

ผลของจำนวนพันธุกรรมชาติ และจำนวนคู่สับพันหลัง ต่อคุณภาพชีวิตในมิติสุขภาพช่องปาก
ในผู้ป่วยสูงอายุไทยที่คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

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THE EFFECTS OF NUMBER OF NATURAL TEETH AND NUMBER OF POSTERIOR
OCCLUDING PAIRS ON THE ORAL HEALTH-RELATED QUALITY OF LIFE IN THAI
ELDERLY PATIENTS AT FACULTY OF DENTISTRY, CHULALONGKORN UNIVERSITY

Miss Kwanrutai Somsak

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Prosthodontics

Department of Prosthodontics

Faculty of Dentistry

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ขวัญฤทัย สมศักดิ์ : ผลของจำนวนฟันธรรมชาติ และจำนวนคู่สบฟันหลัง ต่อคุณภาพชีวิต ในมิติสุขภาพช่องปาก ในผู้ป่วยสูงอายุไทยที่คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย. (THE EFFECTS OF NUMBER OF NATURAL TEETH AND NUMBER OF POSTERIOR OCCLUDING PAIRS ON THE ORAL HEALTH-RELATED QUALITY OF LIFE IN THAI ELDERLY PATIENTS AT FACULTY OF DENTISTRY, CHULALONGKORN UNIVERSITY) อ.ที่ปรึกษาวิทยานิพนธ์หลัก : ผศ.ทญ.ดร.อรพินท์ แก้วปลั่ง, 64 หน้า.

การศึกษานี้มีวัตถุประสงค์เพื่อ 1) เปรียบเทียบคุณภาพชีวิตในมิติสุขภาพช่องปากของผู้ป่วยสูงอายุไทยที่คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ระหว่างกลุ่มที่มีฟันธรรมชาติใช้งานได้น้อยกว่า 20 ซี่ กับกลุ่มที่มีน้อยกว่า 20 ซี่ 2) เปรียบเทียบคุณภาพชีวิตในมิติสุขภาพช่องปากของผู้ป่วยสูงอายุไทยนี้ ระหว่างกลุ่มที่มีคู่สบฟันหลังอย่างน้อย 4 คู่ กับกลุ่มที่มีน้อยกว่า 4 คู่ โดยการสัมภาษณ์ข้อมูลทั่วไป ประวัติทางการแพทย์ และประวัติทางทันตกรรม และประเมินคุณภาพชีวิตในมิติสุขภาพช่องปากโดยใช้ดัชนีโอไอดีพี ในผู้ป่วยสูงอายุไทยที่มาเข้ารับการรักษาในคลินิกบัณฑิตศึกษา ภาควิชาทันตกรรมประดิษฐ์ คณะทันตแพทยศาสตร์จุฬาลงกรณ์มหาวิทยาลัย จำนวน 240 คน จากนั้นนับจำนวนฟันธรรมชาติและจำนวนคู่สบฟันหลังโดยใช้แผ่นซิมสติก ผลการศึกษาพบว่า กลุ่มผู้ป่วยที่มีฟันธรรมชาติตั้งแต่ 20 ซี่ขึ้นไป มีคุณภาพชีวิตในมิติสุขภาพช่องปากสูงกว่า กลุ่มที่มีน้อยกว่า 20 ซี่ อย่างมีนัยสำคัญทางสถิติ และกลุ่มผู้ป่วยที่มีคู่สบฟันหลังตั้งแต่ 4 คู่ขึ้นไป มีคุณภาพชีวิตในมิติสุขภาพช่องปากสูงกว่า กลุ่มที่มีน้อยกว่า 4 คู่ อย่างมีนัยสำคัญทางสถิติ นอกจากนี้ พบว่า กลุ่มที่มีฟันธรรมชาติตั้งแต่ 20 ซี่และคู่สบฟันหลังตั้งแต่ 4 คู่ และกลุ่มที่มีน้อยกว่า 20 ซี่แต่มีคู่สบฟันหลังตั้งแต่ 4 คู่ มีคุณภาพชีวิตในมิติสุขภาพช่องปากสูงกว่า กลุ่มที่มีน้อยกว่า 20 ซี่และน้อยกว่า 4 คู่สบฟันหลังอย่างมีนัยสำคัญทางสถิติ ดังนั้น เราควรจะพิจารณาทั้งผลของจำนวนฟันธรรมชาติและคู่สบฟันหลัง ต่อคุณภาพชีวิตในมิติสุขภาพช่องปาก ไม่ใช่พิจารณาเฉพาะจำนวนฟันธรรมชาติ หรือจำนวนคู่สบฟันหลังเพียงอย่างเดียว เนื่องจากทั้งจำนวนฟันธรรมชาติและจำนวนคู่สบฟันหลัง ต่างก็มีผลต่อคุณภาพชีวิตในมิติสุขภาพช่องปาก

ภาควิชาทันตกรรมประดิษฐ์..... ลายมือชื่อนิสิต.....
 สาขาวิชาทันตกรรมประดิษฐ์..... ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก.....
 ปีการศึกษา2555.....

