)	† p-Value
IED									
0 (1007)	517 (51.3)	1.00		1.00		1.00		1.00	
1-5 (189)	161 (85.5)	5.45 (3.58, 8.29)	< 0.001	5.43 (3.53, 8.37)	< 0.001	5.47 (3.54, 8.44)	< 0.001	4.84 (3.05, 7.70)	< 0.001
GED									
No (576)	193 (35.5)	1.00		1.00		1.00		1.00	
Yes (620)	485 (78.2)	7.13 (5.51, 9.22)	< 0.001	7.53 (5.76, 9.86)	< 0.001	7.34 (5.60, 9.62)	< 0.001	7.60 (5.66, 10.22)	< 0.001
DCA									
No (701)	272 (38.8)	1.00		1.00		1.00		1.00	
Yes (495)	406 (82.0)	7.19 (5.46, 9.46)	< 0.001	7.34 (5.54, 9.72)	< 0.001	7.29 (5.49, 9.68)	< 0.001	7.26 (5.36, 9.82)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

*** Adjusted model 3: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health, OPs, OPRs and self-perceived dry mouth.

Chapter 6

6. Discussion and conclusions

6.1. Introduction

This chapter is divided into four sections. The discussion of the main finding is presented in Section 6.2. The important methodological issues are considered in Section 6.3. Conclusions and recommendations are presented in Section 6.4 and 6.5.

6.2. Discussion of main findings

The main findings of this research were that older people in Guangxi with more impaired dental status had significantly more eating difficulties and eating related impacts than those with better dental status. People with poorer dental status, eating difficulties and self-perceived dry mouth had significantly lower oral health-related quality of life. These results support the hypothesis of the thesis.

Five subjective measures were used to measure eating difficulties and eating impacts. They were: 1. General Eating Difficulty (GED); 2. Ease of Eating certain Foods (EEF); 3. Index of Eating Difficulty (IED); 4. Dissatisfaction with Chewing Ability (DCA); and 5. OIDP eating impact. These five measures may provide different types of information on eating difficulty.

The General Eating Difficulty (GED) is a general measure of eating difficulty using a single-item question. Ease of Eating certain Foods (EEF) was used to assess the ability to eat 16 specific foods items. Index of Eating Difficulty (IED) was created a measure of the severity of eating difficulties. Dissatisfaction with Chewing Ability (DCA) was an individual's overall assessment of their chewing ability. The OIDP eating impact refers to the prevalence of the OIDP items that assessed that impact of oral conditions on the eating difficulties experienced by respondents in the past 6 months.

The OIDP index was used as a measure of oral health-related quality of life (OHRQoL).

6.2.1. Eating difficulty

Eating difficulty was very prevalent in a sample of older Chinese population. General Eating Difficulty was reported by 51.8% of dentate subjects. Nearly half of subjects (48%) had difficulty eating at least one food of 16 individual items listed. More than one seventh (15.8%) was unable to eat one or more of five types of foods with different textures. Just fewer than fifty seven percent (56.7%) of subjects reported that eating difficulty impacted on their daily life and 41.3% were dissatisfied with their chewing ability. These results suggest that many older Chinese people in Guangxi were not satisfied with their ability to eat certain foods.

In the present study, General Eating Difficulty was defined as when a subject had difficulty biting, chewing or swallowing foods normally eaten. Dissatisfied with Chewing Ability was defined as when a subject was dissatisfaction with chewing. Some subjects could chew some foods but could not eat them because they had sensitive teeth or food catching due to a big gap between adjacent teeth. Expressions of satisfaction and dissatisfaction incorporate not only perceptions, but also the individual's expectations and values (Jokovic and Locker, 1997). For example, people who expect that tooth loss is a natural consequence of ageing may have low chewing ability but may nevertheless express satisfaction with their chewing ability. So it is not surprising that there were differences in the percentages of people who were Dissatisfied with Chewing

Ability and those had General Eating Difficulty in the present study. This finding may indicate that some older Chinese people in Guangxi did not express dissatisfaction with chewing ability even though they had eating difficulty.

One of measures of eating difficulty used in this study was Index of Eating Difficulty (IED). The IED is a new index developed as part of the work for this thesis, which was based on the Chewing Ability Index (Leake, 1990) but modified both in terms of types of foods so that it was relevant for the Chinese populations and scoring methods. It has five categories of Chinese foods. These five categories of indicator foods include 10 Chinese foods with different textures. As this was a new index, the reliability and validity were tested. Informal and formal discussions with some academics, nutritionists, and epidemiologists were carried out, two pilot studies were conducted. The results showed that the IED had a good reliability, the coefficient of reproducibility and the coefficient of scalability were 0.99 and 0.89 respectively, which are above acceptable values. In the present study, unlike in the studies using the Chewing Ability Index (CAI) developed by Leake (1990), the index was not used on an interval but on an ordinal scale because we cannot assume that the differences between two scores are equal. For example, the difference between score 0 (eat everything) and score 1 (eat everything except the foods in category 6) is not equal to the difference between score 2 and score 3 and so on (Table 4.3). Actually, this is a critique applied to all similar measures and not only the CAI. Therefore, the median and the prevalence of the different categories of the IED, not the mean and the standard deviation, were reported in the present study.

The findings showed that 84.2% of subjects had an IED of 0, suggesting that these subjects could eat all foods listed; only 2.2% of subjects had an IED of 5 meaning that they could not eat any of foods listed (Table 5.19). This very high prevalence of people with an IED of 0 could be perceived as being contradictory to the fact that 48.3% of people reported that they had some difficulty or could not eat some foods listed at all. However, it should be apparent questions on dietary restriction and questions for the IED were different. There were three answers to question on dietary restriction, namely "could eat easily", "could eat with some difficulty" and "could not eat at all" for each food item listed on questionnaires, but there were just two answers, namely "could eat " and "could not eat" on questionnaires for the IED (Appendix 4). So, people could answer "could eat" even if they had some difficulty eating the foods. People who answered "could eat" for the IED included people who answered "could eat easily" and people who answered "could eat with some difficulty" for some food items. People with an IED of 0 included people reporting they could eat some foods with some difficulty.

In the present study, the time frame for the OIDP eating impact referred to the past six months, while General Eating Difficulty focused on what occurred at the time of interview. Therefore, some subjects could have the OIDP eating impact before the interview and had completely recovered when interviewed whereby they may report no general difficulty eating. This may be why the percentage of people with the OIDP eating impact was higher than the percentage of people with General Eating Difficulty.

Subjectively assessed Dissatisfaction with Chewing Ability measures have been used in many studies (Andersson et al., 2004; Gilbert et al., 1998; Locker, 1992; Locker, 2002; Miura et al., 2001; Miura et al., 2005; Peek et al., 2002; Sarita et al., 2003). The prevalence of Dissatisfaction with Chewing Ability in the present study (41.3%) was higher than in some studies (Gilbert et al., 1998; Locker, 2002; Peek et al., 2002). Locker (2002) reported that 12.6% were dissatisfied with their chewing ability in a population of similar age to that used in this study. In the Florida Dental Care Study, 16% of subjects were dissatisfied with their chewing ability (Gilbert et al., 1998). Both studies are comparable to the present study because the same single-item question asking subjects to rate their satisfaction was used.

Nearly half (48%) of the Chinese people in the present study reported that they had some difficulty or could not eat salted roast chicken, roast pork ribs, roast duck or chicken. About one third had difficulty or could not eat apples. Even very common foods such as cooked sliced pork or cooked green vegetables, cooked cucumber and carrots posed difficulties in between 15-25% of people (Table 5.23). The comparison of our results with those from other studies is difficult because the foods used in this study differed from those in other countries. Only apples provide an example of a food that can be used for international comparisons (Anastassiadou and Heath, 2002). For example, 36% of dental subjects in the present study had difficulty or could not eat apples compared with 28% of dentate subjects in the NDNS (Steele et al., 1998). The percentages of people who could eat some hard foods with some difficulty or not eat them at all were higher in the present study than in the NDNS. The possible reasons are that in general some Chinese foods on the list like salted roast chicken, roast pork ribs, roast duck or chicken, boiled chicken or duck were harder compared to foods listed in the NDNS because the bones were not removed from the chicken, duck and pork ribs.

It is difficult to compare the results of the IED from the present study with the findings from other studies because the foods used and scoring systemin the present study differ from those in other studies done in a number of countries. In addition, oral health and cultural attitudes to health also differ between the sample of this study and the samples of studies carried out in other countries, further hindering the comparability between the studies.(Gilbert et al., 1998; Gilbert et al., 2004; Leake, 1990; Miura et al., 1997; Miura et al., 2000; Miura et al., 2003; Tsuga et al., 1998; Koyama et al., 2005; Kurita et al., 2001; Locker, 2002; Peek et al., 2002; Sarita et al., 2003; Takata et al., 2006). This was discussed in the literature review (section 2.1). The percentage of people who could not eat apples was lower when compared with that found in Leake's study. In Leake's study, nearly 23% could not chew the whole apples without cutting it up. But in the present study, only 14% could not chew the whole apple (Table 5.2). There are two possible reasons for this. One is that some people who answered they could chew apples in our study included those who could chew apples with some difficulty, as stated earlier. Actually, in the present study 36% of subjects reported they could eat with some difficulty or could not eat the whole apple. Another reason is that there were some varieties of soft apples in Guangxi and older people may choose these.

In most cases of eating difficulty, the difficulties were probably related to chewing ability, but there may have been other factors involved. For example, in the south of China, some foods like salted roast chicken, roast pork ribs, roast duck or chicken are regarded as too "hot" for older people. When people get older, they are more likely to eat soft or "cold" foods, like tofu in water, rice porridge, and boiled fish. In addition, older people may consider that eating hard foods can damage teeth because your teeth become fragile when you get older. They also consider that soft food can be very nutritious and as good as normal food after careful food preparation (Kwok et al., 2004). Therefore, some people consider that older Chinese people prefer eating soft foods instead of eating hard foods. Then, they adapt to eating soft foods. This is a possible reason why perceived eating difficulty was much higher in the present study compared to other studies (Gilbert et al., 1998; Locker and Miller, 1994; Sheiham et al., 1999; Sheiham and Steele, 2001).

As expected, there were socioeconomic and demographic gradients in eating difficulties. People who are of higher socioeconomic levels have better health (Adler et al., 1994). In the present study, like in some other studies (Peek et al., 2002), more people in the lower than the higher socioeconomic groups had eating difficulties. People from manual occupations and people with low self-assessed social class were more likely to be dissatisfied with their chewing ability and have an IED between 1 and 5. The possible reasons for the difference is that people from non manual occupations had higher mean numbers of natural plus replaced teeth and filled teeth compared to people from manual occupations. In addition, people with high self-assessed social class had higher mean of filled teeth compared to those with low self-assessed social class. The differences were statistically significant. This indicates that people at higher levels of socioeconomic position were more likely to have their missing teeth replaced and their decayed teeth filled.

Age is a very important factor in relation to eating difficulty. Age was significantly related to all of measures of eating difficulty in the present study. As age increased, General Eating Difficulty, Dissatisfaction with Chewing Ability, and the percentage of people with an IED between 1 and 5 increased. For example, 74.6 % of people aged 75 years and over but only 54.1% of people aged 65-74 years older and 40.7 % of people aged 55-64 years older reported they had general eating difficulty (Table 5.21). In general, these results support the findings from some other studies (Gilbert et al., 1998; Kurita et al., 2001; Peek et al., 2002) and suggest that sociodemographic variables may influence eating difficulty by affecting other aspects of health, such as general health, tooth loss or oral disease (Peek et al., 2002). It is interesting to note that although females had a higher number of natural plus replaced teeth than males (Table 5.12) there were no significant differences in all of measures of eating difficulty between the sexes.

Significant relationships were found between clinical dental status and eating difficulty in the present study. People with fewer teeth, fewer occluding pairs and more unfilled spaces were more likely to have eating difficulty, namely more likely to have General Eating Difficulty, Dissatisfaction with Chewing Ability, an IED between 1 and 5 and more difficulty eating certain foods than those with more teeth, more occluding pairs and fewer unfilled spaces. The present study, like others, showed that eating difficulties were higher among people with fewer teeth (Gilbert et al., 1998; Sheiham et al., 1999). For example, those with 1-20 teeth reported more General Eating Difficulty than those with more than 20 teeth. There were strongly significant relationships between clinical dental status and Index of Eating Difficulty for each specific clinical dental status category. The probability of having an IED between 1 and 5 markedly increased for people with 1-20 teeth compared to those with more than 20 teeth. After adjusting for age, sex, occupation, self-assessed social class and self-perceived general health, the statistical significances were maintained between people with 1-20 teeth or 21-25 teeth and those with 26-28 teeth. For ease of eating certain foods, about 75% of subjects with 1-20 natural teeth had some difficulty eating whole apples or could not eat them at all, whereas only 15% of those with 26-28 had the same limitation. These differences were statistically significant and were maintained after adjusting for sociodemographic factors and self-perceived general health. A threshold of 20 or 21 teeth has been widely used as a broad indicator of a functional dentition for some years (Sheiham et al., 1999; Shimazaki et al., 2001). The findings from the present study support this concept.

The number of teeth is related to eating difficulty, however the number of pairs of teeth is a more refined measure because this takes into account both number and position of teeth in the mouth. Oosterhaven et al (1988) reported that the number of occlusal contacts in the premolar area were more important than number of missing premolar in terms of chewing ability. The number of occluding pairs of teeth has been widely used to determine chewing ability and eating difficulty. There are some well-conducted studies which have tested the relationship between dental status and chewing ability using the number of occluding pairs of teeth (Gilbert et al., 2004; Leake, 1990; Nowjack-Raymer, 2000; Sheiham et al., 1999). Leake (1990), in developing an index of chewing ability, found that the number of opposing pairs of posterior teeth followed by the number of functional pair of premolar and anterior natural teeth were the most important factors in affecting chewing ability. In another study using Leake's Chewing Ability Index to measure current chewing difficulty, Gilbert et al (2004) reported on a study of a community-based sample aged 45 years and over from four counties in North Florida. Of people who reported tooth loss, those with 0-8 Occluding Pairs of natural teeth (OPs) at baseline were approximately 1.6 times more likely to experience chewing difficulties compared with those with 9-12 OPs (28% vs. 18%) and about 3.5 times as likely as those who had 13 to 16 OPs (28% vs. 8%).

In the aforementioned studies, the number of occluding pairs of natural teeth was calculated while the number of occluding pairs of teeth for natural plus replaced teeth was also calculated in the present study. In the present study, all relevant variables, irrespective of whether they referred to natural teeth only or natural plus replaced teeth had negative relationship to eating difficulty.

The present study demonstrated that the chewing ability reduced with decreasing the number of occluding pairs of teeth. Eating difficulties increased as the numbers of OPs, POPs, AOPs, OPRs, POPRs and AOPRs decreased. One of the main findings was that Ease of Eating certain Foods was influenced by the number of occluding pairs. People with more occluding pairs were more likely to be able to eat certain hard foods without difficulty. After adjusting for the effects of sociodemographic variables and self-perceived general health, the differences were highly statistically significant for all foods listed except rice porridge, boiled fish and tofu in water which are very soft foods that every body could eat easily. For example, 68.5% of subjects with 0-10 OPs had some difficulty eating whole apples or could not eat them at all, but only 14.6% of those with 16-18 OPs had same limitation. These findings support the concept that the number of occluding pairs of teeth are important factors affecting eating difficulty and chewing ability (Foerster et al., 1998; Gilbert et al., 2004; Leake, 1990; Nowjack-Raymer, 2000; Peek et al., 2002; Sheiham et al., 1999).

What is surprising in this study is that people with 28 natural teeth still had some difficulty eating certain listed foods. The probable reasons were that condition of the teeth, not just tooth loss affects eating difficulty. Some people with 28 natural teeth had caries, mobile teeth, decayed roots and exposed roots that all influence eating difficulty. The results from this study showed that the most common reason for people with 28 natural teeth having some difficulty eating certain foods was food catching (46.4%). The next most common reason was sensitive teeth caused by cervical wear, caries or exposed roots. Toothache, loose teeth, oral ulcers and periodontal disease also can cause eating difficulty in people with 28 teeth (Table 9.1 in Appendix 9).

It is interesting to point out that the levels of Ease of Eating certain Foods, General Eating Difficulty, Dissatisfaction with Chewing Ability, and the percentage of people with an IED between 1 and 5 in people with replaced teeth were higher than in those with natural teeth only. For example, 68.7% of people with 21-25 natural plus replaced teeth had some difficulty eating whole apple compared to only 47.6% of those with 21-25 natural teeth only had the same limitation (Table 8.5 in Appendix 8). Similarly, the percentage of people with General Eating Difficulty was 86.8% in those with 1-20 natural teeth but 100% in those with 1-20 natural plus replaced teeth. For Dissatisfaction with Chewing Ability, the differences were small, 85.3% compared to 87.5%, and for Index of Eating Difficulty they were 64.0% compared to 66.7%. There were similar finding for those with 26-28 natural teeth and those with 26-28 natural plus replaced teeth (for GED, 32.3% compared to 54.0%, for DCA, 26.6 compared to 36.4%, for IED 4.9% compared to 11.1%) (Table 8.9-10 in Appendix 8). The gap in Ease of Eating certain Foods, General Eating Difficulty, Dissatisfaction with Chewing Ability and Index of Eating Difficulty between natural teeth and replaced teeth indicates that artificial teeth are not as satisfactory as natural teeth.

Unfilled spaces due to missing teeth that were not replaced by a fixed or removable prosthesis may affect eating ability. Some authors consider anterior spaces to be more important for aesthetics than for function (Tsakos et al., 2004). There were significant relationships between eating difficulty and unfilled spaces in the present study. People with more than 2 unfilled anterior spaces had the most difficulty eating apple and corn on the cob which needed to be bitten by the front teeth. For example, 94.5% of people with more than 2 anterior unfilled spaces, 61.6% of people with 1-2 anterior unfilled spaces could eat whole apples with some difficulty or could not eat them at all but only 28.6% of people with no anterior unfilled spaces had the same limitation. A possible reason was that missing anterior teeth reduced biting ability of apples, which normally needs to be bitten using anterior teeth. In addition, periodontally affected teeth may be mobile and/or sensitive when biting. In such situations there may be reduced biting ability. There was a highly significant difference in the IED by anterior unfilled spaces in both unadjusted and adjusted models. The differences were significant when comparing three groupings by anterior unfilled spaces with each other. These findings indicate that unfilled anterior spaces did not just affect aesthetics but also affected difficulty eating some foods. The finding for posterior unfilled spaces was interesting. No statistically significant difference in the IED existed between people with no posterior unfilled spaces and people with 1-2 unfilled posterior spaces in unadjusted and adjusted models (Table 5.27). This indicates that a few unfilled spaces in the posterior area may not lead to a serious eating difficulty.

Eating impacts were very prevalent in the present study. More than half the sample reported having an eating impact on their daily life. The percentage of people with OIDP eating impact was high (94%) in people with an OIDP over zero. This suggests the OIDP eating impact is the main factor affecting the oral health-related quality of life in a sample of older Chinese people in Guangxi. Clincal dental status significantly affected eating impact. The probability of an eating impact increased as the number of teeth, number of occluding pairs decreased and number of unfilled spaces increased. The results were consistent with the findings from other studies (Astrom et al., 2006; Kida et al., 2006a; Srisilapanan and Sheiham, 2001a; Tsakos et al., 2004; Tsakos et al., 2006).

In conclusion, eating difficulties were prevalent in a sample of older Chinese people in Guangxi province. There were strong relationships between clinical dental status and eating difficulties and eating impacts. The relationships were significant for 13 foods, which required more chewing but not for soft foods such as tofu in water, rice porridge, and boiled fish. People with fewer teeth, fewer occluding pairs of teeth, and more unfilled spaces, were more likely to report general eating difficulty, dissatisfaction with chewing ability, having more difficulty eating certain foods and having an IED between 1 and 5.

6.2.2. Oral health-related quality of life (OIDP)

As more people have migrated to all corners of the globe, multicultural or international research is challenging oral health services research, particularly in the field of subjective measures of oral health-related quality of life (Lawrence, 2001). This requires using culturally sensitive health-related quality of life measures, primarily to enable comparison or pooling of results across different language groups (Cohen, 1997). This study is the first to measure oral health-related quality of life (OHRQoL) using OIDP in Mainland China. It addressed the cross-cultural translation and adaptation process for English-version into a Chinese version. In the present study, the cross-cultural translation and adaptation process were successfully conducted. Chinese version-OIDP was very similar to the original version and was easily understood by the elderly Chinese population. The results from the present study showed that the Chinese version-OIDP had excellent psychometric properties in a sample of older Chinese population in Guangxi. In the reliability and validity tests, all of the correlations were positive which means that the homogeneity of the items was not in question. On the other hand, no correlation was high enough for any item to be redundant. All of the item-total correlations were above the minimum recommended level of 0.20 for including an item in a scale (Kline, 1986). The standard item alpha was over both recommended minimum values of 0.5 (Cronbach, 1951; Ebel, 1951; Woodbury, 1950) and 0.7 (Streiner and Norman, 1995). The alpha coefficients did not increase when any of the items was deleted. The test-retest reliability was tested through the whole study. Both the weighted kappa for OIDP categories (0.86) and the Intraclass Correlation Coefficient (ICC) for OIDP score (0.91) were high. For validity, there were highly significant relationships between OIDP scores and perceived dental treatment ($p < 0.001$), self-perceived oral health ($p < 0.001$), and self-perceived general health ($p <$

0.001). This indicates that the Chinese version OIDP is a reliable, valid measure and is a useful measure of oral health-related quality of life in a sample of older Chinese population in Guangxi.