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KWANRUTAI SOMSAK : THE EFFECTS OF NUMBER OF NATURAL TEETH AND NUMBER OF POSTERIOR OCCLUDING PAIRS ON THE ORAL HEALTH-RELATED QUALITY OF LIFE IN THAI ELDERLY PATIENTS AT FACULTY OF DENTISTRY, CHULALONGKORN UNIVERSITY. ADVISOR : ASST. PROF. ORAPIN KAEWPLUNG, Ph.D., 64 pp.

The objectives of this study were 1) to compare the oral health-related quality of life (OHRQoL) of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who had at least 20 natural teeth (NT) with those who had less than 20 NT, 2) to compare the OHRQoL of these patients who had at least 4 posterior occluding pairs (POP) with those who had less than 4 POP. 240 Thai elderly patients of Graduate Prosthodontic Clinic at Faculty of Dentistry, Chulalongkorn University were interviewed about general information, medical history and dental history, and evaluated OHRQoL by using OIDP. We counted number of functional NT and number of POP by using shimstock film. The results showed that the subjects with at least 20 NT had more OHRQoL than those with less than 20 NT significantly, and the subjects with at least 4 POP had more OHRQoL than those with less than 4 POP significantly. Furthermore, the subjects with at least 20 NT and at least 4 POP and those with less than 20 NT and at least 4 POP had better OHRQoL than those with less than 20 NT and less than 4 POP. These results indicated that we should consider the effect of the number of NT plus the number of POP on the OHRQoL, not only the number of NT or only the number of POP, because both number of NT and number of POP affect the OHRQoL.

Department :Prosthodontics..... Student's Signature.....

Field of Study :Prosthodontics..... Advisor's Signature.....

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CONTENTS

	Page
ABSTRACT IN THAI.....	iv
ABSTRACT IN ENGLISH.....	v
ACKNOWLEDGEMENTS.....	vi
CONTENTS.....	vii
LIST OF TABLES.....	ix
LIST OF FIGURES.....	x
LIST OF ABBREVIATIONS.....	xi
CHAPTER I INTRODUCTION.....	1
Background and rationale.....	1
Objectives.....	2
Hypothesis.....	2
Expected benefits.....	2
CHAPTER II LITERATURE REVIEW.....	4
1. Aging society.....	4
2. Oral health problems in elderly people.....	5
3. Oral health-related quality of life.....	9
4. Oral health-related quality of life indices for elderly people.....	10
5. Tooth loss and its impacts on oral health-related quality of life.....	19
CHAPTER III MATERIAL AND METHODS.....	25
CHAPTER IV RESULTS.....	29
CHAPTER V DISCUSSION.....	38
CHAPTER VI CONCLUSION.....	47
REFERENCES.....	48
APPENDIX.....	58

BIOGRAPHY 64

LIST OF TABLES

	Page
Table 1 Dimensions and items of GOHAI.....	12
Table 2 Dimensions and items of OHIP-14 Regression Short Form.....	14
Table 3 Dimensions and items of OHIP-14 Impact Short Form.....	15
Table 4 Dimensions and items of OIDP.....	17
Table 5 Patterns of frequency score of OIDP.....	17
Table 6 Pattern of severity score of OIDP.....	18
Table 7 The inclusion and exclusion criteria of the functional natural teeth we counted in this study.....	27
Table 8 The average number of functional NT and POP, the distribution of the subjects according to the number of functional NT and POP, and total OIDP score of the participants.....	29
Table 9 Daily performances affected by the oral impacts according to OIDP, main symptoms, main oral impairments, and OIDP scores.....	31
Table 10 Relationship between the number of functional natural teeth and the number of posterior occluding pairs, and the OIDP scores.....	35
Table 11 The relationship between the number of functional natural teeth plus the number of posterior occluding pairs and OIDP scores.....	37

LIST OF FIGURES

	Page
Figure 1 The population pyramids for Thailand in 2000 projections to 2030.....	5
Figure 2 The theoretical framework of ODP.....	16

LIST OF ABBREVIATIONS

NT	Natural teeth
POP	Posterior occluding pairs
NOP	Natural occluding pairs
AOP	Anterior occluding pairs
OHRQoL	Oral Health-Related Quality of Life
B.E.	Buddhist Era
A.D.	Anno Domini
GOHAI	General Oral Health Assessment Index
OHIP	Oral Health Impacts Profile
OIDP	Oral Impacts on Daily Performances

CHAPTER I

INTRODUCTION

Background and Rationale

Nowadays, Thailand has been facing with rapid increase in the elderly population. The report on the 2007 survey of the older persons in Thailand showed that elderly people who are at least 60 years old was 10.7% of total Thai population [1]. Common oral problems in elderly people are tooth loss, dental caries, periodontal disease, xerostomia and oral precancer/cancer [2]. Major reasons of tooth loss are severe dental caries and periodontal disease [2-5]. The 6th National Oral Health Survey in Thailand 2006-2007 showed that tooth loss was the major oral problem among Thai elderly people with the average tooth loss at 13.38 teeth per person [6].

There are several organizations that determine the goal of number of natural teeth (NT) in elderly people. For example, World Health Organization (WHO) proposed a goal that elderly people should have at least 20 NT [7]. World Dental Federation (FDI) recommended that 50% of individuals of 65 years and above should have 20 or more teeth [8]. In Thailand, Department of Health, Ministry of Public Health determined the Strategic Planning for 2009-2011 that recommend senior population should have at least 20 NT and 4 posterior occluding pairs (POP) [9].

The 6th National Oral Health Survey in Thailand 2006-2007 showed that 54.8% of Thai elderly people had at least 20 NT. 77.6% of people aged 60-74 years and 64.92% of people aged 80 years had at least 4 POP. The average POP of people aged 60-74 years and people aged 80 years are 3.27 and 1.28 pairs respectively [6].

Today, oral health-related quality of life (OHRQoL) which characterizes people's perceptions of oral health becomes interesting in dental professionals as the concept of oral health has been changed. It is believed that clinical measurements which measure only oral pathology and oral health status in professionals' aspect cannot reflect all aspects of oral health nor indicate whether people can perform daily activities properly

[10-14]. Moreover, it is believed that quality of life should come from subjective assessment, not from normative assessment [15]. Therefore, there are lots of attempts to consider how oral conditions affect quality of life in people's aspect. OHRQoL indices are used to evaluate the effects of oral health on performing daily activities in people's aspect [10,11,16-18].

Objectives

- 1) To compare the OHRQoL of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who have at least 20 NT with those who have less than 20 NT.
- 2) To compare the OHRQoL of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who have at least 4 POP with those who have less than 4 POP.

Hypothesis

1) H_0 : The OHRQoL of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who have at least 20 NT does *not differ* from those who have less than 20 NT statistically.

H_A : The OHRQoL of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who have at least 20 NT *differs* from those who have less than 20 NT statistically.

2) H_0 : The OHRQoL of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who have at least 4 POP does *not differ* from those who have less than 4 POP statistically.

H_A : The OHRQoL of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who have at least 4 POP *differs* from those who have less than 4 POP statistically.

Expected benefits

1) Knowing whether the OHRQoL of Thai elderly dental patients at Faculty of Dentistry, Chulalongkorn University who have at least 20 NT and at least 4 POP, according to the goal of Ministry of Public Health, differs from the other groups.

2) The results of this study could be the information and suggestion to the Department of Health, Ministry of Public Health for improving the quality of life of Thai elderly people in the future.

3) The results of this study would be useful for future studies.

CHAPTER II

LITERATURE REVIEW

1. Aging society

Since the the compositions of populations have changed and life expectancy has risen dramatically throughout the world, the number of elderly population has increased [19]. Older population, according to the United Nations, generally refers to the chronological age of 65 years and older [20]. There were 4 main categories of a definition of old age; 1) chronology, 2) change in social role such as change in work patterns, and adult status of children, 3) change in capabilities such as invalid status, and change in physical characteristics, and 4) change in health status [20]. The reasons for increased life expectancy are reduction in mortality, improvements in health and living conditions in the first half of life, and developments of modern medical and dental care for elderly persons [21].