The prevalence of oral impacts might be considered as high in this sample of older Chinese population in Guangxi because 60% subjects reported they had at least one oral impact in the past six months. The prevalence of oral impacts was much higher in this study than that in both Greek and British elderly samples (Tsakos et al., 2004; Tsakos et al., 2006) and similar to Thai samples of adults aged 60-74 years (Srisilapanan and Sheiham, 2001a) and older Tanzanian people (Kida et al., 2006b). Like most previous studies (Kida et al., 2006b; Srisilapanan and Sheiham, 2001a; Tsakos et al., 2004; Tsakos et al., 2006) eating related oral impact was the most common impact. The above-mentioned studies used the same oral health-related quality of life measure, namely the OIDP index. They are comparable with the present study.

Other daily life activities, such as cleaning teeth (17.5% subjects reported oral impacts on their cleaning teeth), relaxing (sleeping) (9.9%), speaking (7.5%) and contact with people (7.3%) were also affected. This suggests that quality of life was compromised by dental and oral disorders. This high prevalence of oral impacts suggests that many older Chinese people in Guangxi were not achieving high levels of oral health-related quality of life.

An interesting finding is that overall prevalence of OIDP and eating impacts were higher in populations in developing countries including China, Thailand, Uganda, and Tanzania than in developed countries including UK, Greece and Norway (Table 6.1). A possible reason is that people in developed countries have better oral health. For example, in the present study, the main factor causing OIDP impacts was not only tooth loss, but toothache as well, while the main cause for eating impacts was food catching. These results were consistent with the findings by Adulyanon (1996), Srilapananan (1997), and McMillan (2003). McMillan (2003) also reported that the food catching was the most common negative impact (57%) among elderly people in Hong Kong. This may indicate that food catching is common in Chinese people. Another possible reason is cultural differences in conceptions of health (Murray and Lopez, 1996).

Table 6.1 Summary of studies measuring oral impacts using the OIDP indicator.

Year	Author	Age range (yrs)	Number of subjects	Source of sample	Prevalence of OIDP	Prevalence of eating impact
2006	Zeng	55-100	1196	Guangxi of China	60.0%	56.7%
2006	Kida et al	50-100	1031	Tanzania	51.2% in urban 62.1% in rural	42.5% in urban 55.1% in rural
2006	Astrom et al	67-79	1309	Norway	18.4%	11.3%
2006	Tsakos et al	65+	753	Britain	12.3% in dentate 16.3% in edentate	7.5% in dentate 11.9% in edentate
2004	Tsakos et al	65+	681	Greece	39.1% in dentate 47.6% in edentate	29.9% in dentate 41.2% in edentate
2001	Srilapananan et al	64-74	707	Thailand	52.8%	47.2%

The evidence from epidemiological studies shows that factors including age, sex, dental status, oral disease, socio-economic status, cultural background, and smoking might influence oral health–related quality of life (OHRQoL) (Astrom et al., 2006; McGrath and Bedi, 2004; Steele et al., 2004; Tsakos et al., 2004; Tsakos et al., 2006). Sociodemographic factors affecting OHRQoL were reported by a number of authors (Astrom et al., 2006; John et al., 2003; McMillan et al., 2003; Savolainen et al., 2005; Sheiham et al., 2001b). Sheiham et al (2001) reported on the association between the prevalence of oral impacts and social class in the UK, lower socio-economic groups had more oral impacts on their daily performances than higher socio-economic groups. In a study of Norwegian adults aged 16-79 years older, the region of residence was significantly related to the prevalence of OIDP (Astrom et al., 2006). Consistent with the results from some studies (Astrom et al., 2006; Sheiham et al., 2001b; Steele et al., 2004), the present study revealed that sociodemographic factors were related to OIDP scores. People from lower self-assessed social class or manual occupation were more likely to have higher OIDP scores than people from higher self-assessed social class and non-manual occupation, but this significant difference was not found when analysing OIDP as a binary variable in the logistic regression. Categorizing data differently can affect statistical significance. When OIDP scores were used to test the relationships between OIDP and self-assessed social class and occupation using univariate analysis, there were significant relationships, but when OIDP was used as a dichotomous variable the statistical significance changed because some information on variability was lost.

The findings from many studies indicate that age was a factor affecting OHRQoL (Astrom et al., 2006; Carr et al., 2001; John et al., 2003; Steele et al., 2004). A study comparing two national samples showed that the impact of oral health on quality of life reduced with increasing age, which is independent from the effect on tooth loss (Steele et al., 2004). Unlike these previous studies, this study did not find age was an important factor affecting OIDP scores and prevalence of OIDP. However, the restricted age range of the present study needs to be acknowledged. The lack of an observed age related effect might be due to the fact that everyone was 55 years and over.

The relationship between clinical indicators and perceived assessment of oral health-related quality of life is not very clear. In general, there are weak associations between clinical indicators of normative need and OHRQoL (Gooch et al., 1989; Locker and Slade, 1994; Srisilapanan and Sheiham, 2001a). The relationship between clinical dental status and OHRQoL is stronger for some clinical measures of dental status, such as number of natural teeth, number of occluding pairs of natural teeth (Astrom et al., 2006; Elias and Sheiham, 1999; John et al., 2004; Leao and Sheiham, 1995; Locker and Miller, 1994; Locker and Slade, 1994; McGrath and Bedi, 2002; Slade et al., 1996; Srisilapanan and Sheiham, 2001a; Steele et al., 2004; Tsakos et al., 2004; Tsakos et al., 2006).

An important finding of this study was the significant relationships between clinical dental status and subjective oral health-related quality of life (OHRQoL). Among dentate subjects, the number of teeth, the number of occluding pairs of teeth and the number of unfilled spaces were significantly related with Oral Impacts on Daily Performances (OIDP) even after controlling for sociodemographic variables and self-perceived general health. Furthermore, the results of the present study showed that people with 20 or less teeth had a significantly higher prevalence of oral impacts compared to those with more than 20 teeth ("teeth" includes natural teeth and replaced teeth). After controlling for the effects of age, sex, occupation, self-assessed social class and self-perceived general health, subjects with 1-20 natural teeth had 2.3 times higher odds of experiencing oral impacts when compared with those with 26-28 natural teeth. In a comparable study of an elderly population in Athens, Greece, the same measure of OHRQoL, namely OIDP, and clinical measures were used. In this study in Greece, there was a significant association between OIDP scores and number of teeth. Participants with 1-10 natural teeth had the highest prevalence of oral impacts (45.7%). Prevalence of oral impacts was 42.5% in subjects with 11-20 natural teeth, while subjects with 21 or more teeth had a significantly lower prevalence of OIDP (28.5%). In the adjusted model, people with 1-10 teeth had 2.0 times; those with 11-20 had 1.8 times higher odds of experiencing oral impacts, compared with those with 21 or more teeth (Tsakos et al., 2004).

Another important finding in this thesis was the significant relationship between oral impacts with both occluding pairs of natural teeth and occluding pairs of natural plus replaced teeth. This significant relationship existed for all measures of occluding pairs including OPs, POPs, AOPs, OPRs, POPRs and AOPRs. The prevalence of oral impacts was significantly lower in subjects with more than 10 OPs or 5-12 POPs or 4-6 AOPs. People with 0-10 OPs had 2.1 times higher odds of experiencing oral impacts than those with 16-18 OPs. Similarly for POPs and AOPs, those with 0-4 POPs were 2.1 times; those with 0-3 AOPs were 2.0 times more likely to report oral health impacts on their daily performance than those with 10-12 POPs and those with 6 AOPs after adjusting for age, sex, occupation, self-assessed social class and self-perceived general health. These findings were consistent with some previous studies (Locker and Slade, 1994; Sheiham et al., 2001b; Tsakos et al., 2004; Tsakos et al., 2006). Here, OPs and POPs categories in the present study were different from some other studies (Gilbert et al., 2004; Locker and Slade, 1994) because occluding pairs of molars were scored as two occluding pairs. So the maximum OPs and POPs were 18 and 12 respectively (excluding third molars), which is higher compared with the above-mentioned studies. In a study of an older Greek population aged 65 years and over using OIDP index, the OIDP was statistically significantly related to OPs and POPs (Tsakos et al., 2004). In another comparable study of a nationally representative sample of the British older population, dentate people with 0-9 OPs were 2.6 times and those with 0-3 AOPs were 3.0 times more likely to experience oral impacts when compared with those with 10 or more OPs or those with 4-6 AOPs respectively. The significant relationships existed between oral impacts and OPs and AOPs but not for POPs. The author stated that this lack of significance for the relationship between oral impacts and POPs might be related to the overall lower prevalence of oral impacts in the older British population (Tsakos et al., 2006).

Elias and Sheiham (1998) reported that the anterior teeth had a higher impact on the perceived perception of satisfaction. The premolar pairs had a higher impact on satisfaction than molars. Three premolar pairs, intact anterior sextants and no molars were sufficient in regard to their oral status even when the molar teeth were not replaced with partial dentures. In the present study, no significant difference in OHRQoL existed between people with 10-12 POPs and those with 5-9 POPs but there was a significant difference between people with 4-5 AOPs and 6 AOPs. This may suggest that, to a certain extent, anterior occluding pairs had a higher impact on OHRQoL compared with posterior occluding pairs.

In the present study, unfilled anterior spaces were also calculated. There were significantly relationships between unfilled anterior spaces and OIDP scores. Subjects with more than 2 unfilled anterior spaces were 2.9 times, and those with 1-2 unfilled anterior spaces were 1.7 times more likely to experience oral impacts than those with no unfilled anterior spaces. This is agreement with other studies (Srisilapanan and Sheiham, 2001a; Tsakos et al., 2004; Tsakos et al., 2006). Unfilled anterior spaces affect appearance of a person and could be expected to affect many OIDP items, such as smiling, social contacts and emotional stability apart from the obvious difficulties with eating and speaking (Tsakos et al., 2004). The findings from the present study were that unfilled anterior spaces affected more than one OIDP performance, particularly speaking, smiling and social contact (results not presented).

In conclusion, the prevalence of Oral Impacts on Daily Performances (OIDP) was very high in a sample of older Chinese people in Guangxi province. Eating impact was the most common impact. Clinical dental status was related to oral health impacts on the quality of life. As the numbers of teeth, numbers of occluding pairs of teeth (whether natural teeth or natural plus replaced teeth) increased and unfilled of spaces decreased, OIDP scores decreased.

6.2.3. Eating difficulty and oral health-related quality of life

Since eating difficulty reflects the subject's self-perceived difficulty eating different foods, it may be closely related not only to physical health but also to subject's overall satisfaction with their daily life and social interactions than a more objective measure such as number of teeth. Therefore, this study tried to assess the relationship between eating difficulty and overall OIDP scores, namely OHRQoL. There were significant relationships between eating difficulty and overall OHRQoL in both unadjusted and adjusted models in the present study. The median of overall OIDP scores was 4.4 in people with an IED of 0 but 8.9 in those with an IED between 1 and 5. There were similar trends for Dissatisfaction with Chewing Ability (DCA), the median of overall OIDP scores was 6.7 in people with DCA while 0 in those without. After adjusting for age, sex, occupation, self-assessed social class, self-perceived general health, self-perceived dry mouth, numbers of OPs and OPRs, people with an IED between 1 and 5 were 4.74 (95% CI = 2.91 - 7.72) times more likely to have experienced oral impacts on their daily life in comparison to those with an IED of 0. Similarly, those reporting general eating difficulty were 7.50 (95% CI = 5.56 - 10.13) times, while those dissatisfied with their chewing ability were 6.54 (95% CI = 4.81 - 8.89) times more likely to report oral impacts in comparison to sample without GED and DCA in each case. People with eating difficulty reported more oral health impacts on their daily life. These findings strongly suggest that eating difficulties affect oral health related-quality of life. This may suggest that if we can do something decreasing eating difficulty may be able to improve quality of life in elderly population.

This finding was consistent with a study in Japan (Takata et al., 2006). Takata et al (2006) reported that subjects who were able to chew 5-9 indicator foods were 2.1 times, and those who were able to chew 0-4 indicator foods were 2.7 times more likely to be dissatisfied with their physical condition in comparison with those who were able to chew 15 indicator foods. The prevalence of dissatisfaction with daily life was 3.4 times higher in subjects who were able to chew 0-4 indicator foods than in subjects were able to chew 15 indicator foods after adjustment for sex, mental status and activities of daily living status. Dissatisfaction with interaction involving family or friends was also prevalent in people who could eat only 5-9 indicator foods and those who were able to eat 0-4 indicator foods. This indicates that Japanese people who had eating difficulty had poor quality of life as well.

Eating is not just a purely biological activity but also related to social needs and culture. Therefore, eating difficulty may affect OHRQoL by different pathways, such as social or psychological impacts.

In conclusion, there were significant positive relationships between eating difficulty and OIDP scores. People with eating difficulty were more likely to report oral impacts on their daily life.

6.2.4. Self-perceived dry mouth and eating difficulty and oral health-related quality of life

Good oral health is more than healthy teeth. Oral disease and disorders can affect general health, well being and quality of life. The results from the present study showed that self-perceived dry mouth was reported by 38.4% of dentate people including people feeling their mouth dry at meals and people feeling dryness at night. This suggests that self-perceived dry mouth was common in a sample of older Chinese people in Guangxi.

Some research showed that dry mouth was related to eating difficulty and difficulties in eating certain foods (Gerdin et al., 2005; Peek et al., 2002; Sheiham et al., 1999). Sheiham (1999) reported that in dentate people, although there were slightly more people with, rather than, without dry mouth who could eat certain foods only with difficulty or not eat them at all, the differences were not significant after adjusting for age, sex, social class, region of origin and denture wearing. However, the differences were significant for edentate people. The findings from the present study were consistent with this aforementioned study, For example, a significant percentage of people with self-perceived dry mouth were more likely to report eating difficulty and perceived dissatisfaction with their chewing ability. After adjusting for age, sex, occupation, self-assessed social class and self-perceived general health, there were significant differences between people with self-perceived dry mouth and those without in eating many foods such as salted roast chicken, roast pork ribs, roast chicken or duck, boiled chicken or duck, cooked sliced beef, cooked sliced pork, cooked cucumber or lotus root and cooked carrots. Interestingly, this significant difference did not apply for whole apples, corn on the cob, or cooked green vegetables. The possible reason was that these fruits and vegetables have more water content and stimulate saliva flow.

Regarding the relationship between self-perceived dry mouth and Index of Difficulty Eating, the findings suggest that the percentage of people with an IED between 1 and 5 was higher in people with self-perceived dry mouth compared to people without. This result suggests, to a certain extent, self-perceived dry mouth affects eating difficulty in the present study population. These findings were in accordance with the report by

Locker (2003) that elderly people with subjective dry mouth were more likely to have a problem chewing or eating.

The evidence that dry mouth was a factor affecting OHRQoL was reported by Locker et al (2001, 2003) and Gerdin et al (2005). A study of comparison of GOHAI and OHIP-14 as measure of oral health-related quality of life in elderly people in Canada, found that self-perceived dry mouth was significantly related to OHRQoL (Locker, 2003). In a study of a population of older people in Sweden, Gerdin (2005) reported that both subjective and objective dry mouth were significantly associated with OHRQoL (OHIP). Perceived dry mouth was statistically significantly related with "trouble pronouncing words", "sense of taste has worsened", and "had been irritable with other people" but no significant relationship with "uncomfortable to eat foods". "Difficulty to relax" correlated significantly with objective dry mouth. Consistent with these studies, the finding of the present study showed that self-perceived dry mouth was significantly related to OHRQoL. People with self-perceived dry mouth were more likely to have a higher OIDP score. However, self-perceived dry mouth very weakly affected OHRQoL in the present study. The possible reasons are people had many dental and oral disorders that caused oral impacts. The effects of some dental and oral disorders on quality of life were more important than that of self-perceived dry mouth. The most common impact caused by self-perceived dry mouth was on relaxing (sleeping).

In conclusion, self-perceived dry mouth affected eating difficulty and oral health related-quality of life. People with a self-perceived dry mouth were more likely to have eating difficulty and be dissatisfied with their chewing ability. Also those with self-perceived dry mouth had a higher OIDP score than those without self-perceived dry mouth, but self-perceived dry mouth was not an important cause of oral impacts.

6.3. Methodological considerations

The findings of the present study should be considered in relation to the study's methodological strengths and weaknesses.

6.3.1. Strengths of the study

1. The response rate of 96.4% was quite high. The manner of selecting people was a very important factor for achieving this high response rate. The samples from the routine check-ups centre of the hospital were very pleased to have this free and extra dental clinical examination. Another important factor contributing to the high response rate was cooperation between the author and chief administrators of the hospital.

2. A new Index of Eating Difficulty based on Chinese foods was developed to measure eating difficulty appropriate for older Chinese people. Two pilot studies were conducted to improve the reliability and validity of this index. The Index of Eating Difficulty was successfully used to measure eating difficulty in our older Chinese population. The index and the method of analysis of the data from the index is an advance on the previously used Chewing Ability Index (Leake, 1990).

3. The Oral Impacts on Daily Performances (OIDP) measure has not been used with Chinese populations in Mainland China. The process of cross-cultural translation and adaptation has facilitated-the derivation of the Chinese version of the OIDP. The results showed that the OIDP index has excellent psychometric properties in our older Chinese population.

4. This study did not just simply count numbers of natural teeth as a measure of clinical dental status but also counted number of natural plus replaced teeth, numbers of

occluding pairs of teeth, numbers of posterior occluding pairs of teeth and numbers of anterior occluding pairs of teeth for natural teeth or natural plus replaced teeth. In addition, unfilled spaces were used as well. These nine different approaches allowed for the comprehensive assessment of dental status, were calculated for different groups, namely dentate people, people without prostheses and people with prostheses.

6.3.2. Limitations of the study

Although this study has clearly identified strengths, there are also some weaknesses.

They are:

1. The aims of this study were to develop new methods to measure eating difficulty and test the relationships between clinical dental status and eating difficulty and oral health-related quality of life. Therefore, it did not require a representative sample. The subjects were from 20 different companies including different occupations and with different incomes. The subjects came for medical check-ups not for dental check-ups. So the findings may not reflect conditions in a truly representative population sample

2. Very few edentate people took part in this study and therefore our findings cannot be generalised to edentate older people.

6.4. Conclusions

1. A new Index of Eating Difficulty has been developed which is applicable to older Chinese people. This study has demonstrated that this Index of Eating Difficulty is a valid and reliable measure of eating difficulty in a sample of older Chinese people in Guangxi province.

2. The prevalence of General Eating Difficulty and Dissatisfaction with Chewing Ability was high. These findings suggest that eating difficulty in a sample of older Chinese people in Guangxi was high.

3. Sociodemographic factors were important factors affecting eating difficulty. Increasing age and low social class were associated with greater eating difficulty.

4. Clinical dental status was statistically significantly related to eating difficulty. People with less teeth or less occluding pairs of teeth (whether teeth is natural or replaced) had more eating problems including having general eating difficulty and dissatisfaction with chewing ability and having some difficulty eating or could not eat some foods. In addition they had higher odds of having Index of Eating Difficulty over 0.

5. The prevalence of Oral Impacts on Daily Performances was high (60%) in this study. OIDP eating impact was the most common impact. This high prevalence indicated that many older Chinese people in Guangxi were not achieving high levels of oral health-related quality of life.

6. Clinical dental status was related to oral impacts. People with more missing teeth or fewer occluding pairs of teeth (whether natural or replaced teeth) had higher OIDP scores and OIDP eating impact. These results indicate that poor dental status impacts on

quality of life in a sample of older Chinese people.

7. Self-perceived dry mouth was significantly related to eating difficulty and OHRQoL. People with self-perceived dry mouth were more likely to have eating difficulty and have high risk of experiencing oral impacts on their daily life.

8. OIDP scores were significantly related with eating difficulty. People with a high OIDP score had high risk of having an IED between 1 and 5, having General Eating Difficulty and Dissatisfaction with Chewing Ability. This indicated that eating difficulty affected OHRQoL.

6.5. Recommendations

6.5.1. Recommendation for further research

1. The findings of this thesis might differ between geographical areas of China and other countries. However, the findings certainly provide a basis for further work in other parts of China.

2. The relationships between dental status and nutrient intake, and nutritional status were not tested in this study. We used some foods that were hard to eat, such as salted roast chicken, roast pork ribs and roast chicken to test whether people had difficulty eating or not. Although a very high percentage of people had difficulty eating some foods, it does not mean that they were malnourished because they could not eat these hard foods. Kwok et al (2004) reported that poor functional status is associated with lower fibre intake, but not with intakes of macronutrients or micronutrients in Chinese vegetarian old age home residents in Hong Kong. It would be interesting to assess the relationships between dental status and nutrient intake, and nutritional status in a large sample combined with nutrition epidemiology and clinical nutrition sciences in Mainland China.

3. This study focused only on older people. Older people often suffer multiple acute or chronic diseases with variable functional, emotional, and other social consequences. This could impact on their eating difficulty and quality of life. In addition, they experience a variety of disease process over many years and have variable access to the dental care system over the course of their lives. Therefore, oral health knowledge, attitudes, expectations may affect their daily life as well. So in the future research, the Index of Difficulty Eating and OIDP should be used in other age groups.

6.5.2. Recommendation for public health policy

1. Nutrition researchers and health promotion policy makers should include dental status in their surveys as a factor that influences the intake of food items including fresh fruits, vegetables and dietary fibre.

2. Oral health problems should be given a higher priority by policy makers. Even though most of them are not life threatening they cause significant impacts on the quality of life of older people.

3. Since dental status and eating difficulty can impact on a person's daily life in elderly populations, dental care workers should improve the ability to eat in the elderly people in order to improve their oral health-related quality of life.