In Thailand, older persons, according to the Act on Older Persons B.E. 2546 (2003 A.D.), means “persons who have attained the age of at least sixty years and are of Thai nationality” [22]. The 2007 survey of the older persons in Thailand reported that elderly people who are at least 60 years old was 10.7% of total Thai population [1]. The United Nations’ definitions of *ageing society* and *aged society* as a country or region in which people aged at least 60 years old make up 10% and 20% of the total population, respectively; therefore, Thailand now becomes an ageing society [23]. The office of the National Economics and Social Development Board predicted that Thai elderly population tends to increase continuously, from 9.43% in 2000 to 10.9% in 2010, and 25.12% in 2030 [24]. This indicates that Thailand will be an aged society in the near

future. Figure 1 shows the population pyramids for Thailand in 2000 projections to 2030. Moreover, there is a prediction that life expectancy at birth tends to increase from 71 years old in 2000-2005 to 76.8 years old in 2025-2030, and 79.1 years old in 2050 [25].

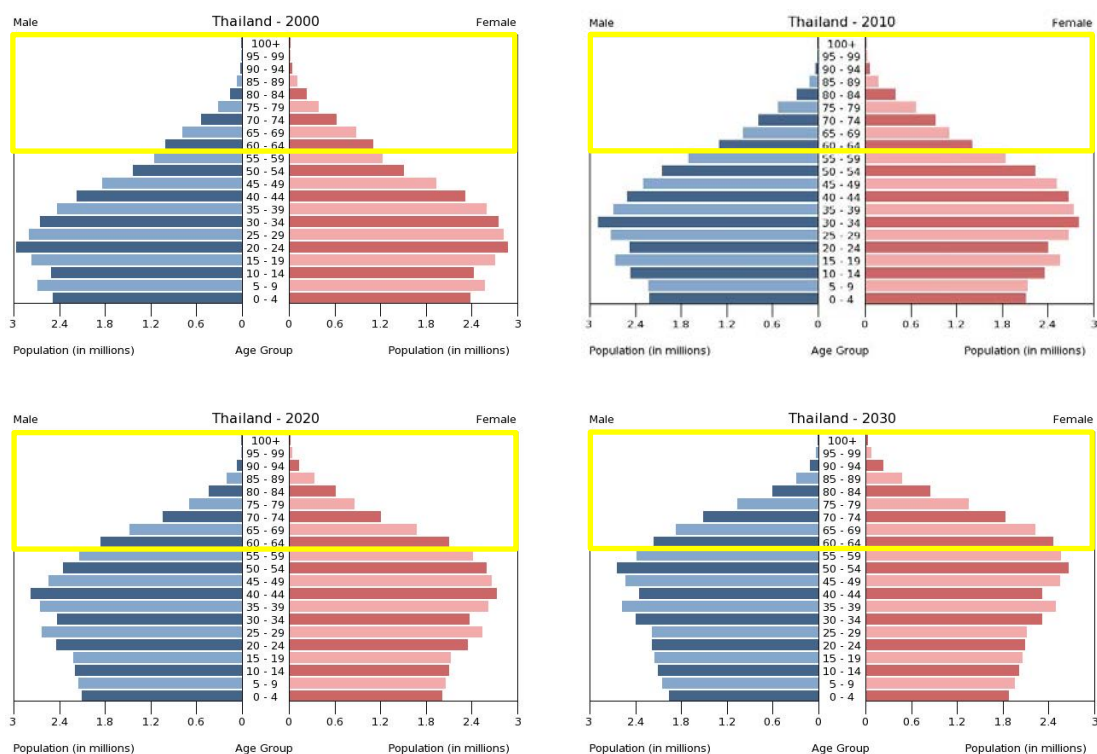


Figure 1 The population pyramids for Thailand in 2000 projections to 2030 (Source: U.S. Census Bureau, International Data Base)

2. Oral health problems in elderly people

Globally, elderly people are facing with many oral problems. The oral health problems commonly found in the elderly people include tooth loss, dental caries, periodontal disease, dry mouth, and oral precancer/cancer [2].

Tooth loss is the most common oral problem on elderly people universally [26]. The major reasons for tooth loss are severe dental caries and periodontal disease [2-5,27,28]. Dental caries was the main reason for tooth loss among the women (60.7%) than did in men (49.6%), and periodontal disease was the main reason for tooth loss among the men (44.5%) than did in women (32.1%) [3]. The reasons for tooth extraction in molars and in anterior teeth were dental caries and periodontal disease respectively [3]. Smoking is a risk factor of tooth loss because it is associated with periodontal disease [29]. The other reasons for tooth loss are trauma and elective extraction for prosthetic or orthodontic reasons [27]. Dry mouth might be a cause of tooth loss as it causes dental caries [30-35].

The significant predictors for the number of teeth lost were the number of teeth, the number of decayed teeth, the number of decayed root surfaces, plaque index, and periodontal pocket depth (especially deeper than 6 mm) [4,36]. The risk factors of tooth loss were gender, whether person was living alone, the number of decayed coronal surfaces, and number of decayed root surfaces [36]. The incidence of edentulism was associated with age, gender, ethnicity, self-rating of general health status, mental health status, socio-economic status (social class, income, education level), the number of teeth, number of filled teeth, percentage of decayed teeth, plaque index, periodontal pocket depth, and denture status [4,37-39]. Edentulism was more likely in men (28.4%) than in women (19.9%) [4]. People who have low levels of social class, income, and education are more likely to be edentulous than people who have high levels of social class, income, and education [2,37,38]. The number of teeth lost was associated with gender, marital status, employment status, self-rating of oral health status, periodontal attachment loss, and the number of decayed root surfaces [40,41]. Tooth loss in men (5.1 teeth per person) was more than that in women (4.0 teeth per person) [4], and

unemployed people had more number of teeth lost than employed people [40]. The number of remaining teeth was associated with age, ethnicity, education level, employment status, annual household incomes, diabetes, smoking, self-rating of general health status, the number of remaining teeth, attitude to the quality of natural teeth, and dental care habits (tooth brushing frequency, dental floss use, and annual oral prophylaxis) [29,38,40,42].

When considering the distribution of tooth loss in elderly, Hand JS et al. [36] found that the incidence of tooth loss was highest in mandibular molars, followed by maxillary molars, maxillary premolars, maxillary incisors, mandibular premolars, maxillary canines, mandibular incisors, and the lowest one was mandibular canines. Whereas, Papas A et al. [43] showed that anterior teeth and mandibular teeth are retained longer than posterior teeth and maxillary teeth respectively.

In Thailand, Department of Health, Ministry of Public Health determined the Strategic Planning for 2009-2011 that senior population should have at least 20 NT and 4 POP [9]. This strategic plan concept might be developed from the shortened dental arch concept that the minimum number of teeth which could fulfill the requirements of a functional dentition was suitable for elderly population [44], and from the article mentioned by Srisilapanan P [45].

The term *shortened dental arch* was first used in 1981 by Käyser AF [46]. It is defined as a dentition where the anterior region is intact but the most posterior teeth are missing. This condition is always seen as molars which often lost by dental caries and periodontal disease [46]. After his study, Käyser found that oral functions changed slowly until 4 occlusal units were left and then change rapidly (in this study, a pair of occluding premolars corresponds to one unit, and a pair of occluding molars

corresponds to two units). Therefore, he concluded that there is sufficient adaptive capacity in shortened dental arches when at least 4 occlusal units were left, preferably in a symmetrical position [46].

Srisilapanan P [45] indicated that the minimum number of POP which was sufficient for the good masticatory system was 4 POP. She reported that malnutrition in elderly Thais was associated with having less than 4 POP. Thai elderly persons with at least 4 POP were 2.2 times greater than those with less than 4 POP to have under standard of body mass index (BMI). In this article, a pair of occluding premolars corresponds to one pair, and a pair of occluding molars also corresponds to one pair [45].

By the way, the protocol for counting POP of the Thai Ministry of Public Health [47] determined that a pair of occluding premolars corresponds to one pair, and a pair of occluding molars also corresponds to one pair, like the article of Srisilapanan P [45].

In Thailand, the 6th National Oral Health Survey 2006-2007 [6] reported that tooth loss was the major oral problem in elderly Thais. The average remaining teeth of Thai elderly people in 60-74 year-old group and 80 year-old group were 18.11 and 10.53 respectively. Most Thai elderly people (94.04%) lost their teeth with an average of 13.38 teeth lost per person. 10.47% of them had no teeth (totally edentulous). 54.8% had at least 20 NT. 77.6% of Thai elderly in 60-74 year-old group and 64.92% of those in 80 year-old group had at least 4 POP. The average POP of those in 60-74 and 80 year-old group were 3.27 and 1.28 pairs respectively.

Furthermore, when we look back on the previous national data in 1989, 1994, and 2000-2001 to the recent national data (2006-2007) [6], we found that the number of senior people with at least 20 NT had increased continuously. (The percentage of older people who had at least 20 NT was 40.8, 47.7, 49.0, and 54.8 respectively.)