4. Although the relationship between eating difficulty and nutrient intake is uncertain, people should be encouraged to keep their natural teeth as they enable be their masticatory performance better than artificial teeth and do not restrict food choice. This goal could be readily achieved with support from strong public health policy.

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APPENDICES

Appendix 1

Development of an Index of Eating Difficulty (IED)

The most commonly used methods of assessing chewing ability and eating difficulty were mainly developed in Western populations and as Chinese cuisine differs markedly from Western diets, it was necessary to develop an Index of Eating Difficulty (IED) appropriate for Chinese populations. To develop an IED to evaluate the relationship between clinical dental status and eating difficulty, two methods were used: namely Chinese nutritional experts' judgment to assess the most popular foods eaten by elderly Chinese people, and a study in older people in Guangxi province of China to test the views of experts. The first part of the study was done by consulting a number of nutritional experts and compiling a list of foods based on their answers. The second part of the study is outlined below.

1.1 Study to assess the most popular foods eaten by elderly Chinese people

Aim: To assess the most popular foods eaten by elderly Chinese people in Nanning city, Guangxi province, China. The information was used to design a questionnaire and develop a new Index of Eating Difficulty based on Chinese foods to evaluate the relationship between clinical dental status and eating difficulty.

Objective: To test which foods are frequently eaten, which foods are considered to be: hard; medium hard; soft; sticky foods or foods with seeds, by elderly Chinese people in Guangxi.

Methods: This study was carried out in Nanning city, Guangxi province in south of China in 2003. An opportunistic sample of 90 old people aged 60 years and over was selected from the people who attended the Routine check-up in the First affiliated hospital of Guangxi Medical University. The questionnaires included questions on dental status, ethnic group, and 39 Chinese food items-covering meats, grains, vegetables, fruits, and snacks based on the recommends by two Chinese nutritional experts. These 39 foods were considered as common eaten by people who living in

Guangxi. The subjects were asked about their frequency of the intake and perception about texture of the foods. Questionnaires were given to, and completed by, the subjects in person and then returned to the researcher.

Results: 90 subjects were included in this study. 70 (78% response) completed and returned the questionnaire. The frequency of eating certain foods and perception of food texture is shown in Table 1.1. Two lists of foods were compiled, namely "very frequently eaten foods" and "frequently eaten foods". "Very frequently eaten foods" were those foods eaten very frequently by at least 50% of the sample. "Frequently eaten foods" are defined as those eaten very frequently or frequently by at least 50% of the sample. The levels of frequency were defined as: Very frequent: twice a week or more; Frequent: once a week or 2-3 times a month; Not frequent: once a month or less.

As shown in Table 1.1, "very frequently eaten foods" included: cooked green vegetables (79% of the sample ate very frequently); green vegetable soup (76%); rice porridge (73%); soft rice (69%); steamed bread (54%); cooked sliced pork (53%). Frequently eaten foods included: boiled fish (91% of the sample ate very frequently or frequently); tofu in water (89%); cooked beans (84%); cooked cucumber or lotus root (79%); cooked carrot (77%); cooked noodles (73%); dry tofu (66%); corn on the cob (63%); rice noodles (61%); fried eggs (61%); soft bread (51%); cooked green bean sprouts (50%) and boiled chicken or duck (50%).

Foods considered as "hard" by at least 40% of the sample included: fried peanut (considered hard by 76% of the samples); sugar cane (63%); roast pork ribs (60%); salted roast chicken (54%); hard rice (47%); roast pork (46%); roast duck or chicken (46%) and whole apple (43%). "Hard/Medium" foods were defined as those foods considered hard by at least 30% of the sample and those considered as medium by at least 50% of the sample, e.g. boiled chicken or duck (considered hard by 33% and medium by 59% of the sample); corn on the cob (33% and 50%); cooked sliced beef (33% and 56%); and fried sleeve-fish (31% and 46%) (Table 1.2). Classification by the level of texture of foods and frequency of eating these foods is detailed in Table 1.3. There were senven texture levels of foods, namely "hard", "hard/medium", "medium", "medium/soft, soft, sticky and foods with seeds". This table gives a picture of texture levels of some Chinese foods and the frequency of eating these foods. Most of the frequently eaten foods are "soft" and "medium". There were no hard foods in the "very frequently" or "frequently eaten foods" lists, except apples. The old people avoided certain hard foods, such as: roast pork; roast duck or chicken; salted roast chicken; roast pork ribs, and fried peanuts. The "very frequently" and "frequently eaten fruits" were whole, apples pears, bananas, and oranges. Sugar cane is the hardest fruit on this food list. Raw tomatoes were considered to be a food with seeds.

Discussion: Food choice is influenced by numerous factors, such as: age; sex; nutrition/need; psychology; socioeconomic status; dietary habits; general health and oral health status. From the results of this study, elderly Chinese people were more likely to eat "soft", "soft/ medium", or "medium" foods. Fruits and seafood are not frequently eaten. Chinese people like to eat rice, green leafy vegetables, pork, and tofu every day. However it is difficult to eat beef, chicken, duck and other similar foods every day for most Chinese people because of cost and custom. Beef, chicken, duck, and some seafood, such as shrimps and fried sleeve-fish are too expensive for some people. Some fruits are luxury products for some poor people and so fruits are rarely eaten.

Table 1.1 Frequency of eating certain foods in older Chinese people (N=70).

Food item	Frequency of eating foods*			
	Very frequent (%)**	Frequent (%)	Not frequent (%)	Non response (%)
Rice noodle	15.7	45.7	34.3	4.3
Cooked noodle	25.7	47.1	24.3	2.9
Steamed bread	54.3	25.7	18.6	1.4
Soft bread	22.9	28.6	35.7	12.8
Rice porridge	72.8	10.0	14.3	2.9
Hard rice	30.0	7.1	52.9	10.0
Soft rice	68.6	8.6	14.3	8.5
Fried pastry	7.1	15.7	65.7	11.5
Cooked sliced pork	52.9	31.4	11.4	4.3
Cooked sliced beef	5.7	28.6	55.7	10.0
Roast pork	5.7	21.4	65.7	7.2
Roast duck or chicken	7.1	27.1	52.9	12.9
Boiled chicken or duck	15.7	34.3	44.3	5.7
Salted roast chicken	2.9	11.4	71.4	14.3
Roast pork ribs	8.6	12.9	62.9	15.7
Fried eggs	21.4	40.0	32.9	5.7
Fried sleeve-fish	1.4	7.2	87.1	4.3
Shrimps	1.4	20.0	67.1	11.2
Boiled fish	48.6	42.9	7.1	1.4
Dry tofu	27.1	38.6	28.6	5.7
Tofu in water	47.1	41.4	10.0	1.4
Cooked carrot	40.0	37.1	20.0	2.9
Cooked green vegetables	78.6	11.4	7.1	2.9
Cooked beans	28.6	55.7	14.3	1.4
Cooked cucumber or lotus root	28.6	50.0	18.6	2.8
Cooked green bean sprout	14.3	34.3	50.0	1.4
Fried peanuts	8.6	10.0	67.1	14.3
Green vegetable soup	75.7	15.7	5.7	2.9
Corn on the cob	11.4	48.6	37.1	2.9
Whole apple	30.0	28.6	32.9	8.5
Water melon	11.4	47.1	35.7	5.7
Pineapple	1.4	15.7	74.3	8.5
Sweet melon	7.1	20.0	68.6	4.3
Sugar cane	1.4	8.6	74.3	11.7
Pear	20.0	45.7	31.4	2.9
Banana	38.6	35.7	21.4	4.3
Orange	24.3	38.6	30.0	7.1
Mango	1.4	24.3	64.3	10.0
Raw tomato	20.0	15.7	55.7	8.6

*Very frequent: twice a week or more;

Frequent: once a week or 2-3 times a month

Not frequent: once a month or less

**%: the percentage of people that chose this item

Table 1.2 Frequency foods by perception of food texture in older Chinese people (N = 70).

Food item	Perception of food texture				
	Hard food (%)*	Medium/ hard food (%)	Soft food (%)	Stickiness or food with seeds (%)	Non Response (%)
Rice noodle	0.0	21.4	75.7	0.0	2.9
Cooked noodle	1.4	27.1	65.7	1.4	5.7
Steamed bread	1.4	54.3	37.1	1.4	7.2
Soft bread	1.4	41.4	41.4	10.0	7.2
Rice porridge	1.4	4.3	94.4	0.0	4.3
Hard rice	47.1	42.9	0.0	0.0	10.0
Soft rice	0.0	34.3	57.1	0.0	8.6
Fried pastry	28.6	45.7	4.3	10.0	11.5
Cooked sliced pork	14.3	80.0	1.4	0.0	4.3
Cooked sliced beef	32.9	55.7	1.0	0.0	10.0
Roast pork	45.7	48.6	1.4	0.0	4.3
Roast duck or chicken	45.7	45.7	4.3	0.0	10.0
Boiled chicken or duck	32.9	58.6	2.9	0.0	4.3
Salted roast chicken	54.3	31.4	1.4	0.0	12.9
Roast pork ribs	60.0	24.3	1.4	0.0	14.3
Fried eggs	1.4	38.6	55.7	0.0	4.3
Fried sleeve-fish	31.4	45.7	15.7	0.0	7.2
Shrimps	4.3	54.3	24.3	0.0	17.1
Boiled fish	2.9	37.1	52.9	0.0	7.2
Dry tofu	5.7	78.6	5.7	0.0	10.0
Tofu in water	0.0	7.1	92.9	0.0	0.0
Cooked carrot	15.7	61.4	15.7	0.0	7.2
Cooked green vegetables	5.7	65.8	21.4	1.4	5.7
Cooked beans	17.1	64.3	8.6	2.9	7.1
Cooked cucumber or lotus root	11.4	74.3	5.7	1.4	7.1
Cooked green bean sprout	0.0	61.4	28.6	0.0	10.0
Fried peanuts	75.7	14.3	0.0	0.0	10.0
Green vegetable soup	1.4	34.3	55.7	0.0	8.5
Corn on the cob	32.9	50.0	4.3	0.0	12.9
Whole apple	42.9	37.1	2.9	0.0	17.1
Water melon	0.0	22.9	48.6	24.3	4.3
Pineapple	4.3	51.4	25.7	7.1	11.5
Sweet melon	10.0	52.9	18.6	12.9	5.7
Sugar cane	62.9	20.0	4.3	0.0	12.9
Pear	14.3	54.3	18.6	5.7	7.2
Banana	0.0	20.0	72.9	0.0	7.2
Orange	0.0	30.0	38.6	30.0	1.4
Mango	4.3	40.0	41.4	5.7	8.5
Raw tomato	0.0	22.9	54.3	12.9	10.0

* %: the percentage of people that chose this item.

Table 1.3 Classification of foods, by the texture of food and frequency of eating in older Chinese people.

The texture of foods*	Eating Frequency**		
	Very frequently	**Frequently**	**Not frequently**
Hard		Whole apple	Salted roast chicken Roast pork ribs Roast duck or chicken Roast pork Fried peanuts Sugar cane Hard rice
Hard/medium		Boiled chicken or duck Corn on the cob	Cooked sliced beef
Medium	Cooked sliced pork Cooked green vegetable	Dry tofu Cooked carrots Cooked beans Cooked cucumber or lotus root Cooked green been sprout Pear	Fried pastry Fried sleeve-fish Sweet melon
Medium/soft	Steamed bread Soft rice Green vegetable soup	Cooked noodle Soft bread Fried eggs Boiled fish Orange Water melon	Mango Pineapple Shrimps Raw tomato
Soft	Rice porridge	Tofu in water Rice noodle Banana	
Sticky		Soft bread	Fried pastry
Foods with seeds	Water melon	Orange	Sweet melon Raw tomato

* Texture of foods

Hard food: those foods considered as hard by at least 40% subjects.

Hard/medium foods: those foods considered as hard by at least 30% of subjects or as medium by at least 50% of subjects.

Medium foods: those foods considered as medium or hard by at least 60% while as hard by less than 30% subjects.

Medium/soft foods: those foods whose hardness is between medium food and soft food.

Soft foods: those foods considered as soft by at least 70% of subjects.

Sticky foods and foods with seeds: those foods considered as sticky foods or foods with seeds by at least 10% of subjects.

** Eating frequency

Very frequently eaten foods: foods eaten very frequently by at least 50% of subjects.

Frequently eaten foods: foods eaten very frequently or frequently by at least 50% of subjects.

Not frequently eaten foods: the foods that are not very frequently eaten foods or frequently eaten foods.

1.2 Developing a food list and a new Index of Eating Difficulty

We chose some representative foods with different textures, even some hardest foods not frequently eaten (Table 1.3) to test the relationship between clinical dental status and eating difficulty (Table 1.4). This list of 16 indicator foods included food texture, cooking methods, and frequency of eating based on the criteria: one or two foods were selected from each box except sticky or foods with seeds box. The cooking methods and nutritional experts' comments also were considered. Based on the findings and concepts from the National Diet and Nutrition Study (NDNS) in UK (Steele *et al.*, 1998), a list of eating selected foods was constructed for foods eaten in an older Chinese population from Table 1.4 (Table 1. 5).

Table 1.4 A selection of foods by hardness and frequency of eating foods.

The levels of food hardness	Eating Frequency		
	Very frequently	**Frequently**	**Not frequently**
Hard		Whole apple	Salted roast chicken Roast pork ribs Roast duck or chicken
Hard/medium		Boiled chicken or duck Corn on the cob	Cooked sliced beef
Medium	Cooked sliced pork Cooked green vegetable	Cooked carrots Cooked cucumber or lotus root	
Medium/soft	Steamed bread Soft rice	Boiled fish	
Soft	Rice porridge	Tofu in water	

A food list in Table 1.5 was used to test ability to eat certain foods and also used to develop an Index of Eating Difficulty. For testing ability to eat certain foods, subjects were asked the question "Could you eat ...(item)...easily, with some difficulty or not at all?" for all foods listed (Table 1.5). These 16 indicator foods (Table 1.5) were classified into seven groups of foods (Table 1.6). Foods with similar textures were grouped into the same type. This second questionnaire including seven groups of foods was tested on 205 elderly people in the second pilot study. Subjects were asked to indicate whether they could ordinarily eat each of seven groups of foods. The order of the questions had been decided by using random numbers. In the analysis, all seven groups of foods were arranged by frequency of "yes" responses and the pattern of responses was examined. Two groups of foods (categories 3 and 6 in Table 1.6) - steamed bread, soft rice, rice porridge, boiled fish and tofu in water - provided little or no discrimination between respondents, since over 99 percent of all responses reported they could chew them. In addition, most people answered "have not tried" to cooked sliced beef. Therefore only five groups of foods (categories 1, 2, 4, 5, and 7 in Table 1.6) were used to design a questionnaire and develop a new Index of Eating Difficulty (Table 1.7). The Index of Eating Difficulty was used in the main large study. Throughout whole pilot study, an informal detailed discussion was conducted involving a panel of academics, some experienced dentists and some eligible elderly people, in order to improve understanding of the content of the questionnaire.

Table 1.5 Coding of Ease of eating selected foods used in eating difficulty

Food items	Could eat easily	Could eat with some difficulty	Could not eat at all
1. Cooked carrots	1	2	3
2. Roast Pork ribs	1	2	3
3. Boiled fish	1	2	3
4. Rice porridge	1	2	3
5. Cooked cucumber or lotus root	1	2	3
6. Cooked sliced pork	1	2	3
7. Steamed bread	1	2	3
8. Salted roast chicken	1	2	3
9. Cooked green vegetable	1	2	3
10. Whole apple	1	2	3
11. Roast duck or chicken	1	2	3
12.Tofu in water	1	2	3
13. Soft rice	1	2	3
14. Boiled chicken or duck	1	2	3
15. Cooked sliced beef	1	2	3
16. Corn on the cob	1	2	3

Table 1.6 Grouping of foods

Categories	Groups of the selected foods
1	Cooked cucumber or lotus root, cooked carrots
2	Salted roast chicken, roast pork ribs, roast duck or chicken
3	Boiled fish, tofu in water, rice porridge
4	Boiled chicken or duck, cooked sliced beef
5	Cooked sliced pork, cooked green vegetable
6	Steamed bread, soft rice
7	Whole apple, corn on the cob

When developed his Chewing Ability Index, Leake (1990) stated: "the index is probably specific to diet patterns found in Canada, the USA and perhaps Northern European. Researchers examining subjects from other countries will have to develop their particular scale, using foods frequently to the dietary pattern found in those cultures. The principle of using commonly eaten food, which range in order of chewing difficulty to integrate into a Guttman scale, has been demonstrated by this study." Based on the Chewing Ability Index (CAI) developed by Leake (1990) for Western foods, a new five-item Index of Eating Difficulty was constructed based on Chinese foods (Table 1.7).

Eating difficulty was measured using this Index of Eating Difficulty. Subjects were asked some questions about eating difficulty. Questions are similar to those used in the Florida Dental Care Study (FDCS) (Foerster et al., 1998; Peek et al., 2002). The questions are:

Are you able to eat:
Eatq1: whole apple or corn on the cob, or something very similar to that.
Eatq2: cooked sliced pork or cooked green vegetable, or something very similar to that.
Eatq3: boiled chicken or duck, or something very similar to that.
Eatq4: salted roasting chicken or roast pork ribs or roast duck or chicken, or something very similar to that.
Eatq5: cooked cucumber or lotus root or cooked carrots, or something very similar to that.

The subjects were asked to select from three answers (1-yes; 0-no; 2-have not tried). The food categories for which a subject was unable to eat was coded to give an index code as shown in Table 1.7.

The coding was as follows:

IED = 0 – people can eat one or more foods in each of 6 categories (Table 1.7).

IED = 1 – people can eat one or more foods listed in categories 2 to 5 but cannot eat foods in category 6 (Table 1.7).

IED = 2 – people can eat one or more foods in categories 2 to 4 but not 5 and 6 (Table 1.7).

IED = 3 – people can eat one or more foods in categories 2 and 3 but not 4 to 6 (Table 1.7).

IED = 4 – people can only eat one or more foods in category 2 (Table 1.7).

IED = 5 – people cannot eat any of the foods listed in any of the categories in Table 1.7.

Table 1.7 Index of Eating Difficulty

Category	Difficulty eating foods	IED
1	None of foods listed	**5**
2	Cooked sliced pork, cooked green vegetable	**4**
3	Cooked cucumber or lotus root, cooked carrots	**3**
4	Boiled chicken or duck	**2**
5	Whole apple, corn on the cob	**1**
6	Salted roasting chicken, roast pork ribs, roast duck or chicken	**0**

Appendix 2

Information Letter

This survey is being carried out by a dentist from University College London Medical School, with the help of trained interviewers. The aim of this programme is to collect information related to the health of people aged 55 years older and over in Guangxi of China.

Our survey has two parts: firstly, an interviewer will ask you some questions in relation to your mouth, teeth, diet and various habits. This interview will last about 20 minutes.

On a second visit, a qualified dentist will examine your mouth and teeth or dentures. This includes counting the number of teeth and filling, which you possibly have in your mouth should last 10-15 minutes. The dentist will only examine your mouth and will not provide any dental treatment. You will not feel any pain. We can assure you that all instruments, that will be used, are sterilized and that we strictly follow all guidelines, in relation to sterilization and cross-infection control.

This survey relies on your voluntary participation. All data collected from the clinical examination and interview will be treated in the strictest confidence. They will be used for research purposes only, and none outside the research team will know the names and address of the participants.

We thank you for your help with the implementation of this important study. If, in the future, you have any queries about the survey, do not hesitate to contact Mrs. Xiaojuan Zeng using the correspondence address.

Yours sincerely

Aubrey Sheiham

Professor of Dental Public Health
University College London Medical School

Addresses for correspondence:

Xiaojuan Zeng

Appendix 3

Consent Letter

ID number___________

Name_______________

Address: ____

I consent to have my mouth examined by a dentist as part of above study.

I understand that findings of examination will be used for research purposes only and

examiner cannot reveal them to me, or anybody not involved in the study.

Signed: ....

Date: / /

Appendix 4

Questionnaires

Diet and Oral Health Status in Older Chinese people

ORAL HEALTH QUESTIONNAIRE
Department of Epidemiology and Public Health
University College London Medical School
2005

MENTAL STATUS

Some people have better memory than others. I would like to do a brief test about your memory. Would you mind answering a few questions?

Correct answer 1
Wrong answer 2

	Code
1. What is the current year?	
2. What is the month now?	
3. About what time is it now? Is it in the morning or in the afternoon?	
4. Who is the Prime Minister of the country?	
5. Do you know the name of city you are living?	

GENERAL INFORMATION

1. Name:	
2. Ethnicity	
3. Date of birth...	
4. Work address /home address..	
5. Home telephone number	
6. Date of interview	
7. The reason for refusing interview...	
8. Interviewer...	
9. ID..	

PART 1 SOCIODEMOGRAPHIC DATA

Now, I would like to ask you some questions about yourself

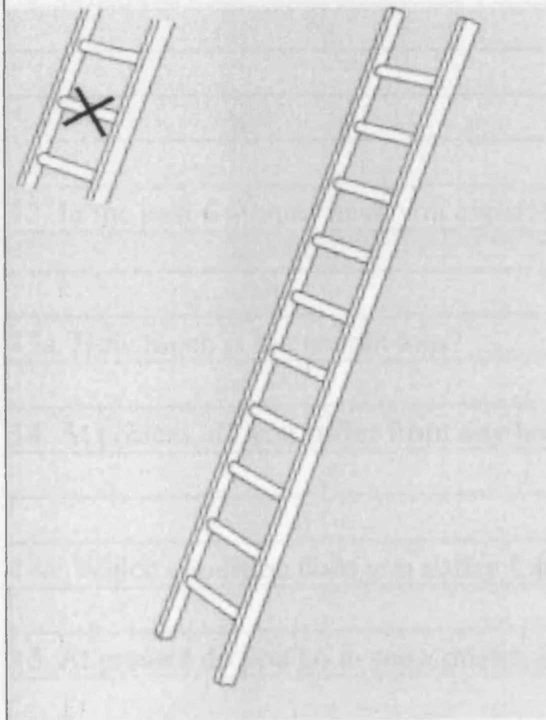
Circle one of the answers

	Code
1. Sex	
Male 1	
Female 2	
2. Age ______	
3. Marital status	
Married 1	
Living as married 2	
Single (i.e. never married) 3	
Widowed 4	
Divorced 5	
Separated 6	
4. Education level	
No education 1	
1-6 yrs (primary school) 2	
7-9 yrs (second school) 3	
10-12 yrs (high school) 4	
13-18 yrs (university or college) 5	
19 yrs and over (postgraduate) 6	
5. Past occupation	
Professional 1	
Administrator 2	
Clerks 3	
Business 4	
Services 5	
Worker 6	
Farmer 7	
Others 8	
6. Present occupation	
Retired 1	
Re-employed, keep doing the same job after retirement 2	
Getting other job after retired 3	
No job 4	
7. Family income/month...	
8. Number of members living in household..	

9. Think of this ladder as representing where people stand in our society. At the top of the ladder are the people who are the best off – those who have the most money, most education and best jobs. At the bottom are the people who are the worst off – who have the least money, least education, and the worst jobs or no jobs. The higher up you are on this ladder, the closer you are to the people at the very top and the lower you are, the closer you are to the people at the very bottom.

Please mark a cross on the rung on the ladder where you would you places yourself.

Example:



PART 2 GENERAL HEALTH

Now, I would like to ask you some questions about your health in general.

10. Height (cm)...	
11. Weight (kg)...	
Circle one of the answers	**Code**
12. In general, would you like to say your general health is?	
Excellent 1	
Very good 2	
Good 3	
Fair 4	
Poor 5	
13. In the past 6 months have you experience unusual weight loss or not?	
Yes, go to 13 a	
No, go to 14	
13a. How much is the weight loss? ....kg	
14. At present, do you suffer from any health condditions?	
Yes, go to q14a	
No, go to q15	
14a. Which condition does you suffer from, please specify........................	
15. At present do you go to see a doctor for any treatment?	
Yes 1	
No 2	
16 Do you have any long-standing illness, disability or infirmity? (Long-standing means anything that has troubled you over a period of time or that is likely to affect you over a period of time)	
Yes, go to q16a	
No, go to q17	
16a. What is the matter with you? Please specify	
17. This question concerns any medicines that you may have taken during the last fourteen days. Have you been taking any medicines, tablets, tonics or pills prescribed by a doctor within the last fourteen days?	

Yes, go to q17a-q17b	
No, go to Part 3	
17a. Could you please list any medicines you are taking below?	
a..	
b.	
c..	
17b. And the reason for taking the medicine?	
a..	
b..	
c..	

PART 3 ORAL HEALTH STATUS

I am going to ask some questions about your oral health

Circle one of the answers

	Code
18. In general, would you like to say your oral health is?	
Excellent 1	
Very good 2	
Good 3	
Fair 4	
Poor 5	
19. In the past 6 months have you experienced any dryness in your mouth?	
Yes, go to q19a-q19c	
No, go to q20	
19a. When do you feel /have dryness in your mouth?	
Feel dry when you are eating a meal 1	
Feel dry at night 2	
Feel dry when you wake up 3	
Feel dry at other time of the day 4	
Can't say 9	
19b. Does dryness in your mouth ever cause you any of the following difficulties?	
Difficulty chewing food 1	
Difficulty swallowing food 2	
Difficulty taking medication 3	
No difficulty 4	
Can't say 9	
19c. Have you done any of the following to relieve your dry mouth?	
Chew gum 1	
Suck hard sweets or mints 2	
Sip water or other liquid 3	
Take any other product or medication 4	
Have not done anything 5	
Can't say 9	

The next few questions are about your denture (including complete and removable dentures)

Circle one of the answers	**Code**
20. Do you have any false teeth /denture?	
Yes 1 go to q21	
No 2 go to q24	
21. Do you usually wear your denture?	
All the time including sleep 1	
Only when awake 2	
Only occasional, for eating 3	
Only occasionally, for social occasions 4	
Don't wear them anytime 5	
22. Has the denture on your upper jaw ever dropped when you speak?	
Yes 1	
No 2	
Can't say 3	
23. Does the denture on your upper jaw ever drop when your mouth is open? (Apart from you speak)	
Yes 1	
No 2	
Can't say 3	
24. How much do you think you need dental treatment?	
1__________2__________3__________4__________5 Not at all...A great deal	

PART 4 EATING

I would now like to ask you about how well you able to eat foods nowadays.

Q1: In general, how well are you able to bite, chew, and swallow food that you eat nowadays?

Circle one of the answers **Code**

No difficulty 1	
A little difficulty 2	
A fair amount of difficulty 3	
A great amount of difficulty 4	

Q2: How satisfied are you with your ability to chew overall?

Circle one of the answers **Code**

Very satisfied 1	
Satisfied 2	
Dissatisfied 3	
Very dissatisfied 4	
Don't know 5	

Q3: Are you able to eat....?

Circle one of the answers

	Code
1: Are you able to eat whole apple or corn on the cob, or something very similar to that?	
Yes 1	
No 2	
Have not tried 3	
2. Are you able to eat cooked sliced pork or cooked green vegetable, or something very similar to that?	
Yes 1	
No 2	
Have not tried 3	
3. Are you able to eat boiled chicken or duck, or something very similar to that?	
Yes 1	
No 2	
Have not tried 3	
4. Are you able to eat salted roasting chicken or roast pork ribs or roast duck or chicken, or something very similar to that?	
Yes 1	
No 2	
Have not tried 3	
5. Are you able to eat cooked cucumber or lotus root or cooked carrots, or something very similar to that?	
Yes 1	
No 2	
Have not tried 3	

Now I am going to read out a list of different types of food and I would like you to tell me for each one whether you could eat it easily, with some difficulty or not at all. It doesn't matter whether you like the types of food or ever choose to eat nowadays. We are interested in how well you could eat it if you wanted to. (Read out each item and code).

Q4: Could you eat ...(item)...easily, with some difficulty or not at all?

Food items	Could eat easily	Could eat with some difficulty	Could not eat at all	Code
1. Cooked carrots	1	2	3	
2. Roast Pork ribs	1	2	3	
3. Boiled fish	1	2	3	
4. Rice porridge	1	2	3	
5. Cooked cucumber or lotus root	1	2	3	
6. Cooked sliced pork	1	2	3	
7. Steamed bread	1	2	3	
8. Salted roast chicken	1	2	3	
9. Cooked green vegetable	1	2	3	
10.Whole apple	1	2	3	
11. Roast duck or chicken	1	2	3	
12.Tofu in water	1	2	3	
13. Soft rice	1	2	3	
14. Boiled chicken or duck	1	2	3	
15.Cooked sliced beef	1	2	3	
16.Corn on the cob	1	2	3	

PART 5

Oral Impacts on Daily Performances (OIDP)

Instructions

I would like you to tell me whether or not problems with your mouth, teeth or dentures have caused you difficulty with each one of these 9 activities in your everyday life in the past 6 months.

- **Eating**
- **Speaking**
- **Cleaning**
- **Light physical activities**
- **Going out**
- **Sleeping (Relaxing)**
- **Smiling**
- **Emotional state**
- **Social contact**

For each activity above:

Q1:

In the past 6 months, have you had any difficulty ... **ACTIVITY / BEHAVIOUR**... due to problems with your mouth, teeth or dentures?

(Please choose your answer by ticking one box in column **Q1**)

If you have answered **"yes"** in column **Q1** – please go to column **Q2**

If you have answered **"no"** in column **Q1** – please go to next activity

Q2:

Have you had this difficulty ... **ACTIVITY/BEHAVIOUR**... on a regular basis over the past 6 months or only for part of this period?

(Please choose your answer by ticking one box in column **Q2**)

If you have answered **"on a regular basis"** in column **Q2** – please go to column **Q3**

If you have answered **"only for part of this period"** in column **Q2** – please go to column **Q4**

Q3:

Answer this column only if you have answered **"on a regular basis"** in column **Q2.** During the past 6 months, how often have you had this difficulty...**ACTIVITY / BEHAVIOUR**?

(Please choose your answer by ticking one box in column **Q3**)

Q4:

Answer this column only if you have answered **"only for part of this period"** in column **Q2.** For how much of the past 6 months have you had this difficulty...**ACTIVITY / BEHAVIOUR?**

(Please choose your answer by ticking one box in column **Q4**)

Q5:

Using a scale from 0 to 5, where 0 is no effect and 5 is very severe effect, how much effect would you say that this difficulty ...**ACTIVITY / BEHAVIOUR**... has had on your everyday life?

(Please choose your answer by ticking one box in column **Q5** and go to column **Q6**)

Q6:

Which one of the symptom in Table 4.1 has been the cause of this difficulty in ....**ACTIVITY / BEHAVIOUR**...?

(Please choose your answer by putting the answer code into column **Q6**)

Table 4.1 Special oral conditions

	Answer Code
Toothache	1
Tooth loss	2
Loose tooth	3
Decay (hole in tooth)	4
Fractured tooth	5
Sensitive tooth	6
Color of teeth	7
Shape or size of teeth	8
Position of teeth (e.g. crooked or projecting, gap)	9
Deformity of mouth or face (e.g. cleft lip, cleft palate)	10
Oral ulcer or spot	11
Burning sensation of mouth	12
Bad breath	13
Taste disturbance	14
Dry mouth	15
Breeding gums	16
Swollen gums (gum abscess)	17
Receding gums	18
Tartar	19
Clicking or grating noise in jaw	20
A pain in jaw joint	21
Difficulty in open mouth wide	22
Loose or ill-fitting denture	23
Improper filling or crown (e.g. broken, colour)	24
Any other reason? (Please specify)	88
Can't say	99

Table 4.1 Answer table

Performances	Q1: yes no	Q2: If yes, how often	Q3: If on a regular basis, how often	Q4: If only for part of period, how many days in total	Q5: Effect on everyday life	Q6: Cause
Eating and enjoying your food	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	
Speaking and pronouncing clearly	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	
Cleaning your teeth	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	

Table 4.1 Continued

Performances	Q1: yes no	Q2: If yes, how often	Q3: If on a regular basis, how often	Q4: If only for part of period, how many days in total	Q5: Effect on everyday life	Q6: Cause
Doing light physical activities, such as cooking, some light housework	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	
Going out, for example, going to park for walk shopping, visiting	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	
Relaxing (including sleeping)	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	

Table 4.1 Continued

Performances	Q1: yes no	Q2: If yes, how often	Q3: If on a regular basis, how often	Q4: If only for part of period, how many days in total	Q5: Effect on everyday life	Q6: Cause
Smiling, laughing and showing teeth without embarrassment	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	
With your emotional state, for example becoming more easily upset than usual	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	
Enjoying the contact of other people, such as relatives, friends or neighbours	1☐ 2☐	1☐ on a regular basis 2☐ only for part of period	1☐ less than once a month 2☐ once or twice a month 3☐ once or twice a week 4☐ 3-4 times a week 5☐ every or nearly every day 9☐ can't say	1☐ up to 5 days 2☐ up to 30 days 3☐ up to 2 months 4☐ up to 3 months 5☐ more than 3 months 9☐ can't say	0☐ no effect 1☐ a very minor effect 2☐ a fair minor effect 3☐ a moderate effect 4☐ a fairly severe effect 5☐ a very severe effect 9☐ can't say	

Appendix 5

The Oral Impacts on Daily Performances (OIDP)

The Oral Impacts on Daily performance (OIDP) developed by Adulyanon and Sheiham (1997), attempts to measure oral impacts on the person's daily life. The OIDP index measures three main categories of performance: physical, psychological and social performance. Nine impacts of the index were used in this study.

Physical performance:

Eating and enjoying foods

Speaking and pronouncing clear

Cleaning teeth, such as brushing you teeth or rinsing your teeth with cold or hot water

Light physical activities, such as cooking or cleaning your room.

Going out, such as going to the park for walk, shopping, visiting friend or relatives.

Psychological performance:

Relaxing (including sleeping), such as watching TV

Smiling, laughing and showing your teeth without embarrassment

Maintain usual emotional state without being irritable

Social performance:

Enjoying the contact of the other people, such as relatives, friends or neighbours

The OIDP score tells the degree of oral health impacts in daily life in terms of the frequency and severity of impacts. The higher the score, the higher degree of the impact is.

The OIDP score = [(frequency score* of oral impact on performance 1 × severity score* of oral impact on performance 1) + (frequency score of oral impact on performance 2 × severity score of oral impact on performance 2) + (frequency score of oral impact on performance 3 × severity score of oral impact on performance 3) + (frequency score of oral impact on performance 4 × severity score of oral impact on performance 4) + (frequency score of oral impact on performance 5 × severity score of oral impact on performance 5) + (frequency score of oral impact on performance 6 × severity score of oral impact on performance 6) + (frequency score of oral impact on performance 7 × severity score of oral impact on performance 7) + (frequency score of oral impact on performance 8 × severity score of oral impact on performance 8) + (frequency score of oral impact on performance 9 × severity score of oral impact on performance 9)] × 100/225**

* Score ranged from 0 to 5

** Maximum possible score which are from 5 and score 5 in all performances. Sum of 9 performances score = 225.

Appendix 6

Diagnostic Criteria for the Examination

Please note that code "9" has been reserved as a general code for "unscorable" and can be used at any time. However, unscorable codes complicate analysis so please only use them where it is absolutely necessary.

1. Temporomandibular joint assessment

Symptoms

The following codes and criteria are used:

0 = No symptoms.

1 = Occurrence of clicking, pain, or difficulties in opening or closing the jaw once or more per week.

9 = Not recorded.

Signs

The following codes and criteria are used:

0 = No symptoms.

1 = Occurrence of clicking, tenderness (on palpation) or reduced jaw mobility (opening <30 mm).

9 = Not recorded.

Clicking of one or both temporomandibular joints

Clicking is evaluated directly by an audible sharp sound or by palpation of temporamandibular joints

Tenderness (on palpation) of the anterior and/or masseter muscles on one or both sides

The tenderness should be evaluated by unilated palpation with the firm pressure of two fingers, exerted twice on the most voluminous part of the muscle. Tenderness is recorded only if the palpation spontaneously provokes an avoidance reflex.

Reduced jaw mobility ---opening of < 30 mm

Taken as the distance between the incisal tips of the central maxillary and mandibular incisors. As a general guide, in an adults jaw, mobility is considered to be reduced if the subject is unable to open his or her jaw to the wide of two fingers.

2. Soft tissues

Present code “1”, Absent code “0”.

Soft tissue lesion(s)

Angular cheilitis

Denture stomatitis I

Denture stomatitis II

Denture stomatitis III

Denture hyperplasia

Ulceration (aphthous,herpetic, traumatic)

Acute necrotizing gingivitis

Candidiasis

Abscess

Other condition, specify if possible............

The three classifications of denture stomatitis are based on a WHO classification:

I - patchy or localised redness over denture bearing area.

II- redness over full denture bearing area.

III - multiple small nodular or granular lesions covering denture bearing area with associated inflammation.

"Angular Cheilitis" is defined as inflammation with or without cracking localised to one or both commisures. "Denture Hyperplasia" is a firm enlargement of the vestibular mucosa, clearly related to the flange of a denture. Ulceration applies to ulcerated lesion, which is due to any reasons.

3. Edentulous status

The edentulous status should be recorded for each jaw. The following codes are provided for this:

0 = no natural teeth

1 = any natural teeth

4. Prosthesis status

The presence of prostheses should be recorded for each jaw.

The following codes are provided for this:

0 = no prosthesis

1 = bridge

2 = removable partial denture

3 = both bridge(s) and partial denture (s)

4 = complete denture

9 = Not recorded

5. Prosthetic need

The recording should be made for each jaw on the perceived need for prostheses. The following codes are provided for this:

0 = no need for prosthesis

1 = need new bridge

2 = need new removable partial denture

3 = need new complete denture

4 = need repair existing prosthesis

9 = not recorded

6. Occlusal Examination

Occlusial examination is a very important part of the examination as it relates to the partial dentition and distribution of teeth, which for many older people are of more significance than levels of disease. There are two grids for this examination. One records the presence of spaces and unopposed teeth; the other records the exact pattern of occlusal contacts.

Spacing

Spacing refers NOT simply to missing teeth, but focuses on recording actual spaces. Spaces are always recorded on the chart according to the position of the space, not according to the tooth missing. For example loss of a lower first premolar may cause the second premolar to drift forward and fill the gap, this may then leave a space in the second premolar position. On the chart this would be recorded as a space in the second premolar position, even though it is the first premolar, which has been lost. We are interested here in the aesthetic and functional problems of spaces.

A "space" is a gap greater than a half premolar width.

Where there is a space, it is coded as either restored or unrestored. Where there is a bridge or where the subject normally wears a partial denture which fills the space, it should be recorded as restored. If for example, there is a partial denture but the tooth which filled the gap has broken off and not been replaced, then this should be coded as unrestored, because technically (and aesthetically) it is.

The codes for spacing are as follows:

0 = No space

1 = Space (unfilled)

2 = Space (restored)

Unfilled spaces due to missing teeth not being filled by a fixed or removable prosthese.

Occlusal contacts

This section need only be completed if there are some natural teeth in both arches.

The subject is asked to close their teeth together normally. Occasionally people do bizarre things at this point, like stick their mandible forward or laterally into some odd position. If they do this, ask them to swallow and keep their teeth closed after swallowing. For the anterior occlusal contacts, if the anterior teeth are already in contact it should be coded like posterior occlusal contacts. Where there is no contact, the subject should be asked to bite edge to edge to see if contact can be obtained. If this is possible, it should be coded as contact. If not, it should be coded as no contact.

The assessment of occlusal contacts refers NOT to teeth but to occlusal units, and it is the lower teeth which are used for measurement. An occlusal unit is a single incisor, canine or premolar or half a molar (mesial or distal). These are counted back from the midline. There are potentially 18 occlusal units. Like spacing, the position of an occlusal unit does not depend on which tooth is present, but on the position in which the unit is lying. For a contact to be present, it must form an occlusal stop with a tooth in the opposing arch, or at least appear to do so. In rare cases pairs of teeth may slide past each other and end up with mesial or distal surfaces in contact, but not forming any sort of stop, these should be coded as no contact. If there is obviously fresh air between the teeth code as no contact, but generally if in doubt score as a contact (note that although it doesn't seem like it, this is theoretically scoring "low" as a contact is analogous to "sound" or not diseased). Note that coding takes place from the midline backwards as this makes it much easier to keep track of the position.

The codes for occlusal contacts are:

0 = no contact

1 = both opposing teeth are natural

2 = natural and artificial teeth contact

3 = both opposing are artificial

Note that bridge abutments of fixed bridge should be counted as natural teeth whereas bridge pontic should be counted as artificial teeth.

7. Diagnostic criteria for dentition status and treatment need

For this part of the examination the coronal and root surfaces will be examined separately. Each surface will be coded according to the criteria given below. The examination will be primarily visual with the blunted sickle probe used solely for the removal of plaque and debris and for gentle probing of certain lesions. The probe will not routinely be inserted into the pit and fissure systems of the teeth and is intended for the removal of plaque and debris and to detect the surface texture of root surface lesions.

CODES: DMFT, CROWN AND ROOT			
CROWN		ROOT	
Sound	0	No exposed root	0
Artificial teeth	1	Exposed but sound	1
Missing-unreplaced	2	Missing	2
Decayed	3	Decayed	3
Filled, decayed,	4	Filled, decayed	4
Filled, sound	5	Filled, sound	5
Bridge abutments special crown or veneer	6	Cervical wear, unfilled	6
		Cervical wear, filled	7
Unscoreable	9	Unscoreable	9

Sound natural crown: code 0

A natural crown is recorded as sound if it showed no evidence of treated or untreated clinical caries. The stages of caries that precede cavitation, as well as other condition similar to early stages of caries, are excluded because they cannot be reliably diagnosed. Thus, a crown with following defects, in the absence of other positive criteria, should be coded as sound:

----white or chalky spots

----discoloured or rough spots that are not soft to touch with a metal CIP probe;

----stained pits or fissures in the enamel that do not have visual signs of undermined, or softening of

floor or walls detectable with a CIP probe;
dark, shiny, hard, pitted area of enamel in a tooth showing signs of moderate to severe fluorosis;
----lesions that, on the basis of their distribution or history, or visual/ tactile examination, appear to be due to abrasion.

Artificial teeth: code 1

Indicate bridge pontic or artificial teeth in removable partial denture. It means missing eplaced

Missing –unreplaced: code 2

Indicate that the tooth is missing, for whatever reason. This space has not replaced.

Decayed natural crown: code 3

A carious cavity is present which, taking into account the patients oral status, is deemed to be restorable. The criteria for diagnosis of a carious cavity are given below.
Pits and fissures: breakdown of the walls of a pit or fissure or shadowing beneath the enamel surface, detected visually after cleaning with a probe. Stained fissures are not necessarily designated as carious.
Approximal surfaces: cavities with a soft floor detected by gentle probing, or brown/grey shadowing detected visually from the buccal, lingual or occlusal aspects.
Smooth surfaces: A cavity with a soft floor detected by gentle probing.
NOTE: "Arrested" caries, appearing dark brown/black and having a hard floor, or hard floored hypoplastic pits are not designated carious.