In 2005, Jainkittivong A et al. [48] investigated the oral complaints, dental health status, and dental treatment needs in Thai elderly dental patients (60 year old and older) attending the Oral Diagnosis Clinic at the Faculty of Dentistry, Chulalongkorn University. They found that tooth loss or inefficient chewing (16.1%) was ranked the third oral complaint next to faulty prostheses (21.1%) and pain and/or swelling (16.3%). 36.8% of the subjects had at least 20 functional NT. The mean number of remaining teeth in 60-64, 65-69, and at least 70 year-old group were 18.5, 17.0, and 15.2, respectively. Prosthetic treatment was the major treatment requirement (84.5%).

By the way, the oral problems commonly found in elderly people which cause tooth loss are dental caries, periodontal disease, and dry mouth [2-5,7,27,28,30-35].

3. Oral health-related quality of life

In the past, bio-medical concept of health, which focused on disease, pathological, physiological and clinical outcomes, was believed [49,50]. Health, in this concept, means the absence of diseases. The professionals measured health status, according to this concept, by using clinical indicators such as DMFT (Decayed, Missing and Filled Teeth) and CPITN (Community Periodontal Index of Treatment Needs), which measured dental caries and periodontal disease respectively. The goal of this concept was to eliminate the diseases. When the time passed, it is believed that clinical measurements in professionals' aspect cannot reflect a full picture of health nor indicate whether people can perform daily activities properly [10,49,51].

Therefore, socio-medical concept, which focused on dimensions of functioning and overall well-being, was become popular and replaced the old concept [15,49,50,52,53]. Health, in this concept, includes psychosocial environmental, and

cultural dimensions [54]. The definition of health by the World Health Organization (WHO) is “Health is a state of complete physical, mental, and social well-being, and not merely an absence of disease or infirmity” [55]. The goal of this concept is not only to eliminate the diseases but also to make person have good quality of life and well-being [46]. Health-related quality of life measurement, which shows the individual’s subjective feelings of health, is used to assess health conditions regarding this concept [49,55].

Socio-dental concept is adapted from socio-medical concept [49]. Persons could be assessed the oral health by using the OHRQoL index. The OHRQoL focuses on the impact of oral conditions on individual’s functioning and psychosocial well-being [56]. It is from individual’s subjective feelings of oral health [49]. The samples of OHRQoL indices are Sociodental Scale, RAND Dental Health Index, Sickness Impact Profile, Geriatric Oral Health Assessment Index, Dental Impact Profile, Oral Health Impact Profile, Subjective Oral Health Status Indicators, Oral Health Quality of Life Inventory, Dental Impact on Daily Living, Oral Health-Related Quality of Life, and Oral Impacts on Daily Performance [57].

4. Oral health-related quality of life indices for elderly people

Nowadays, there are many instruments measuring OHRQoL for elderly people. The three indices which are popular and widely used are the General Oral Health Assessment Index (GOHAI), the Oral Health Impacts Profile (OHIP) and the Oral Impacts on Daily Performances Index (OIDP) [58].

- **The General Oral Health Assessment Index (GOHAI)**

GOHAI was developed by Atchison KA and Dolan TA in 1990, from elderly dental patients in Los Angeles, USA [58,59]. It is the oldest index which is used at present. Its development was from the idea that measuring about oral health should cover many dimensions, not from any theoretical frameworks [58]. This index was originally developed for using in elderly people, called Geriatric Oral Health Assessment Index. After that, it was widely used in many age groups, so its name was changed to General Oral Health Assessment Index [58,59].

There are 12 items which reflex oral problems affecting people in 3 dimensions in this index (Table 1) [58-60]. All questions of GOHAI assess the frequency of the effects of oral health and scoring on six-point Likert scale (0 = never, 1 = seldom, 2 = sometimes, 3 = often, 4 = very often, 5 = always). The calculator has to reverse the score of 9 items which indicate negative response (limit the kinds or amounts of food due to dental problems, have trouble biting or chewing any kinds of food, prevent from speaking, limit contacts with people, worry or concern about the dental problems, feel nervous or self-conscious due to dental problems, feel uncomfortable eating in front of people, use medication to relieve pain or discomfort from around the mouth, and teeth or gums are sensitive to hot, cold or sweets) before calculating GOHAI score, then sum the final score of each of the 12 items. GOHAI score ranges from 0 to 60. The higher GOHAI score indicates the better oral health [58,59].