Filled, decayed natural crown: code 4

A crown is considered filled, with decay, when it has one or more permanent restorations and one or more area that are decayed. No distinction is made between primary and secondary caries (i.e. the same code applies whether or not the carious lesions are in physical association with the restoration(s))

Filled, sound natural crown: code 5

A crown is considered filled, without decay, when one or more permanent restorations are present and there is no caries anywhere on crown. A tooth that has been crowned because of previous decay is recorded in this category.

Bridge abutment, special crown or veneer: code 6

This code is used under coronal status to indicate that tooth forms part of a fixed bridge, i.e. is a bridge abutment. This code can also be used for crowns placed for reasons other than caries and for veneers or laminates covering the labial surface of tooth on which there is no evidence of caries or a restoration.

Unscoreable crown: code 9

This code is used for any erupted permanent tooth that cannot be examined for any reason (e.g.because of orthodontic bands, severe hypoplasia, etc.)

Sound root: code 0

The gingival margin is at or above the CEJ with no exposure of root surface.

Exposed but sound root: code 1

The gingival margin is below the CEJ exposing some (any) root surface. The exposed root surface should be sound, with no evidence of restoration or caries.

Missing root: code 2

As for crown.

Decayed root: code 3

Caries is recorded as present when a lesion feels soft or leathery to probing with the CPI probe. If the root caries is discrete from the crown and will require a separate treatment, it should be recorded as root caries. For single carious lesions affecting both the crown and the root, the likely site of origin of lesion should be recorded as decayed. When it is not possible to judge the site of origin, both the crown and the root should be recorded as decayed.

Filled, decayed root: code 4

A root is considered filled, with decay, when it has one or more permanent restorations and more areas that are decayed. No distinction is made between primary and secondary caries.

In the case of filling involving both of the crown and root, judgement of the side of origin is more difficult. For any restoration involving both the crown and root with secondary caries, the most likely site of the primary caries lesion is recorded as filled, with decay. When it is not possible to judge the site of origin of primary caries lesion, both the crown and root should be recorded as filled, with decay.

Filled, sound root: code 5

A root is considered filled, without decay, when one or more permanent restorations are present and there is no caries anywhere on root.

In the case of filling involving both of the crown and the root, judgement of the side of origin is more difficult. For any restoration involving both the crown and the root, the most likely site of the primary caries lesion is recorded as filled. When it is not possible to judge the site of origin of primary caries lesion, both the crown and the root should be recorded as filled.

Cervical wear, unfilled: code 6

Wear of the necks of the teeth normally occurs as a wedge or saucer shaped defect, often on outward facing (buccal or labial) surface of the root. Cervical wear was diagnosed when a defete was more than 1 mm in depth.

Cervical wear, filled: code 7

Cervical wear but had been filled.

Unscoreable root: code 9

This code is used under root status to indicate either that the tooth that cannot be extracted or that calculus is present to such an extent that a root examination is not possible.

Treatment needs

Treatment requirements should be assessed for the whole tooth, including both coronal and root caries. Immediately after the status of a tooth is recorded, and before proceeding to next tooth or tooth space, the type of treatment required, if any, should be recorded. If no treatment required, code "0" should be placed in the appropriate treatment box.

The codes and criteria for treatment needs are:

0- None (no treatment)

This code is recorded if a crown and a root are both sound, or if it is decided that a tooth should not receive any treatment

1- Need filling (s)

This code is used to indicate the treatment required to:

- Treat initial, primary or secondary caries;
- Treat discolouration of a tooth, or a developmental defect;
- Treat lesions due to trauma, abrasion, erosion or attrition;
- Replace unsatisfactory fillings sealants.

A filling is considered unsatisfactory if one or more of following condition exist:

- A deficient margin to an existing restoration that has leaked or is likely to permit leakage into the dentine. The decision as to whether a margin is deficient should be based on the examiner's clinical judgement, on evidence gained from the insertion of CPI probe at margin, or on the presence of severe staining of tooth structure.
- An overhanging margin of an existing restoration that causes obvious local irritation to the gingival and cannot be removed by recontouring of restoration.
- A frature of an existing restoration that either causes it to be loose or permits leakage into the dentine
- Discolouration

2- Pulp care and restoration

This code is used to indicate that a tooth probably needs pulp care prior to restoration with a filling or crown because of deep and extensive caries, or because of tooth mutilation or trauma.

Note: A probe should never be inserted into depth of a cavity to confirm the presence of a suspected pulp exposure.

3- Scalling

This code is used to indicate that teeth probably need scalling because teeth are covered by many calculus.

4- Crown for any reason

5- Extraction

- A tooth is recorded as "indicated for extraction", depending on the treatment on the treatment possibilities available, when:
- Caries has so destroyed the tooth that it cannot be restored;
- Periodontal disease has progressed so far that the tooth is loose, painful or functionless and, in the clinical judgement of the examiner, cannot be restored to a functional state;

- A tooth needs to be extrated to make way for a prosthesis; or
- Extraction is required for orthodontic or cosmetic reason, or because of impaction.

6-Need prostheses

7-Need for other care

8. Diagnostic criteria for the measurement of periodontal disease

Mobility

This is a modification of Miller's index (instruction to examiner: feels your own teeth to get a feel for what is normal. Even very small movements can be detected fairly easily. Increased mobility should be coded where there is unequivocally increased mobility. 1mm mobility is actually quite a lot, This will correspond to very mobile teeth).

0- No increased mobility.

1- Increased mobility, but less than 1mm movement horizontally.

2- Gross movement, more than 1mm horizontally or vertical/rotational movement.

9- unscoreable

This should be measured using a finger at one side of the tooth to detect movement, while a rigid instrument (e.g. a mirror handle) is applied to the other, the tooth is then very gently wiggled.

IF IN DOUBT, SCORE LOWER.

Loss of Attachment:

The codes are:

0 0-3mm

1 4-5mm

2 6-8mm

3 9-11mm

4 12+mm (rare)

9 unscoreable

The surface is recorded as unscoreable if the CEJ cannot be estimated, due to gross decay, wear or the presence of a restoration. If the position of the CEJ can be estimated with some confidence, the total loss of attachment should be measured. Crowns cause a particular problem, where the crown margin has extended past the CEJ. In these cases it is reasonable to record loss of attachment from the crown margin, unless the morphology of the restoration allows you to estimate the attachment loss. Generally, if you can estimate loss of attachment, please do. Unscoreable codes are difficult to deal with in the analysis and are best avoided, unless there is no option.

Probing should be gentle. Note that sometimes subgingival calculus can stop a probe penetrating to the depth of the pocket and it may be necessary to gently work the probe down the root surface. Loose debris can be cleared from the gingival margin using the probe, if necessary.

Community Periodontal Index (CPI)

Indicators: three indicators of periodontal status are used for this assessment: gingival bleeding, calculus and periodontal pockets.

Sextants. The mouth is divided into sextants defined by tooth numbers: 18-14, 13-23, 24-28, 38-34, 33-43, and 44-48. A sextant should be examined only if there are two or more teeth present which are not indicated for extraction.

Note: this replaces the former instruction to include single remaining teeth in the adjacent sextant.

The two molars in each posterior sextant are paired for recording and, if one is missing, there is no replacement. If no index teeth or tooth is present in a sextant qualifying for examination, all the remaining teeth in that sextant are examined and the highest score is recorded as the score for the sextant. In this case, distal surface of third molars should not be scored.

Assessing gingival pocket and calculus. An index tooth should be probed, using the probe as a "sensing" instrument to determine pocket depth and to detect subgingival calculus and bleeding response. The sensing force used should be no more than 20 grams. A practical test for establishing this force is to place the probe point under the thumbnail and press until blanching occurs. For sensing subgingival calculus, the lightest possible force that will allow movement of the probe ball tip along the tooth surface should be used.

When the probe is inserted, the ball tip should follow the anatomical configuration of the surface of the tooth root. If the patient feels pain during probing, this is indicative of use of too much force.

The probe tip should be inserted gently into the gingival sulcus or pocket and the total extent of the sulcus or pocket explored. For example, the probe is placed in the pocket at the disto-buccal surface of second molar, as close as possible to the long axis of the tooth. The probe is then moved gently, with short upward and downward movements, along the buccal sulcus or pocket to the mesial surface of the second molar, from the disto-buccal surface of the first molar towards the contact area with the premolar. A similar procedure is carried out for the lingual surface, starting disto-lingually to second molar.

Examination and recording. The index teeth, or all remaining teeth in a sextant where there is no index tooth, should be probed and highest score recorded in the appropriate box.

The codes are:

0- Healthy

1- Bleeding observed, directly or by using a mouth mirror, after probing

2- Calculus detected during probing, but the entire black band on the probe visible

3- Pocket 4-5 mm (gingival margin within the black band on the probe)

4- Pocket 6mm or more (black band on the probe not visible)

9- Not recorded

9. Diagnostic criteria for the assessment of dentures

(1) Complete Dentures

The complete dentures themselves are now examined. Each denture or set of dentures will be assessed according to the criteria given below. The dentures to be assessed are the ones that the patient normally wears.

1. Does the patient have complete dentures which he/she normal wears?

Yes

No

2. Occlusal relationship

- Adequate
- Inadequate
- Unrecordable

Occlusal relationship is recorded by establishing the rest position and then gently supporting the lower denture with the index fingers and asking the patient to close together, with gentle guidance to ensure that closure is along the retruded arch where necessary. The relationship is recorded as inadequate if: (a) there is a slide of greater than one quarter cusp length (1-1.5mm approx.) into intercuspal position from first contact OR (b) if first contact is uneven, leading to displacement of the dentures on further closure OR (c) if first contact is clearly uneven between right and left or where all contact is on the anterior teeth, even in the absence of significant displacement.

3. Extension

- Adequate / underextended
- Overextended
- Unrecordable

The denture is examined in-situ by gentle manipulation of the cheeks, direct visual examination of the post dam area. The patient is also asked to protrude the tongue. The denture is scored as overextended where overextension leading to displacement of the denture on examination or soft tissue damage is present in any area of the periphery.

4. Adaptation (stability)

- Adequate
- Inadequate
- Unrecordable

This is a very difficult one where scoring is highly subjective. The dividing line between what is acceptable and what is not clearly defined, and account must be taken of the quality and mobility of the ridges and the denture bearing areas.

Index fingers and thumbs are placed either side of the premolars and rotatory and lateral forces applied. Where movement over the tissues is greater than considered acceptable, taking into account the denture bearing area, then the adaptation is considered inadequate. Clearly the denture bearing areas should be examined prior to this examination.

5. Retention

- Adequate
- Inadequate
- Unrecordable

Upper: Index fingers are carefully placed in the premolar areas, taking care not to stretch the cheek excessively and break the peripheral seal, and gentle vertical downward pressure exerted. Retention is adequate when resistance to removal is felt and when there is audible or tactile evidence of the peripheral seal being broken.

Lower: Index finger and thumb of one hand are used to grip either side of the central incisors and gentle upward force exerted. Retention is adequate when some resistance to removal is felt. No evidence of the seal breaking is required.

If an "inadequate" code is recorded, the examiner should repeat the examination to verify this.

(2) Partial dentures

The assessment is fairly straightforward. Questions about usage will be covered in the questionnaire. The denture should only be assessed if it is ever actually worn. It does not have to be in the mouth when you visit, provided the subject wears it on some sort of regular basis. The dentist can probe regarding usage. It should not be scored if it resides only in a drawer and is never used.

1. Does the subject have a partial denture which he/she normally wears?

Yes

No

2. Does the partial denture replace all missing teeth?

Yes

No

If extractions have been undertaken since the denture was constructed, without alteration to the denture, score "no". This question does not mean that the denture has to replace third molars, or even second molars for that matter, but refers to gaps that are unfilled for the reason given above.

3. Does the denture provide additional posterior function?

Yes

No

This should be coded as "yes", if the denture has any contact with an opposing natural posterior tooth or denture.

4. Are any natural anterior teeth missing which are replaced by the denture?

- Yes
- No

Appendix 7

Dental Examination Form and Clinical Criteria

year month	day	identification number	examiner
☐☐☐☐	☐☐	☐☐☐☐	☐

Name..............................
Home address/ Work address...

TEMPOROMANDIBULAR JOINT ASSESSMENT

SYMPTOMS ☐	SIGNS ☐		
0=No	0=No	Clicking	☐
1=Yes	1=Yes	Tenderness (on palpation)	☐
9=Not recorded	9=Not recorded	Reduced jaw mobility (< 30 mm opening)	☐

SOFT TISSUES Present 1 Absent 0

Angular Cheilitis	☐	Denture Hyperplasia	☐	Abscess	☐
Denture Stomatitis I	☐	Ulceration (aphthous,herpetic, traumatic)	☐	other condition. Specify if possible............	☐
Denture Stomatitis II	☐	Acute necrotizing gingivitis	☐		☐
Denture Stomatitis III	☐	Candidiasis	☐		☐

Upper Lower	Upper Lower	Upper Lower
Edentulous status ☐☐	Prosthesis status ☐☐	Prosthetic need ☐☐
0= no natural teeth	0=no prosthesis	0=no need for prosthesis
1= any natural teeth	1=bridge	1=need new bridge
	2=removable partial denture	2=need new removable partial denture
	3=both bridge(s) and partial denture (s)	3=need new complete denture
	4=complete denture	4=need repair existing prosthesis
	9=Not recorded	9=Not recorded

SPACING

	7	6	5	4	3	2	1	1	2	3	4	5	6	7
Upper														
Lower														

SPACING CODE
0= No space
1=Space (unfilled)
2= Space (restored)

CONTACTS

8d	8m	7d	7m	6d	6m	5	4	3	2	1	1	2	3	4	5	6m	6d	7m	7d	8m	8d

CONTACTS CODE:
0=no contact
1=both opposing teeth are natural
2=natural and artificial teeth contact
3=both opposing teeth are artificial

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Crown																
Root																

	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Crown																
Root																

TREATMENT NEED
0=no treatment need 1=need filling (s) 2= pulp treatment and restoration
3 = scalling 4 = crown for any reason 5= extraction
6 = need prosthesis 7 = need other care

CODES: DMF, CROWN AND ROOT		
CROWN		ROOT
Sound	0	Sound, no exposed root
Artificial teeth	1	Exposed but sound
Missing	2	Missing
Decayed	3	Decayed
Filled, decayed,	4	Filled, decayed
Filled, sound	5	Filled, sound
Bridge abutments Special crown or veneer	6	Cervical wear , unfilled
	7	Cervical wear, filled
Unscoreable	9	Unscoreable

PERIODONTAL DISEASE

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
mob																
	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
mob																

LA

17/16	11	26/27
47/46	31	36/27

CPI

17/16	11	26/27
47/46	31	36/27

Mobility	**Loss of Attachment(LA)**	**Community Periodontal Index(CPI)**
0=None	0=0-3mm	0=Healthy
1=Increased < 1mm	1=4-5mm	1=Bleeding
2=Increased >1mm	2=6-8mm	2=Calculus
9=Unscoreable	3=9-11mm	3=Pocket 4-5 mm
	4=12$^+$ mm	4=Pocket 6mm or more
	9=Unscoreable	9=Unscoreable

COMPLETE DENTRURES

1.Does the patients have a complete denture which he/she normal wears	4. Adaptation
Yes 1 -upper No 2 -lower	Adequate 1 -upper Inadequate 2 –lower
2. Occlusal relationship	5. Retention
Adequate 1 Inadequate 2	Adequate 1 -upper Inadequate 2 -lower
3. Extension Adequate 1 -upper Inadequate 2 -lower	

PARTIAL DENTURES

1. Does the subject have a partial denture that he/she normal wears?	3. Does the denture provide additional posterior function?
Yes 1 -upper No 0 -lower	Yes 1 -upper No 2 -lower
2. Does the partial denture replace all missing teeth?	4. Are any anterior teeth missing which are replaced by the denture
Yes 1 -upper No 2 -lower	Yes 1 -upper No 2 -lower

Appendix 8

The results from analysis separately for people with only natural teeth and people with replaced teeth

Table 8.1 Distribution of study population by numbers of teeth and occluding pairs for people with only natural teeth and people with replaced teeth.

Dental status	**Sample size (%)**	**Dental status**	**Sample size (%)**
Natural teeth	**N = 669**	**Natural plus replaced teeth**	**N = 527**
No. of teeth		**No. of teeth**	
26-28	470 (70.3)	26-28	404 (76.7)
21-25	124 (18.5)	21-25	99 (18.8)
1-20	75 (11.2)	1-20	24 (4.5)
No. of Occluding Pairs		**No. of Occluding Pairs**	
16-18	401 (55.9)	16-18	250(47.5)
11-15	153 (22.9)	11-15	173 (32.8)
0-10	115 (17.2)	0-10	104 (19.7)
No. of Posterior Occluding Pairs		**No. of Posterior Occluding Pairs**	
11-12	411 (61.4)	11-12	275 (52.2)
5-9	153(22.9)	5-9	171 (32.4)
0-4	105 (15.7)	0-4	81 (15.4)
No. of Anterior Occluding Pairs		**No. of Anterior Occluding Pairs**	
6	543 (81.2)	6	378 (71.7)
4-5	78 (11.7)	4-5	82 (15.6)
0-3	48 (7.1)	0-3	67 (12.7)

Appendix 8 The results from analysis separately for people with only natural teeth and people with replaced teeth

Table 8.2 Mean numbers of natural teeth and numbers of natural plus replaced teeth for people with only natural teeth and people with replaced teeth, by selected sociodemographic factors.

Sociodemographic factors	N	No. of natural teeth Mean (Median)	† p-Value	N	No. of natural plus replaced teeth Mean(Median)	† p-Value
Age			< 0.001			< 0.001
55-64	328	26.7 (28.0)		153	26.8 (28.0)	
65-74	263	24.6 (27.0)		271	26.3 (27.0)	
75+	78	21.1 (24.0)		103	25.1 (26.0)	
Sex			0.004			0.88
Male	333	25.1 (27.0)		242	26.1 (27.0)	
Female	336	25.4 (27.0)		285	26.2 (27.0)	
Occupation			0.81			0.003
Non-manual	305	25.5 (27.0)		279	26.6 (27.0)	
Manual	364	25.5 (27.0)		248	25.7 (27.0)	
Self-assessed social class			0.83			0.03
High (6-10)	322	25.5 (27.0)		282	26.4 (2.6)	
Low (1-4)	347	25.0 (27.0)		245	25.9 (3.0)	
Total	669	25.2 (27.0)		527	26.2 (27.0)	

† Kruskal-Wallis and Mann-Whitney tests

Table 8.3 Mean numbers of OPs, POPs, AOPs* in people with only natural teeth, by selected sociodemographic factors (N = 669).

Sociodemographic factors	OPs Mean (Median)	†p-Value	POPs Mean (Median)	†p-Value	AOPs Mean (Median)	†p-Value
Age		< 0.001		< 0.001		< 0.001
55-64 (328)	16.0 (18.0)		10.2 (12.0)		5.8 (6.0)	
65-74 (263)	13.9 (16.0)		8.5 (10.0)		5.4 (6.0)	
65+ (78)	10.2 (10.5)		5.8 (5.5)		4.3 (5.0)	
Sex		0.10		0.20		0.60
Male (333)	14.2 (16.0)		8.8 (10.0)		5.4 (6.0)	
Female (336)	14.9 (17.0)		9.3 (11.0)		5.6 (6.0)	
Occupation		1.00		0.80		0.72
Non-manual (305)	14.8 (16.0)		9.2 (10.0)		5.6 (6.0)	
Manual (364)	14.3 (16.0)		8.9 (10.0)		5.4 (6.0)	
Self–assessed social class		0.97		0.96		0.53
High (5-10) (322)	14.7 (16.0)		9.1 (10.0)		5.6 (6.0)	
Low (1-4) (347)	14.3 (16.0)		8.9 (10.0)		5.4 (6.0)	
Total (669)	14.5 (16.0)		9.0 (10.0)		5.5 (6.0)	

*OPs: Occluding Pairs of natural teeth

POPs: Posterior Occluding Pairs of natural teeth

AOPs: Anterior Occluding Pairs of natural teeth

†Kruskal-Wallis and Mann-Whitney tests

Table 8.4 Mean numbers of OPRs, POPRs, AOPRs* in people with replaced teeth, by selected sociodemographic factors (N = 527).

Sociodemographic factors (n)	OPRs Mean (Median)	† p-Value	POPRs Mean (Median)	† p-Value	AOPRs Mean (Median)	† p-Value
Age		< 0.001		< 0.001		< 0.001
55-64 (153)	15.4 (16.0)		9.8 (10.0)		5.6 (6.0)	
65-74 (271)	13.6 (14.0)		8.3 (9.0)		5.3 (6.0)	
65+ (103)	11.8 (13.0)		7.3 (8.0)		4.6 (6.0)	
Sex		0.09		0.30		0.06
Male (242)	13.7 (15.0)		8.6 (10.0)		5.1 (6.0)	
Female (285)	13.8 (15.0)		8.5 (10.0)		5.5 (6.0)	
Occupation		0.03		0.05		0.12
Non-manual (279)	14.3 (16.0)		8.9 (10.0)		5.4 (6.0)	
Manual (248)	13.2 (14.0)		8.1 (9.0)		5.1 (6.0)	
Self–assessed social class		0.07		0.08		0.23
High (5-10) (282)	14.1 (16.0)		8.8 (10.0)		5.3 (6.0)	
Low (1-4)(245)	13.5 (14.0)		8.3 (9.0)		5.2 (6.0)	
Total (527)	13.8 (15.0)		8.6 (10.0)		5.2 (6.0)	

*OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Anterior Occluding Pairs of natural plus replaced teeth

†Kruskal-Wallis and Mann-Whitney tests

Table 8.5 Percentage of people with difficulty eating certain foods*, by number of natural teeth and numbers of natural plus replaced teeth for people with only natural teeth and people with replaced teeth.

Foods	No. of natural teeth				No. of natural plus replaced teeth			
	26-28 n=470	21-25 n=124	1-20 n=75	All n=669	26-28 n=404	21-25 n=99	1-20 n=24	All n=527
Salted roast chicken	28.9	63.7	85.3	41.7	49.3	74.7	100.0	56.4
Roast pork ribs	29.1	64.5	85.3	42.0	49.3	74.7	100.0	56.4
Roast duck or chicken	28.1	63.7	85.3	41.1	48.5	74.7	100.0	55.8
Whole apple	14.9	47.6	84.0	28.7	36.6	68.7	95.8	45.4
Corn on the cob	14.5	47.6	84.0	28.4	34.4	67.7	95.8	43.5
Boiled chicken or duck	11.5	37.9	80.0	24.1	29.5	61.6	83.3	38.0
Cooked sliced beef	11.9	37.9	80.0	24.4	30.4	60.6	83.3	38.5
Cooked sliced pork	9.4	28.2	73.3	20.0	22.8	50.5	79.2	30.6
Cooked green vegetable	4.3	21.0	62.7	13.9	17.6	36.4	70.8	23.5
Cooked cucumber or lotus root	3.8	21.0	66.7	14.1	15.6	37.4	75.0	22.4
Cooked carrots	3.6	17.7	58.7	12.4	13.1	31.3	70.8	19.2
Steamed bread	1.3	4.8	18.7	3.9	1.0	7.1	25.0	3.2
Soft rice	0.9	1.6	12.0	2.2	0.0	5.1	12.5	1.5
Rice porridge	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boiled fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tofu in water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* % eat difficulty = % who eat only with difficulty or can't eat at all

Table 8.6 Percentage of people with difficulty eating certain foods*, by the numbers of OPs, POPs, AOPs in people with only natural teeth (N = 669)**

Foods	OPs			POPs			AOPs			All
	16-18 n=401	11-15 n=153	0-10 n=115	10-12 n=411	5-9 n=153	0-4 n=105	6 n=543	4-5 n=78	0-3 n=48	n=669
Salted roast chicken	26.7	54.9	76.5	27.5	55.6	77.1	33.9	64.1	93.8	41.7
Roast pork ribs	26.9	55.6	76.5	27.7	56.2	77.1	34.3	64.1	93.8	42.0
Roast duck or chicken	25.7	54.9	76.5	26.5	55.6	77.1	33.1	64.1	93.8	41.1
Whole apple	14.2	35.9	69.6	14.6	38.6	69.5	19.2	57.7	89.6	28.7
Corn on the cob	14.2	34.6	69.6	14.4	37.9	69.5	19.2	56.4	87.5	28.4
Boiled chicken or duck	11.5	25.5	66.1	11.7	28.8	65.7	15.5	47.4	83.3	24.1
Cooked sliced beef	11.7	26.1	66.1	11.9	29.4	65.7	15.7	50.0	81.3	24.4
Cooked sliced pork	9.5	19.0	58.3	9.5	22.2	58.1	12.2	42.3	72.9	20.0
Cooked green vegetable	5.0	10.5	49.6	4.9	13.7	49.5	6.6	34.6	62.5	13.9
Cooked cucumber or lotus root	4.5	10.5	52.2	4.4	14.4	51.4	6.3	35.9	66.7	14.1
Cooked carrots	4.2	7.8	47.0	4.1	11.1	46.7	5.5	29.5	62.5	12.4
Steamed bread	1.5	1.3	15.7	1.5	2.0	16.2	2.2	5.1	20.8	3.9
Soft rice	1.0	0.7	8.7	1.0	1.3	8.6	1.3	0.0	2.2	2.2
Rice porridge	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boiled fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tofu in water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* % eat difficulty = % who eat only with difficulty or can't eat at all

** OPs: Occluding Pairs of natural teeth

POPs: Posterior Occluding Pairs of natural teeth

AOPs: Anterior Occluding Pairs of natural teeth

Table 8.7 Percentage of people with difficulty eating certain foods*, by numbers of OPRs, POPRs, AOPRs in people with replaced teeth (n = 527).**

Foods	OPRs			POPRs			AOPRs			All
	16-18 n=250	11-15 n=173	0-10 n=104	10-12 n=275	5-9 n=171	0-4 n=81	6 n=378	4-5 n=82	0-3 n=67	n=527
Salted roast chicken	38.4	64.7	85.6	40.0	69.6	84.0	49.7	69.5	77.6	56.4
Roast pork ribs	38.0	65.3	85.6	39.6	70.2	84.0	49.5	70.7	77.6	56.4
Roast duck or chicken	37.2	65.3	84.6	38.9	70.2	82.7	48.9	70.7	76.1	55.8
Whole apple	24.0	55.5	79.8	27.6	57.9	79.0	35.4	62.2	80.6	45.4
Corn on the cob	22.4	52.6	78.8	25.8	55.6	77.8	33.6	59.8	79.1	43.5
Boiled chicken or duck	18.0	47.4	70.2	19.3	52.6	70.4	29.1	56.1	65.7	38.0
Cooked sliced beef	19.6	47.4	69.2	20.4	52.6	70.4	30.4	53.7	65.7	38.5
Cooked sliced pork	15.2	35.8	58.7	16.4	39.8	59.3	22.2	47.6	56.7	30.6
Cooked green vegetable	10.0	26.0	51.9	10.9	30.4	51.9	16.9	34.1	47.8	23.5
Cooked cucumber or lotus root	8.0	25.4	51.9	9.1	29.8	51.9	15.9	32.9	46.3	22.4
Cooked carrots	6.0	22.0	46.2	7.3	26.3	44.4	13.0	28.0	43.3	19.2
Steamed bread	0.4	2.3	11.5	0.7	3.5	52.9	1.6	1.2	14.9	3.2
Soft rice	0.0	1.2	5.8	0.4	1.2	6.2	0.8	1.2	6.0	1.5
Rice porridge	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boiled fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tofu in water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* % eat difficulty = % who eat only with difficulty or can't eat at all

** OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Posterior Occluding Pairs of natural plus replaced teeth

Table 8.8 Summary of the statistically significant relationships between the percentage of subjects who reported they could eat with some difficulty or not eat at all various types of food and a range of measures of oral health. After adjusting for age, sex, occupation, self-assessed social class and general health, analysed separately for people with only natural teeth and people with replaced teeth.

Foods	1	2	3	4	5	6	7	8
	N = 669	N = 669	N = 669	N = 669	N = 527	N = 527	N = 527	N = 527
Salted roast chicken	s2	s2	s2	s2	s2	s2	s2	s1
Roast pork ribs	s2	s2	s2	s2	s2	s2	s2	s1
Roast duck or chicken	s2	s2	s2	s2	s2	s2	s2	s1
Whole apple	s2	s2	s2	s2	s2	s2	s2	s2
Corn on the cob	s2	s2	s2	s2	s2	s2	s2	s2
Boiled chicken or duck	s2	s2	s2	s2	s2	s2	s2	s2
Cooked sliced beef	s2	s2	s2	s2	s2	s2	s2	s2
Cooked sliced pork	s2	s2	s2	s2	s2	s2	s2	s2
Cooked green vegetable	s2	s2	s2	s2	s1	s2	s2	s2
Cooked cucumber or lotus root	s2	s2	s2	s2	s2	s2	s2	s2
Cooked carrots	s2	s2	s2	s2	s2	s2	s2	s2
Steamed bread	s2	s2	s2	s1	s1	s1	n.s.	s2
Soft rice	s1	s1	s1	s2	n.s.	n.s.	n.s.	n.s.
Rice porridge	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Boiled fish	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tofu in water	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

* n.s. = no statistically significant; s1 = p< 0.01; s2 = p< 0.001.

1. Number of natural teeth
2. Number of Occluding Pairs of natural teeth
3. Number of Occluding Posterior Pairs of natural teeth
4. Number of Occluding Anterior Pairs of natural teeth.
5. Number of natural plus replaced teeth
6. Number of Occluding Pairs of natural plus replaced teeth
7. Number of Occluding Posterior Pairs of natural plus replaced teeth
8. Number of Occluding Anterior Pairs of natural plus replaced teeth

**Adjusted model: adjusted for age, sex, occupation, self-assessed social class and self-perceived general health.

Table 8.9 Prevalence of Index of Eating Difficulty (IED), General Eating Difficulty (GED) and Dissatisfactions with Chewing Ability (DCA), by number of natural teeth, numbers of OPs, POPs, AOPs* in people with only natural teeth (N = 669).

Clinical variables (n)	IED=1-5 (%)	† p-Value	GED (%)	† p-Value	DCA (%)	† p-Value
No. of teeth		< 0.001		< 0.001		< 0.001
26-28 (470)	4.9		32.3		26.6	
21-25 (124)	18.5		67.7		57.3	
1-20 (75)	64.0		86.8		85.3	
OPs		< 0.001		< 0.001		< 0.001
16-18 (401)	4.7		30.2		24.7	
11-15 (153)	10.5		59.5		47.7	
0-10 (115)	51.3		77.4		76.5	
POPs		< 0.001		< 0.001		< 0.001
10-12 (411)	5.1		30.9		25.3	
5-9 (153)	12.4		60.1		49.0	
0-4 (105)	51.4		78.1		77.1	
AOPs		< 0.001		< 0.001		< 0.001
6 (543)	6.4		37.8		31.1	
4-5 (78)	32.1		65.4		64.1	
0-3 (48)	70.8		93.8		85.4	
Total (669)	14.1		45.0		38.9	

* OPs: Occluding Pairs of natural teeth

POPs: Posterior Occluding Pairs of natural teeth

AOPs: Anterior Occluding Pairs of natural teeth

† Chi – Squared test for trend

Table 8.10 Prevalence of Index of Eating Difficulty (IED), General Eating Difficulty (GED) and Dissatisfactions with Chewing Ability (DCA), by number of natural plus replaced teeth, numbers of OPRs, POPRs, AOPRs* in people with replaced teeth (N = 527).

Clinical variables (n)	IED=1-5 (%)	† p-Value	GED (%)	† p-Value	DCA (%)	† p-Value
No. of teeth		< 0.001		< 0.001		< 0.001
26-28 (404)	11.1		54.0		36.4	
21-25 (99)	34.3		77.8		67.7	
1-20 (24)	66.7		100.0		87.5	
OPRs		< 0.001		< 0.001		< 0.001
16-18 (250)	4.0		41.6		30.4	
11-15 (173)	22.0		70.5		49.7	
0-10 (104)	45.2		89.4		70.2	
POPRs		< 0.001		< 0.001		< 0.001
10-12 (275)	5.5		44.7		31.6	
5-9 (171)	23.4		73.1		55.0	
0-4 (81)	49.4		87.7		66.7	
AOPRs		< 0.001		< 0.001		< 0.001
6 (378)	12.2		53.2		39.9	
4-5 (82)	28.0		73.2		47.6	
0-3 (67)	38.8		86.6		67.2	
Total (527)	18.0		60.5		44.6	

* OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Posterior Occluding Pairs of natural plus replaced teeth

†Chi – Squared test for trend

Table 8.11 Relationship between dental status and Index of Eating Difficulty (IED) in people with only natural teeth (N = 669).

Dental status	IED=1-5 (n = 94) n%	Unadjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value	***Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (470)	23 (4.9)	1.00		1.00		1.00	
21-25 (124)	23 (18.5)	4.43 (2.39, 8.20)	< 0.001	4.01 (2.13, 7.56)	< 0.001	3.97(2.10, 7.50)	< 0.001
1-20 (75)	48 (64.0)	34.55 (18.39, 64.93)	< 0.001	23.49 (11.81, 46.72)	< 0.001	23.45 (11.80,46.61)	< 0.001
OPs							
16-18 (401)	19 (4.7)	1.00		1.00		1.00	
11-15 (153)	16 (10.5)	2.35 (1.17, 4.70)	0.02	2.13 (1.05, 4.36)	0.04	2.12 (1.04, 4.35)	0.04
0-10 (115)	59 (51.3)	21.18 (11.76, 38.14)	< 0.001	14.44 (7.66, 27.21)	< 0.001	14.40 (7.64, 27.16)	< 0.001
POPs							
10-12 (411)	21 (5.1)	1.00		1.00		1.00	
5-9 (153)	19 (12.4)	2.63 (1.37, 5.05)	0.004	2.22(1.13, 4.39)	0.02	2.22 (1.12, 4.39)	0.02
0-4 (105)	54 (51.4)	19.66 (10.98, 35.21)	< 0.001	12.79 (6.86, 23.86)	< 0.001	12.78 (6.84, 23.87)	< 0.001
AOPs							
6 (543)	35 (6.4)	1.00		1.00		1.00	
4-5 (78)	25 (32.1)	6.84 (3.81, 12.30)	< 0.001	5.58 (3.00, 10.36)	< 0.001	5.55 (2.99, 10.33)	< 0.001
0-3 (48)	34 (70.8)	35.24 (17.32, 71.70)	< 0.001	22.24 (10.37, 47.69)	< 0.001	22.21(10.36, 47.62)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.12 The relationship between dental status and Index of Eating Difficulty (IED) in people with replaced teeth (N = 527).

Dental status	IED=1-5 (n = 95) n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (404)	45(11.1)	1.00		1.00		1.00	
21-25 (99)	34 (34.3)	4.17 (2.49, 7.00)	< 0.001	3.77 (2.19, 6.49)	< 0.001	3.72(2.16, 6.42)	< 0.001
1-20 (24)	16 (66.7)	15.96 (6.46, 39.38)	< 0.001	11.77 (4.53, 30.55)	< 0.001	11.46 (4.40, 29.88)	< 0.001
OPRs							
16-18 (250)	10 (4.0)	1.00		1.00		1.00	
11-15 (173)	38 (22.0)	6.76 (3.26, 13.99)	< 0.001	6.04 (2.87, 12.65)	< 0.001	5.95 (2.84, 12.48)	< 0.001
0-10 (104)	47 (45.2)	19.79 (9.43, 41.52)	< 0.001	15.98(7.40, 34.51)	< 0.001	15.74 (7.27, 34.05)	< 0.001
POPRs							
10-12 (275)	15 (5.5)	1.00		1.00		1.00	
5-9 (171)	40 (23.4)	5.29 (2.82, 9.21)	< 0.001	4.48 (2.36, 8.51)	< 0.001	4.39 (2.31, 8.37)	< 0.001
0-4 (81)	40 (49.4)	16.89(8.57, 33.30)	< 0.001	13.82(6.79, 28.14)	< 0.001	13.65 (6.69, 27. 83)	< 0.001
AOPRs							
6 (378)	46 (12.2)	1.00		1.00		1.00	
4 -5 (82)	23 (28.0)	2.81(1.59, 4.99)	< 0.001	2.36 (1.30, 4.28)	0.006	2.31 (1.27, 4.21)	0.007
0-3 (67)	26 (38.8)	4.58 (2.56, 8.18)	< 0.001	3.48 (1.88, 6.46)	< 0.001	3.38 (1.82, 6.29)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.13 The relationship between dental status and Index of Eating Difficulty (IED) in dentate people (N = 1196).

Dental status	IED=1-5 n=189 n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
OPRs							
16-18 (651)	29 (4.5)	1.00		1.00		1.00	
9-15 (326)	54 (16.6)	4.26 (2.65, 6.84)	<0.001	3.78 (2.33, 6.14)	<0.001	3.76 (2.31, 6.10)	<0.001
0-10 (219)	106 (48.4)	20.12 (12.74, 31.78)	<0.001	14.47 (8.95, 23.41)	<0.001	14.38 (8.88, 23.28)	<0.001
POPRs							
10-12(686)	36 (5.2)	1.00		1.00			
5-9 (324)	59 (18.2)	4.02 (2.59, 6.23)	<0.001	3.38 (2.15, 5.30)	<0.001	3.35 (2.13, 5.27)	<0.001
0-4 (186)	94 (50.5)	18.45 (11.86, 28.70)	<0.001	13.10 (8.23, 20.85)	<0.001	13.01 (8.17, 20.72)	<0.001
AOPRS							
6 (921)	81 (8.8)	1.00		1.00		1.00	
4-5 (160)	48 (30.0)	4.44 (2.96, 6.68)	<0.001	3.66 (2.38, 5.61)	<0.001	3.63 (2.36, 5.58)	<0.001
0-3 (115)	60 (52.2)	11.31 (7.35, 17.41)	<0.001	7.63 (4.81, 12.10)	<0.001	7.56 (4.76, 11.99)	<0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, and self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.14 The relationship between dental status and Dissatisfactions with Chewing Ability (DCA) in people with only natural teeth (N = 669).

Dental status	DCA n= 260 n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (470)	125 (26.6)	1.00		1.00		1.00	
21-25 (124)	71 (57.3)	3.70 (2.45, 5.57)	< 0.001	3.73 (2.45, 5.69)	< 0.001	3.65 (2.39, 5.58)	< 0.001
1-20 (75)	64 (85.3)	16.05 (8.20, 31.42)	< 0.001	14.70(7.22, 29.92)	< 0.001	14.88 (7.30, 30.36)	< 0.001
OPs							
16-18 (401)	99 (24.7)	1.00		1.00		1.00	
11-15 (153)	73(47.7)	2.78 (1.88, 4.11)	< 0.001	2.77 (1.85, 4.14)	< 0.001	2.70 (1.80, 4.05)	< 0.001
0-10 (115)	88(76.5)	9.94 (6.11, 16.19)	< 0.001	8.95(5.30, 15.12)	< 0.001	8.91 (5.27, 15.06)	< 0.001
POPs							
10-12 (411)	104 (25.3)	1.00		1.00		1.00	
5-9 (153)	75 (49.0)	2.84 (1.93, 4.18)	< 0.001	2.78 (1.86, 4.16)	< 0.001	2.73 (1.82, 4.08)	< 0.001
0-4 (105)	81 (77.1)	9.96 (6.00, 16.54)	< 0.001	8.84 (5.16, 15.16)	< 0.001	8.75 (5.10, 15.02)	< 0.001
AOPs							
6 (543)	169 (31.1)	1.00		1.00		1.00	
4-5 (78)	50 (64.1)	3.95 (2.40, 6.50)	< 0.001	3.58 (2.15, 5.98)	< 0.001	3.53 (2.11, 5.90)	< 0.001
0-3 (48)	41 (85.4)	12.96 (5.70, 29.47)	< 0.001	10.00 (4.27, 23.42)	< 0.001	10.08 (4.30, 23.64)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.15 The relationship between dental status and Dissatisfactions with Chewing Ability (DCA) in people with replaced teeth (N = 527).

Dental status	DCA n=235 n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No.of teeth							
26-28 (404)	147 (36.4)	1.00		1.00		1.00	
21-25 (99)	67 (67.7)	3.66 (2.19, 5.84)	< 0.001	3.61 (2.23, 5.82)	<0.001	3.58 (2.21, 5.78)	<0.001
1-20 (24)	21(87.5)	12.22 (3.59, 41.65)	< 0.001	11.16 (3.21, 38.77)	< 0.001	10.90 (3.13, 37.95)	< 0.001
OPRs							
16-18 (250)	76(30.4)	1.00		1.00		1.00	
11-15 (173)	86 (49.7)	2.26 (1.51, 3.38)	< 0.001	2.22 (1.47, 3.34)	< 0.001	2.18 (1.44, 3.29)	< 0.001
0-10 (104)	73 (70.2)	5.39 (3.27, 8.88)	< 0.001	5.22 (3.08, 8.84)	< 0.001	5.15 (3.04, 8.73)	< 0.001
POPRs							
10-12 (275)	87(31.6)	1.00		1.00		1.00	
5-9 (171)	94(55.0)	2.64 (1.79, 3.91)	< 0.001	2.55 (1.70, 3.82)	<0.001	2.50 (1.66, 3.75)	<0.001
0-4 (81)	54 (66.7)	4.32 (2.55, 7.32)	< 0.001	4.08 (2.36, 7.08)	< 0.001	4.04 (2.33, 7.01)	< 0.001
AOPRs							
6 (378)	151 (39.9)	1.00		1.00		1.00	
4 -5 (82)	39 (47.6)	1.36 (0.84, 2.20)	0.21	1.27 (0.77, 2.07)	0.35	1.25 (0.76, 2.04)	0.39
0-3 (67)	45 (67.2)	3.08 (1.77, 5.33)	< 0.001	2.84 (1.60, 5.03)	< 0.001	2.76 (1.55, 4.90)	0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.16 The relationship between dental status and Dissatisfactions with Chewing Ability (DCA) in dentate people (N = 1196).

Dental status	DCA n = 495 n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
OPRs							
16-18 (651)	175 (26.9)	1.00		1.00		1.00	
9-15 (326)	159 (48.8)	2.59 (1.96, 3.42)	<0.001	2.56 (1.93, 3.41)	<0.001	2.52 (1.89, 3.35)	<0.001
0-10 (219)	161 (73.5)	7.55 (5.34, 10.68)	<0.001	7.04 (4.87, 10.19)	<0.001	6.98 (4.82, 10.09)	<0.001
POPRs							
10-12(686)	191 (27.8)	1.00		1.00		1.00	
5-9 (324)	169 (52.2)	2.83 (2.15, 3.72)	<0.001	2.75 (2.07, 3.65)	<0.001	2.70 (2.03, 3.59)	<0.001
0-4 (186)	135 (72.6)	6.86 (4.77, 9.86)	<0.001	6.25 (4.26, 9.15)	<0.001	6.18 (2.22, 9.06)	<0.001
AOPRS							
6 (921)	320 (34.7)	1.00		1.00		1.00	
4-5 (160)	89(55.6)	2.35 (1.68, 3.31)	<0.001	2.16 (1.52, 3.06)	<0.001	2.13 (1.50, 3.02)	<0.001
0-3 (115)	86 (74.8)	5.57 (3.58, 8.67)	<0.001	4.70 (2.97, 7.45)	<0.001	4.62 (2.91, 7.32)	<0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.17 Relationship between dental status and General Eating Difficulty (GED) in people with only natural teeth (N = 669).