Table 1 Dimensions and items of GOHAI [58-60]

Dimension	Item
Physical function	<ul style="list-style-type: none"> - How often did you <i>limit the kinds or amounts of food you eat</i> because of problems with your teeth or dentures? - How often did you <i>have trouble biting or chewing any kinds of food</i>, such as firm meat or apples? - How often were you <i>able to swallow comfortably</i>? - How often have your teeth or dentures <i>prevented you from speaking</i> the way you wanted?
Psychosocial function	<ul style="list-style-type: none"> - How often did you <i>limit contacts with people</i> because of the condition of your teeth or dentures? - How often were you <i>pleased or happy with the looks</i> of your teeth and gums, or dentures?
Psychosocial function	<ul style="list-style-type: none"> - How often were you <i>worried or concerned</i> about the problems with your teeth, gums or dentures? - How often did you <i>feel nervous or self-conscious</i> because of problems with your teeth, gums or dentures? - How often did you <i>feel uncomfortable eating in front of people</i> because of problems with you teeth or dentures?
Pain or discomfort	<ul style="list-style-type: none"> - How often were you <i>able to eat anything without feeling discomfort</i>? - How often did you <i>use medication to relieve pain or discomfort from around your mouth</i>? - How often were your <i>teeth or gums sensitive to hot, cold or sweets</i>?

The advantages of GOHAI are easy to use and taking short time. The disadvantage of GOHAI is that it might not represent all dimensions of oral health and

quality of life because it is not developed from any theoretical frameworks. The uses of GOHAI are to survey and to evaluate the health promotion campaigns in dental patients [58,59].

- The Oral Health Impacts Profile (OHIP)

OHIP was developed by Slade GD and Spencer AJ in 1994, from adult dental patients in Adelaide, Australia. This index was originally developed for using in elderly people [49,61]. Its development was from Locker D's model of oral health which was used to define 7 conceptual dimensions of impact : functional limitation, physical pain, psychological discomfort, physical ability, psychological disability, social disability and handicap [10,49,54,61].

There are 49 items in this index, called OHIP-49. All questions of OHIP assess the frequency of the effects of oral health in the past 12 months, and scoring on five-point Likert scale (0 = never or not applicable, 1 = hardly ever, 2 = occasionally, 3 = fairly often, 4 = very often) [10,54,58,61]. Overall OHIP scores could be calculated in two ways. The first way is to count the number of impacts reported at a threshold level such as "fairly often" or "very often". The second way is to standardize (weigh) subscale scores, and then sum those standardized score. The higher OHIP score indicates the poorer oral health because all questions are about problems affected from oral health [10,58,61].

There are three advantages of OHIP-49. First, it is supported by clearly theoretical framework. Second, it covers many dimensions of oral health. Third, each question is developed from the aspect of general people, not from the aspect of dental professional. The disadvantages of OHIP-49 are taking long time because of many

items, and having many repeated questions [10,58,61]. Therefore, a shorten version has been developed, called OHIP-14 [58,61].

OHIP-14 has been proofed that it can use as OHIP-49. There are 14 items in this index. All questions of OHIP-14 assess the frequency of the effects of oral health in the past 1 month [58,61]. OHIP-14 has two forms. The first form, which is suitable for distinguishing between the people with problems and the people without problem, is OHIP-14 Regression Short Form (Table 2). The second form, which is suitable for finding problems from oral cavity and following up the problems, is OHIP-14 Impact Short Form (Table 3) [58].

Table 2 Dimensions and items of OHIP-14 Regression Short Form [58]

Dimension	Item
Functional limitation	- Trouble pronouncing words - Sense of taste worse
Physical pain	- Painful aching in mouth - Uncomfortable to eat
Psychological discomfort	- Self-conscious - Tense
Physical disability	- Diet unsatisfactory - Had to interrupt meals
Psychological disability	- Difficulty to relax - Been embarrassed
Social disability	- Irritable with others - Difficulty doing jobs
Handicap	- Life less satisfying - Totally unable to function

Table 3 Dimensions and items of OHIP-14 Impact Short Form [58]

Dimension	Item
Functional limitation	- Difficulty chewing - Food catching
Physical pain	- Sensitive teeth - Sore spots
Psychological discomfort	- Worried - Miserable
Physical disability	- Speech unclear - Avoid eating some food
Psychological disability	- Been upset - Been depressed
Social disability	- Irritable with others - Less tolerant of others
Handicap	- Life less satisfying - Financial disadvantage

The uses of OHIP are to survey and to evaluate the dental treatment outcomes in both general people and dental patients [10,58,61]. Moreover, many countries use this index as a part of National Survey such as Great Britain, South Korea and Germany [58].