Dental status	GED n=301 n%	Unadjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value	***Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (470)	152 (32.3)	1.00		1.00		1.00	
21-25 (124)	84 (67.7)	4.39 (2.88, 6.71)	< 0.001	4.16 (2.71, 6.39)	< 0.001	4.07 (2.64, 6.27)	< 0.001
1-20 (75)	65 (86.7)	13.59 (6.59, 27.17)	< 0.001	10.79 (5.24, 22.20)	< 0.001	11.00 (5.32, 22.71)	< 0.001
OPs							
16-18 (401)	121 (30.2)	1.00		1.00		1.00	
11-15 (153)	91 (59.5)	3.40 (2.31, 5.00)	< 0.001	3.28 (2.21, 4.87)	< 0.001	3.20 (2.15, 4.76)	< 0.001
0-10 (115)	89 (77.4)	7.92 (4.87, 12.88)	< 0.001	6.41 (3.83, 10.72)	< 0.001	6.39 (3.81, 10.72)	< 0.001
POPs							
10-12 (411)	127 (30.2)	1.00		1.00		1.00	
5-9 (153)	92 (60.1)	3.37 (2.29, 4.96)	< 0.001	3.18 (2.14, 4.72)	< 0.001	3.12 (2.09, 4.64)	< 0.001
0-4 (105)	82 (78.1)	7.79 (4.80, 13.25)	< 0.001	6.44 (3.78, 10.97)	< 0.001	6.37 (3.73, 10.88)	< 0.001
AOPs							
6 (543)	205 (37.8)	1.00		1.00		1.00	
4-5 (78)	51 (65.4)	3.11 (1.89, 5.12)	< 0.001	2.68 (1.61, 4.46)	< 0.001	2.63 (1.57, 4.40)	< 0.001
0-3 (48)	45 (93.8)	24.72 (7.59, 80.56)	< 0.001	18.38 (5.54, 60.96)	< 0.001	18.77 (5.64, 62.62)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Appendix 8 The results from analysis separately for people with only natural teeth and people with replaced teeth

Table 8.18 The relationship between dental status and General Eating Difficulty (GED) in people with replaced teeth (N = 527).

Dental status	GED n=319 n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (404)	218 (54.0)	1.00		1.00		1.00	
21-25 (99)	77 (77.8)	2.99 (1.79, 4.99)	<0.001	2.74 (1.62, 4.64)	<0.001	2.71(1.60, 4.60)	<0.001
1-20 (24)	24 (100)	-		-		-	
OPRs							
16-18 (250)	104 (41.6)	1.00		1.00		1.00	
11-15 (173)	122 (70.5)	3.36 (2.22, 5.07)	< 0.001	3.35 (2.19, 5.11)	< 0.001	3.23 (2.11, 4.95)	< 0.001
0-10 (104)	93 (89.4)	11.87 (6.05, 23.28)	< 0.001	10.62 (5.30, 21.26)	< 0.001	10.39 (5.18, 20.84)	< 0.001
POPRs							
10-12 (275)	123 (44.7)	1.00		1.00		1.00	
5-9 (171)	125 (73.1)	3.36 (2.22, 5.08)	< 0.001	3.23 (2.11, 4.95)	< 0.001	3.10 (2.02, 4.76)	< 0.001
0-4 (81)	71 (87.7)	8.76 (4.34, 17.70)	< 0.001	7.69 (3.74, 15.84)	< 0.001	7.62 (3.70, 15.73)	< 0.001
AOPRs							
6 (378)	201 (53.2)	1.00		1.00		1.00	
4 -5 (82)	60 (73.2)	2.40 (1.42, 4.08)	0.001	2.20 (1.28, 3.78)	0.005	2.13 (1.24, 3.68)	0.006
0-3 (67)	58 (86.6)	5.67 (2.73, 11.77)	< 0.001	4.72 (2.23, 9.98)	< 0.001	4.45 (2.10, 9.44)	< 0.001

- Sample is too small to do analysis

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.19 The relationship between dental status and General Eating Difficulty (GED) in dentate people (N = 1196).

Dental status	GED n=620 n%	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
OPRs							
16-18 (651)	225 (34.6)	1.00		1.00		1.00	
9-15 (326)	213 (65.3)	3.57 (2.70, 4.72)	< 0.001	3.39 (2.55, 4.51)	< 0.001	3.31 (2.49, 4.42)	< 0.001
0-10 (219)	182 (83.3)	9.31 (6.31, 13.73)	< 0.001	7.46 (4.99, 11.18)	< 0.001	7.40 (4.94, 11.10)	< 0.001
POPRs							
10-12(686)	250 (36.4)	1.00		1.00		1.00	
5-9 (324)	217 (67.0)	2.54 (2.68, 4.68)	< 0.001	3.25 (2.45, 4.33)	< 0.001	3.18 (2.38, 4.23)	< 0.001
0-4 (186)	153 (82.3)	8.09 (5.38, 12.15)	< 0.001	6.44 (4.23, 9.80)	< 0.001	6.37 (4.18, 9.72)	< 0.001
AOPRS							
6 (921)	406 (44.1)	1.00		1.00		1.00	
4-5 (160)	111 (69.4)	2.87 (2.00, 4.12)	< 0.001	2.48 (1.71, 3.59)	< 0.001	2.43 (1.68, 3.52)	< 0.001
0-3 (115)	103 (89.6)	10.85 (5.89, 19.98)	< 0.001	8.11 (4.35, 15.12)	< 0.001	7.97 (4.26, 14.90)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, and self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.20 Distribution of OIDP scores by number of natural of teeth, numbers of OPs, POPs, AOPs* in people with only natural teeth (N = 669).

Dental status	OIDP scores			† p-Value	Eating impact (%)	†† p-Value
	Median	Mean	SD			
No.of teeth				< 0.001		< 0.001
26-28 (470)	4.4	5.1	6.9		51.7	
21-25 (124)	4.4	6.1	7.0		63.7	
1-20 (75)	8.9	11.3	10.1		73.3	
OPs				< 0.001		0.001
16-18 (401)	4.4	5.1	6.8		50.9	
11-15 (153)	4.4	5.7	6.9		62.7	
0-10 (115)	6.7	9.5	9.6		67.0	
POPs				< 0.001		< 0.001
10-12 (411)	4.4	5.2	7.0		51.6	
5-9 (153)	4.4	5.7	6.7		62.1	
0-4 (105)	6.7	9.5	9.7		66.7	
AOPs				< 0.001		< 0.001
6 (543)	4.4	5.1	6.7		52.5	
4-5 (78)	6.7	8.1	8.8		70.7	
0-3 (48)	8.9	12.0	10.8		83.3	
Total (669)	4.4	6.0	7.6		56.4	

*OPs: Occluding Pairs of natural teeth

POPs: Posterior Occluding Pairs of natural teeth

AOPs: Anterior Occluding Pairs of natural teeth

†Kruskal-Wallis

††Chi – Squared test for trend

Table 8.21 Distribution of OIDP scores by numbers of natural plus replaced teeth, numbers of OPRs, POPRs, AOPRs* in dentate people with replaced teeth (N = 527).

Dental status	OIDP scores			† p - Value	Eating impact (%)	†† p - Value
	Median	Mean	SD			
No.of teeth				< 0.001		< 0.001
26-28 (404)	4.4	4.7	6.9		52.2	
21-25 (99)	6.7	9.0	9.5		70.7	
1-20 (24)	11.1	11.7	6.9		83.3	
OPRs				< 0.001		0.001
16-18 (250)	0.9	3.7	5.1		47.6	
11-15 (173)	4.4	7.1	9.4		62.4	
0-10 (104)	6.7	8.8	8.5		71.2	
POPRs				< 0.001		< 0.001
10-12 (275)	0.9	3.8	5.6		46.9	
5-9 (171)	5.3	7.9	9.5		67.8	
0-4 (81)	6.7	8.3	8.1		69.1	
AOPRs				< 0.001		0.005
6 (378)	4.4	5.2	7.5		53.7	
4 -5 (82)	4.4	6.7	7.7		61.0	
0-3 (67)	6.7	8.5	8.5		71.6	
Total (527)	4.4	5.8	7.7		57.1	

* OPRs: Occluding Pairs of natural plus replaced teeth

POPRs: Posterior Occluding Pairs of natural plus replaced teeth

AOPRs: Anterior Occluding Pairs of natural plus replaced teeth.

† Kruskal-Wallis

† Chi – Squared test for trend

Table 8.22 The relationship between dental status and binary OIDP in people with only natural teeth (N = 669).

Dental status	OIDP>0 n=396 (n%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (470)	258 (54.9)	1.00		1.00		1.00	
21-25 (124)	81 (65.3)	1.55 (1.01, 2.37)	0.04	1.57 (1.03, 2.39)	0.03	1.50 (0.98, 2.29)	0.06
1-20 (75)	57 (76.0)	2.60 (1.41, 4.85)	0.001	2.46 (1.35, 4.49)	0.003	2.52 (1.37, 4.64)	0.003
OPs							
16-18 (401)	217 (54.1)	1.00		1.00		1.00	
11-15 (153)	98 (64.1)	1.51 (1.03, 2.22)	0.04	1.55 (1.05, 2.30)	0.03	1.48(0.99, 2.20)	0.05
0-10 (115)	81 (70.4)	2.02 (1.29, 3.16)	0.002	1.92 (1.19, 3.12)	0.008	1.90 (1.16, 3.09)	0.01
POPs							
10-12 (411)	225 (54.7)	1.00		1.00		1.00	
5-9 (153)	97 (63.4)	1.43 (0.98, 2.10)	0.07	1.45 (0.98, 2.14)	0.07	1.39 (0.93, 2.07)	0.11
0-4 (105)	74 (70.5)	1.97 (1.24, 3.13)	0.004	1.88 (1.14, 3.08)	0.01	1.83 (1.11, 3.02)	0.02
AOPs							
6 (543)	302 (55.6)	1.00		1.00		1.00	
4-5 (78)	55 (70.5)	1.91 (1.14, 3.20)	0.01	1.94 (1.15, 3.30)	0.01	1.88 (1.10, 3.21)	0.20
0-3 (48)	39 (81.3)	3.46 (1.64, 7.28)	0.001	3.17 (1.45, 6.90)	0.004	3.27 (1.49, 7.21)	0.003

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.23 The relationship between dental status and binary OIDP in people with replaced teeth (N = 527).

Dental status	OIDP>0 n=322 (n%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (404)	229 (56.7)	1.00		1.00		1.00	
21-25 (99)	71 (71.7)	1.94 (1.20, 3.13)	0.007	1.89 (1.16, 3.08)	0.01	1.85 (1.13, 3.03)	0.01
1-20 (24)	22 (91.7)	8.32 (1.94, 35.61)	0.004	7.82 (1.80, 33.99)	0.006	7.30 (1.67, 31.83)	0.008
OPRs							
16-18 (250)	127 (50.8)	1.00		1.00		1.00	
11-15 (173)	116 (67.1)	1.97 (1.32, 2.95)	0.001	1.88 (1.25, 2.83)	0.002	1.80 (1.19, 2.72)	0.005
0-10 (104)	79 (76.0)	3.06 (1.83, 5.12)	< 0.001	2.96(1.72, 5.07)	< 0.001	2.89 (1.66, 4.92)	<0.001
POPRs							
10-12 (275)	139 (50.5)	1.00		1.00		1.00	
5-9 (171)	123 (71.9)	2.51(1.67, 3.77)	< 0.001	2.41 (1.59, 3.65)	< 0.001	2.30 (1.51,3.50)	< 0.001
0-4 (81)	60 (74.1)	2.80(1.61, 4.85)	< 0.001	2.68 (1.51, 4. 74)	0.001	2.62 (1.48, 4.66)	0.001
AOPRs							
6 (378)	216 (57.1)	1.00		1.00		1.00	
4 -5 (82)	54 (65.9)	1.45 (0.88,2.38)	0.15	1.37 (0.82, 2.27)	0.23	1.31(0.79,2.20),	0.30
0-3 (67)	52 (77.6,)	2.60 (1.41, 4.78)	0.002	2.46 (1.31,4.61)	0.005	2.29 (1.22, 4.32)	0.01

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.24 The relationship between dental status and binary OIDP in dentate people (N = 1196).

Dental status	OIDP>0 n=718 (n%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
OPRs							
16-18 (651)	344 (52.8)	1.00		1.00		1.00	
9-15 (326)	214 (65.6)	1.71 (1.30, 2.25)	< 0.001	1.70 (1.28, 2.25)	< 0.001	1.63 (1.23, 2.27)	0.001
0-10 (219)	160 (73.1)	2.42 (1.73, 3.39)	< 0.001	2.34 (1.64, 3.35)	< 0.001	2.29 (1.60, 3.29)	< 0.001
POPRs							
10-12(686)	364 (53.1)	1.00		1.00		1.00	
5-9 (324)	220 (67.9)	1.87 (1.42, 2.47)	< 0.001	1.85 (1.39, 2.45)	< 0.001	1.78 (1.33, 2.36)	< 0.001
0-4 (186)	134 (72.0)	2.28 (1.60, 3.25)	< 0.001	2.20 (1.51, 3.19)	< 0.001	2.15 (1.47, 3.12)	< 0.001
AOPRS							
6 (921)	518 (56.2)	1.00		1.00		1.00	
4-5 (160)	109 (68.1)	1.66 (1.16, 2.38)	0.005	1.64 (1.14, 2.36)	0.008	1.58 (1.10, 2.29)	0.01
0-3 (115)	91 (79.1)	2.95 (1.85, 4.71)	< 0.001	2.77 (1.71, 4.51)	< 0.001	2.68 (1.64, 4.37)	< 0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.25 The relationship between dental status and OIDP eating impact in people with only natural teeth (N = 669).

Dental status	Eating impact n=377 (n%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (470)	243 (51.7)	1.00		1.00		1.00	
21-25 (124)	79 (63.7)	1.64 (1.09, 2.47)	0.02	1.67 (1.10, 2.52)	0.02	1.59 (1.05, 2.42)	0.03
1-20 (75)	55 (73.3)	2.57 (1.49, 4.42)	0.001	2.39 (1.33, 4.29)	0.003	2.44 (1.35, 4.41)	0.003
OPs							
16-18 (401)	204 (50.9)	1.00		1.00		1.00	
11-15 (153)	96 (62.7)	1.63 (1.11, 2.38)	0.01	1.67 (1.13, 2.46)	0.01	1.59 (1.07, 2.37)	0.02
0-10 (115)	77 (67.0)	1.96 (1.27, 3.02)	0.002	1.83 (1.14, 2.93)	0.01	1.80 (1.12, 2.90)	0.02
POPs							
10-12 (411)	212 (51.6)	1.00		1.00		1.00	
5-9 (153)	95 (62.1)	1.54 (1.05, 2.25)	0.03	1.55 (1.05, 2.28)	0.03	1.49 (1.00, 2.21)	0.05
0-4 (105)	70 (66.7)	1.88 (1.20, 2.94)	0.006	1.75 (1.08, 2.84)	0.02	1.71 (1.05, 2.78)	0.03
AOPs							
6 (543)	285 (52.5)	1.00		1.00		1.00	
4-5 (78)	54 (70.7)	2.04 (1.22, 3.39)	0.006	2.05 (1.22, 3.46)	0.007	1.99 (1.18, 3.38)	0.01
0-3 (48)	38 (83.3)	3.44 (1.68, 7.04)	0.001	3.10 (1.46, 6.56)	0.003	3.18 (1.49, 6.81)	0.003

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.26 The relationship between dental status and OIDP eating impact in people with replaced teeth (N = 527).

Dental status	Eating impact n=301 (n%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
No. of teeth							
26-28 (404)	211 (52.2)	1.00		1.00		1.00	
21-25 (99)	70 (70.7)	1.83 (1.23, 2.72)	0.003	1.76 (1.17, 2.63)	0.006	1.69 (1.13, 2.53)	0.01
1-20 (24)	20 (83.3)	2.72 (1.66, 4.44)	<0.001	2.63 (1.57, 4.40)	<0.001	2.55 (1.51, 4.28)	<0.001
OPRs							
16-18 (250)	119 (47.6)	1.00		1.00		1.00	
11-15 (173)	108 (62.4)	2.39 (1.60, 3.56)	<0.001	2.32 (1.54, 3.49)	<0.001	2.23 (1.48, 3.36)	<0.001
0-10 (104)	74 (71.2)	2.54 (1.50, 4.30)	0.001	2.44 (1.41, 4.23)	0.001	2.39 (1.38, 4.15)	0.002
POPRs							
10-12 (275)	129 (46.9)	1.00	0.02	1.00	0.06	1.00	0.09
5-9 (171)	116 (67.8)	1.35 (0.83, 2.19)	0.23	1.27 (0.77, 2.09)	0.35	1.23 (0.74, 2.02)	0.42
0-4 (81)	56 (69.1)	2.18 (1.23, 3.84)	0.007	2.03 (1.13, 3.65)	0.02	1.91 (1.06, 3.45)	0.03
AOPRs							
6 (378)	203 (53.7)	1.00		1.00		1.00	
4 -5 (82)	50 (61.0)	1.70 (1.29, 2.23)	<0.001	1.68 (1.27, 2.22)	<0.001	1.62 (1.22, 2.14)	0.001
0-3 (67)	48 (71.6)	2.25 (1.63, 3.12)	<0.001	2.15 (1.52, 3.03)	<0.001	2.10 (1.48, 2.98)	<0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Table 8.27 The relationship between dental status and OIDP eating impact in dentate people (N = 1196).

Dental status	Eating impact n=678 (n%)	Unadjusted OR (95% C.I.)	† p-Value	*Adjusted OR (95% C.I.)	† p-Value	**Adjusted OR (95% C.I.)	† p-Value
OPRs							
16-18 (651)	323 (49.6)	1.00		1.00		1.00	
9-15 (326)	204 (62.6)	1.70 (1.29, 2.23)	<0.001	1.68 (1.28, 2.22)	<0.001	1.62 (1.22, 2.14)	0.001
0-10 (219)	151 (68.9)	2.25 (1.63, 3.12)	<0.001	2.15 (1.52, 3.03)	<0.001	2.10 (1.48, 2.98)	<0.001
POPRs							
10-12(686)	341 (49.7)	1.00		1.00		1.00	
5-9 (324)	211 (65.1)	1.89 (1.44, 2.48)	<0.001	1.86 (1.40, 2.45)	<0.001	1.79 (1.35, 2.37)	<0.001
0-4 (186)	126 (67.7)	2.12 (1.51, 2.99)	<0.001	2.02 (1.41, 2.90)	<0.001	1.98 (1.38, 2.84)	<0.001
AOPRS							
6 (921)	488 (53.0)	1.00		1.00		1.00	
4-5 (160)	104 (65.0)	1.65 (1.16, 2.34)	0.005	1.60 (1.12, 2.19)	0.01	1.55 (1.08, 2.22)	0.02
0-3 (115)	86 (74.8)	2.63 (1.69, 4.09)	<0.001	2.42 (1.53, 3.83)	<0.001	2.34 (1.48, 3.72)	<0.001

† P – value from likelihood ratio test

* Adjusted model 1: adjusted for age, sex, occupation, self-assessed social class.

** Adjusted model 2: adjusted for age, sex, occupation, self-assessed social class, self-perceived general health.

Appendix 9

The reasons causing eating difficulty in people with 28 teeth who had eating difficulty

Table 9.1 The reasons causing eating difficulty in people with 28 teeth who had eating difficulty (N = 71).

Reasons	N (%)
Food catching	33 (46.4)
Sensitive tooth	23 (32.4)
Toothache	20 (28.2)
Loose teeth	14 (19.7)
Oral ulcer	11 (15.5)
Swollen gum/periodontal disease	11 (15.5)
Decay	5 (7.0)
Others	3 (4.2)
No reason	5 (7.0)

Appendix 10

Appendices in Chinese

介绍信

这次口腔健康调查由广西医科大学附属口腔医院的牙科医生和经过培训的调查者负责。这次活动的目的是对 55 岁以上的老人口腔健康情况进行调查和了解。

调查分二个部分，首先进行问卷调查，调查者将要问你一些有关你的口腔，牙齿，假牙的问题。这个过程需要 15-20 分钟。这个过程完成后，由口腔医院的牙科医生给你进行全面的口腔检查，包括你的口腔黏膜，龋齿和牙齿的充填等情况。这个过程需要 10-15 分钟。我们只是检查口腔但不提供治疗。过后，你可以去医院治疗。我们保证检查时不会给你带来疼痛。检查的所有的器械均高压无菌消毒或是一次性器械。我们保证不会给你带来交叉感染。

这次活动基于自愿的原则。你的所有的资料我们将替你保密，这些资料只用作研究用，我们课题组以外的人不会知道你的名字，地址等个人资料。我们感谢你们的合作。如果有什么问题，可以联系广西口腔医院的曾晓娟医生。

致

礼

Aubrey Sheiham

口腔公共卫生教授

伦敦大学 UCL 学院

曾晓娟

广西南宁双拥路 12 号

广西医科大学附属口腔医院

电话：0771-5358348

同意书

编号………………………………………………………………………………………..

名字………………………………………………………………………………….…

地址…………………………………………………………………………….……

我同意参加这次口腔健康调查，我能理解我的资料只作为研究用，检查结果不会给我本人或课题组以外的人知道。

签名………………………………………………………………………………

时间……………………………………………………………………………..

Questionnaire (Chinese version)

老年人口腔健康调查表

广西医科大学附属口腔医院
Department of Epidemiology and Public Health
University College London Medical School
2005

精神状况和记忆力测试

一些人有好的记忆力, 希望你不介意我们先问你几个问题来测试一下你的记忆力.

正确答案 1
错误答案 2

	答案号
1. 今年是哪一年?	
2. 这个月是几月份?	
3. 现在是什么时间? 现在是上午还是下午?	
4. 现在谁是国家主席?	
5. 你能告诉我我们现在所在的城市名字吗?	

第一部分: 一般情况

1. 名字:

2. 编号:

3. 出生年月:

4. 工作单位/家庭地址:

5. 家庭电话:

6. 调查时间:

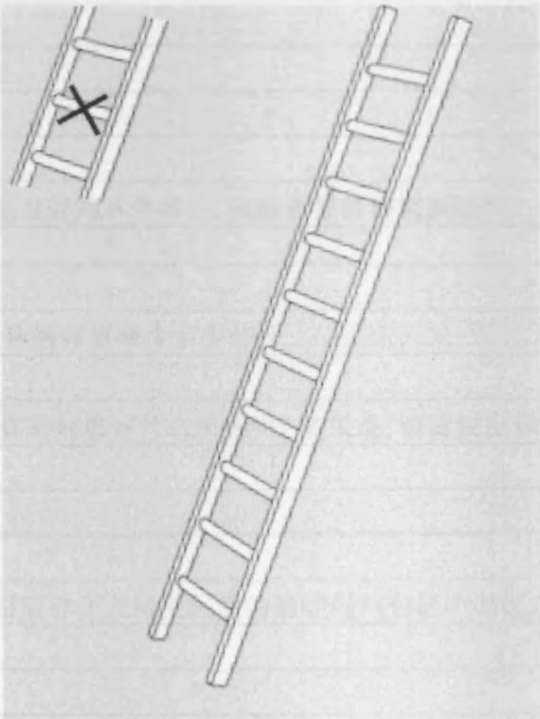
7. 拒绝调查的原因:

8. 调查者:

9. 编号:

只选一个答案,在答案栏内打钩(√)

	答案
1.性别	
男 1	
女 2	
2.年龄______	
3.婚姻状况	
已婚 1	
未婚同居 2	
单身,从未结婚 3	
丧偶 4	
离异 5	
分居 6	
4.受教育程度	
未读过书 1	
读过 1-6 年的书,小学文化程度 2	
读过 7-9 年的书,初中文化程度 3	
读过 10-12 年的书,高中文化程度 4	
读过 13-18 年的书,大专或大学文化程度 5	
读过 19 年的书,硕士以上文化程度 6	
5. 退休前的职业	
专业技术人员 1	
行政人员 2	
办事员 3	
商业 4	
服务业 5	
工人 6	
农民和渔民 7	
其他,请写出…………………8	
6. 现在的职业	
完全退休 1	
退休后,继续反聘 2	
退休后,从事其他工作 3	
无退休,继续务农或从事家务劳动 4	
其他,请写出…………………8	
7. 家庭月收入………………	

8.家庭成员人数………….. 家庭成员是指现在住在一起的家庭成员	
9. 这个梯子共有10阶梯, 分别代表人们所在的不同社会阶层. 最高的一个阶梯, 代表最高的社会阶层, 即在这个阶层的人, 有好的工作, 高的收入, 有较高的文化程度, 而最下面的阶梯, 代表最低的社会阶层, 即在这个阶层的人, 工作最差或没有工作, 收入最低或没有收入, 文化程度低或没有读过书. 越靠近上面的梯子, 你的工作,收入,文化程度越接近最高的 社会阶层的人, 越靠近下面的梯子, 你的工作,收入,文化程度越接近最低的社会阶层的人.想想你属于哪一个梯子, 请在这个梯子上面打叉. 例如 	

第二部分: 身体健康状况

10.身高 ----------------	
11.体重 -----------------	
12.通常情况下,你认为你的健康状况是	
只选一个答案, 在答案栏内打钩(√)	答案号
很好 1	
好 2	
良好 3	
一般 4	
差 5	
13.在过去的 6 个月中, 你有过异常体重减轻吗?	
是 回答第 13a 条问题 1	
否 回答第 14 条问题 2	
13a.你的体重减少多少公斤..	
14. 你目前患有什么疾病吗? 如果是, 请你说出你所患的疾病的名称.....................	
是 1	
否 2	
15.目前你正在接受医生的治疗吗? (包括中西医)	
是 1	
否 2	
16. 你是否患有慢性疾病，残疾，或体质衰弱 (指长期的引起你的身体功能障碍的慢性疾病, 如慢性气管炎, 哮喘, 高血压, 心脏病, 糖尿病等)	
是, 回答第 14 a 条问题 1	
否, 回答第 15 条问题 2	
16. 如果有, 是什么疾病? 请写出...	
17.们来询问你的用药史. 在过去的 2 周内你用过药吗? 包括针剂, 药片,药丸, 滋补品（避孕药除外）	
是 回答第 17a - 17b 条问题 1	
否 回答第 3 部分问题 2	
17a. 请列出你所用的药名	
a..	
b.	

c...	
17b. 请列出你所用药原因	
a...	
b..	
c..	

第三部分: 口腔健康状况

现在我们问一些有关你的口腔健康的问题	
只选一个答案, 在答案栏内打钩(√)	答案号
18. 通常情况下, 你认为你的口腔健康状况是	
很好 1	
好 2	
良好 3	
一般 4	
差 5	
19. 在过去 6 个月内, 你有过口腔干燥的症状吗?	
是 回答第 19a, 19b, 19c 条问题 1	
否 回答第 20 条问题 2	
19a.你在什么情况下感到口干?	
在吃饭时感到口干 1	
在夜间感到口干 2	
在早上起床时感到口干 3	
任何时候都感到口干 4	
不清楚 9	
19b.你的口干症曾经引起下面的问题吗?	
咀嚼食物困难 1	
吞咽食物困难 2	
服药困难 3	
无以上困难 4	
不清楚 9	
19c.你采取了什么方法来缓解你的口干症?	
嚼口香糖 1	
含硬的糖果或薄荷糖 2	
喝水或其他汤水,饮料 3	
用一些其他物品或药来缓解口干 4	
未采取任何措施	
不清楚 9	
下面的问题是有关你的假牙的问题	
20. 你有活动假牙吗?	
是 回答第 20-23 条问题 1	

否 回答第 24 条问题 2	
21 你什么时候戴你的假牙?	
任何时候都戴,包括睡觉 1	
睡觉时不戴, 醒的时候戴 2	
吃东西的时候才戴 3	
有社交活动,如出门购物, 探亲访友才戴 4	
任何时候都不戴 5	
22 在说话的时候, 你的上面假牙曾经脱落过吗?	
是 1	
否 2	
不清楚 9	
23 你在开口时候, 你的上面假牙曾经脱落过吗?	
是 1	
否 2	
不清楚 9	
24 你是否认为你需要看牙?	
1___________2___________3___________4___________5 不需看牙…………………………………………………极需看牙	

第四部分: 吃的问题

现在我们问一些有关吃的问题

只选一个答案, 在答案栏内打钩(√)　　答案

Q1: 通常情况下, 你咬, 咀嚼和吞咽食物的能力如何

没有困难 1	
有一点困难 2	
有中等程度的困难 3	
有很大程度的困难 4	
不清楚 9	
Q2: 总的来说, 你对你的咀嚼食物的能力满意吗	
非常满意 1	
满意 2	
不满意 3	
非常不满意 4	
不清楚 9	

Q3: 下面是有关你吃一些事物的问题

只选一个答案,在答案栏内打钩(√)

	答案
1: 你能够吃得动煮玉米棒、未切成小片的整个脆苹果或类似硬度的食物吗?	
能 1	
不能 2	
没有试过 9	
2. 你能够吃得动炒瘦肉片、 炒青菜或类似硬度的食物吗?	
能 1	
不能 2	
没有试过 9	
3. 你能够吃得动白切鸡、鸭或类似硬度的食物吗?	
能 1	
不能 2	
没有试过 9	
4. 你能够吃得动盐锔鸡、烤排骨、 烤鸭、烤鸡或类似硬度的食物吗?	
能 1	
不能 2	
没有试过 9	
5. 你能够吃炒黄瓜或莲藕、炒红萝卜或类似硬度的食物吗?	
能 1	
不能 2	
没有试过 9	

Q4:现在请你对我们列出的食物进行回答. 对下面的每一项食物, 你感觉是很容易吃, 吃起来有一定困难或不能吃(因为牙齿的问题). 请不要依据你是否喜欢此类食物来回答问题.

注意: "吃" 的意思是咬, 咀嚼,吞咽食物. 至于能不能消化这个食物我们在此不关心.

食物	容易吃	吃起来有一定困难	不能吃	答案
1. 炒红萝卜	1	2	3	
2. 炸排骨	1	2	3	
3. 鱼	1	2	3	
4. 粥	1	2	3	
5. 炒黄瓜或莲藕	1	2	3	
6. 炒瘦肉片	1	2	3	
7. 包子、馒头	1	2	3	
8. 盐焗鸡	1	2	3	
9. 炒青菜	1	2	3	
10. 未切成小片的整个脆苹果	1	2	3	
11. 烤鸭、鸡	1	2	3	
12. 水豆腐	1	2	3	
13.软米饭	1	2	3	
14. 白切鸡、鸭	1	2	3	
15. 炒牛肉片	1	2	3	
16. 煮玉米棒	1	2	3	

第五部分:口腔健康对人们日常生活的影响

在过去的 6 个月里，是否有因为你的口腔，牙齿，假牙的问题而影响到你的日常生活的一些活动?

- 吃东西
- 说话或发音清楚
- 刷牙或漱口
- 做轻微的劳动, 如家务活, 买菜作饭
- 出门, 如到公园锻炼, 出去购物, 探亲访友
- 休息(包括睡眠), 如看电视
- 当你笑的时候, 露出你牙齿不觉得尴尬
- 情感方面: 比平常容易感觉烦恼
- 社会交往方面: 能够正常与其他人交往, 如亲戚,朋友,邻居

Q1

在过去的 6 个月里，是否由于你的口腔，牙齿，假牙的问题, 引起你日常生活的不便?

只选一个答案, 在 Q1 答案栏内打钩(√)

如果是, 请回答问题 Q2

如果否, 请看下一个日常活动

Q2

你的问题是在这 6 个月内有规律的出现呢？还是只出现在这 6 个月的某段时间?

只选一个答案, 在 Q2 答案栏内打钩(√)

如果你选＂有规律的出现＂，请回答问题 Q 3

如果你选＂只出现在这 6 个月的某段时间＂，请回答问题 Q 4

Q 3

在过去的 6 个月内, 你的问题出现的频率

只选一个答案, 在 Q 3 答案栏内打钩(√)

Q 4

在过去的 6 个月中, 有多长一段时间有这些不适?

只选一个答案, 在 Q 4 答案栏内打钩(√)

Q 5

这些问题对你口常生活影响的程度. 用 0-5 来表示这些问题对你口常生活影响的程度.其中“0 ”表示没有影响, 5 表示有非常严重的影响.

只选一个答案, 在 Q 5 答案栏内打钩(√)

Q 6

现在我们要问你是什么原因引起你的问题. 你可以从表 1 中选出 1 个或多个答案，如果有多个答案, 按照你认为的重要性来排列. 把所选的答案号填入 Q 6 答案栏内.

表 1

	答案号
牙痛 1	
缺牙 2	
牙齿松动 3	
牙齿龋坏, 牙齿有龋洞 4	
牙折 5	
牙齿过敏 6	
牙齿的颜色 7	
牙齿的形状和大小 8	
牙齿的位置,如牙齿突出,弯曲, 牙缝过大等 9	
口腔和面部畸形,如兔唇, 狼咽 10	
口腔溃疡和斑点 11	
口腔灼热症 12	
口臭 13	
味觉失常 14	
口干症 15	
牙龈出血 16	
牙龈脓肿 17	
牙龈萎缩 18	
牙结石 19	
上颌关节弹响 20	
上颌关节疼痛 21	
张口度受限 22	
松的或不合适的假牙 23	
不良充填物或冠套, 如损害, 颜色不好 24	
其他的原因, 请写出........................88	
不清楚 99	

答案表

日常活动	Q1.是 否	Q2. 问题出现的规律	Q3.有规律的常出现	Q4.只出现在这 6 个月的某段时间	Q5 影响的程度	Q6 引起你的问题的原因
吃东西	1□ 2□	1□有规律的常出现 2□只出现在 6 个月的某个时段	1□每月少于一次 2□大约每月 1-2 次 3□大约每周 1-2 次 4□每周 3-4 次 5□每天或几乎每天 9□不清楚	1□少于 5 天 2□5 天-1 个月之间 3□1-2 个月之间 4□2-3 个月之间 5□大于 3 个月 9□不清楚	1□没有影响 2□非常轻微的影响 3□轻微的影响 4□中等程度的影响 5□严重的影响 6□非常严重的影响 9□不清楚	
说话或发音清楚	1□ 2□	1□有规律的常出现 2□只出现在 6 个月的某个时段	1□每月少于一次 2□大约每月 1-2 次 3□大约每周 1-2 次 4□每周 3-4 次 5□每天或几乎每天 9□不清楚	1□少于 5 天 2□5 天-1 个月之间 3□1-2 个月之间 4□2-3 个月之间 5□大于 3 个月 9□不清楚	1□没有影响 2□非常轻微的影响 3□轻微的影响 4□中等程度的影响 5□严重的影响 6□非常严重的影响 9□不清楚	
刷牙或漱口	1□ 2□	1□有规律的常出现 2□只出现在 6 个月的某个时段	1□每月少于一次 2□大约每月 1-2 次 3□大约每周 1-2 次 4□每周 3-4 次 5□每天或几乎每天 9□不清楚	1□少于 5 天 2□5 天-1 个月之间 3□1-2 个月之间 4□2-3 个月之间 5□大于 3 个月 9□不清楚	1□没有影响 2□非常轻微的影响 3□轻微的影响 4□中等程度的影响 5□严重的影响 6□非常严重的影响 9□不清楚	

答案表续表 1

日常活动	Q1.是 否	Q2. 问题出现的规律	Q3.有规律的常出现	Q4.只出现在这 6 个月的某段时间	Q5 影响的程度	Q6 引起你的问题的原因
做轻微的劳动，如家务活，买菜作饭	1☐ 2☐	1☐有规律的常出现 2☐只出现在 6 个月的某个时段	1☐每月少于一次 2☐大约每月 1-2 次 3☐大约每周 1-2 次 4☐每周 3-4 次 5☐每天或几乎每天 9☐不清楚	1☐少于 5 天 2☐5 天-1 个月之间 3☐1-2 个月之间 4☐2-3 个月之间 5☐大于 3 个月 9☐不清楚	1☐没有影响 2☐非常轻微的影响 3☐轻微的影响 4☐中等程度的影响 5☐严重的影响 6☐非常严重的影响 9☐不清楚	
出门，如到公园锻炼，出去购物，探亲访友	1☐ 2☐	1☐有规律的常出现 2☐只出现在 6 个月的某个时段	1☐每月少于一次 2☐大约每月 1-2 次 3☐大约每周 1-2 次 4☐每周 3-4 次 5☐每天或几乎每天 9☐不清楚	1☐少于 5 天 2☐5 天-1 个月之间 3☐1-2 个月之间 4☐2-3 个月之间 5☐大于 3 个月 9☐不清楚	1☐没有影响 2☐非常轻微的影响 3☐轻微的影响 4☐中等程度的影响 5☐严重的影响 6☐非常严重的影响 9☐不清楚	
休息(包括睡眠)，如看电视	1☐ 2☐	1☐有规律的常出现 2☐只出现在 6 个月的某个时段	1☐每月少于一次 2☐大约每月 1-2 次 3☐大约每周 1-2 次 4☐每周 3-4 次 5☐每天或几乎每天 9☐不清楚	1☐少于 5 天 2☐5 天-1 个月之间 3☐1-2 个月之间 4☐2-3 个月之间 5☐大于 3 个月 9☐不清楚	1☐没有影响 2☐非常轻微的影响 3☐轻微的影响 4☐中等程度的影响 5☐严重的影响 6☐非常严重的影响 9☐不清楚	

答案表续表 2

日常活动	Q1.是 否	Q2. 问题出现的规律	Q3.有规律的常出现	Q4.只出现在这 6 个月的某段时间	Q5 影响的程度	Q6 引起你的问题的原因
当你笑的时候,露出你牙齿不觉得尴尬	1□ 2□	1□有规律的常出现 2□只出现在 6 个月的某个时段	1□每月少于一次 2□大约每月 1-2 次 3□大约每周 1-2 次 4□每周 3-4 次 5□每天或几乎每天 9□不清楚	1□少于 5 天 2□5 天-1 个月之间 3□1-2 个月之间 4□2-3 个月之间 5□大于 3 个月 9□不清楚	1□没有影响 2□非常轻微的影响 3□轻微的影响 4□中等程度的影响 5□严重的影响 6□非常严重的影响 9□不清楚	
情感方面：比平常容易感觉烦恼	1□ 2□	1□有规律的常出现 2□只出现在 6 个月的某个时段	1□每月少于一次 2□大约每月 1-2 次 3□大约每周 1-2 次 4□每周 3-4 次 5□每天或几乎每天 9□不清楚	1□少于 5 天 2□5 天-1 个月之间 3□1-2 个月之间 4□2-3 个月之间 5□大于 3 个月 9□不清楚	1□没有影响 2□非常轻微的影响 3□轻微的影响 4□中等程度的影响 5□严重的影响 6□非常严重的影响 9□不清楚	
社会交往方面：能够正常与其他人交往，如亲戚,朋友,邻居	1□ 2□	1□有规律的常出现 2□只出现在 6 个月的某个时段	1□每月少于一次 2□大约每月 1-2 次 3□大约每周 1-2 次 4□每周 3-4 次 5□每天或几乎每天 9□不清楚	1□少于 5 天 2□5 天-1 个月之间 3□1-2 个月之间 4□2-3 个月之间 5□大于 3 个月 9□不清楚	1□没有影响 2□非常轻微的影响 3□轻微的影响 4□中等程度的影响 5□严重的影响 6□非常严重的影响 9□不清楚	

口腔健康评价表的说明

1. 一个地方检查，符合条件的人有多少，我们请求他们检查的有多少人，拒绝的有多少人，要记录病人拒绝检查的原因.

2. 脓肿是指任何原因引起的脓肿，包括牙周脓肿和根尖脓肿.

3. 如果病人在口中只剩下残根，也算是无牙颌病人. 此时，在牙颌状况一拦里填 0

4. 缺牙间隙不是指单纯的牙齿缺失，而是指牙齿缺失的间隙。记录时是记录间隙的牙位， 而不是记录缺失牙齿牙位。

例 1:下颌第一前磨牙缺失引起第二前磨牙前移填补了这个空缺，第二前磨牙位置出现间隙，此时应记录为第二前磨牙间隙，而不是第一前磨牙间隙。

例 2: 如 21|12 缺失，但间隙已缩小，只象是 1|1 ，此时记录为 1|1

缺失.

5. 记录缺牙间隙和牙接触时，从中间到两侧进行（见图）. 检查时应戴上所有的假牙.

7 6 5 4 3 2 1 | 1 2 3 4 5 6 7

← →

6. 间隙大于半个前磨牙的宽度时,才需记录成一个单位的间隙.

如果间隙已由固定桥修复,记录为间隙已修复.
如果病人有活动假牙，但从不戴，记录为间隙未修复.
如果病人有活动假牙，常戴或者偶尔戴，记录为间隙已修复

7. 检查牙接触需在正中合位进行。如果在正中合位后牙接触，则记录为后牙接触。对于前牙，如果正中合位时牙齿已接触，则记录为前牙接触。如果此时前牙不接触，则叫病人下颌前伸，咬住切端，如是此时前牙切端能接触，则仍记录为前牙接触。如果此时仍无接触，则记录为无接触。

8. 检查牙接触以下颌牙作为参照标准，一个牙接触单位是指一颗前牙或一颗尖牙或一颗前磨牙或半个磨牙（近中或远中）。

9. 所有的牙（包括人工牙、自然牙、残根），无论何种原因不能接触对颌牙，均记录为不接触。

10. 在检查 DMFT 时，所有的活动假牙应去除，按自己的牙的真实情况记录，在记录缺牙间隙和牙接触时，戴上假牙。

11. 楔状缺损需要补时才记录为楔状缺损。

12. 如果病人有牙结石又有牙龈出血，应记录为“ 2 ＝牙结石”。

13. 在检查 CPI 和 LOA 中，如有指数牙存在

    $\begin{array}{c|c} 76 & 67 \\ \hline 76 & 67 \end{array}$ ，如果 7 严重，则检查 7 ，如果指数牙 6 、 7 缺失，则剩下的牙以最重的牙记分。每个区必须有 2 个或 2 个以上的功能牙存在时才进行此项检查。

14. 所有的 8 不须进行检查，但是如果 7 缺失， 8 移到 7 的位置，在记录缺牙间隙和牙齿接触时，须把 8 看 7 进行记录。

15. 糖尿病、高血压、心脏病均算是长期疾患。

16. OIDP 必须回答是这些口腔问题影响你的日常生活的程度，而不是口腔的疾病影响口腔问题的程度。