- **The Oral Impacts on Daily Performances Index (OIDP)**

OIDP is developed by Adulyanon S and Sheiham A in 1997, from Thai people aged 35-44 years in Thailand [58,62,63]. The theoretical framework of OIDP which is presented in Figure 2 was modified from the World Health Organization's International Classification of Impairments, Disabilities and Handicaps. This classification was

revised for dentistry by Locker D. The first level of OIDP's framework refers to the oral impairments. The second level refers to the intermediate impacts which includes the initial negative impacts affected from oral health status (pain, discomfort, functional limitation and dissatisfaction with appearance). The third level refers to ultimate impacts which represent the impacts on ability to perform daily activities. The daily activities in OIDP are categorized into 3 dimensions : physical, psychological and social dimension. OIDP measures the third level of this theoretical framework [58,63].

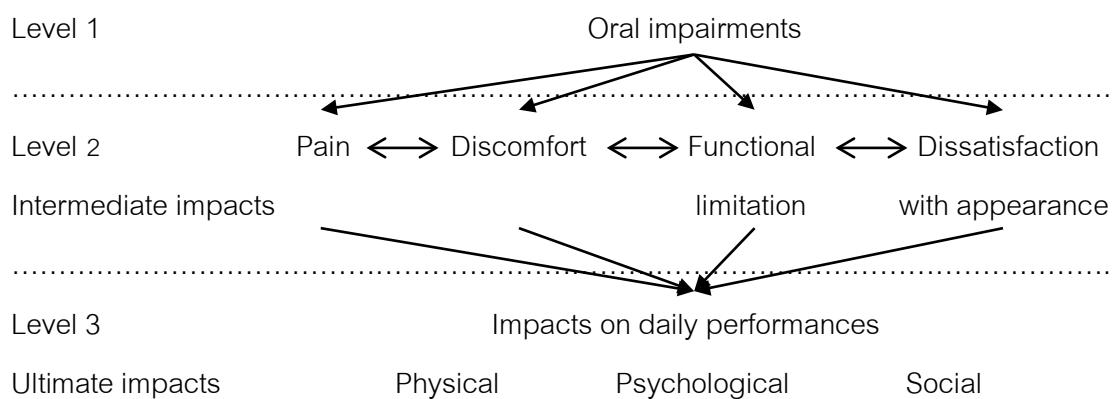


Figure 2 The theoretical framework of OIDP

There are 8 items in this index (Table 4). All items cover only important daily activities which affected from oral health [58,63].

Table 4 Dimensions and items of OIDP [58,63]

Dimension	Item
Physical	<ul style="list-style-type: none"> - Eating and enjoying food - Speaking and pronouncing clearly - Cleaning teeth
Psychological	<ul style="list-style-type: none"> - Sleeping and relaxing - Maintain usual emotional state without being irritable - Smiling, laughing and showing teeth without embarrassment
Social	<ul style="list-style-type: none"> - Enjoying contact with people - Carrying out major work or social role

The questions of OIDP assess both frequency and severity of the problems from oral health in the past 6 months [18,54,58,63]. There are two patterns of frequency score according to the pattern of problem occurrence; regular pattern and spell pattern (Table 5). If the problems occur regularly, we will use regular pattern. If the problems occur less frequency than once a month, we will use spell pattern [58,63]. The severity score ranges from 0 to 5 (Table 6), and decimal number is not permitted [58,63].

Table 5 Patterns of frequency score of OIDP [58,63]

Score	Regular Pattern	Spell Pattern
0	Never affected in past 6 months	0 day
1	Less than once a month	1-5 days
2	Once or twice a month	6-15 days
3	Once or twice a week	16-30 days
4	3-4 times a week	1-3 months
5	Every or nearly every day	Over 3 months

Table 6 Pattern of severity score of OIDP [58,63]

Score	Pattern
0	None
1	Very less severe
2	Less severe
3	Moderately severe
4	Severe
5	Very severe

The score of each problem is originally and usually calculated by multiplying the frequency with the severity score (ranges from 0 to 25), then sum all of each problem's score to be the total score (ranges from 0 to 200). The higher OIDP score indicates the poorer oral health because all items are about the problems affected from oral health [18,54,58,63]. However, some studies had modified the scoring of OIDP by using only frequency score. For example, the study of Astrom AN and Okullo I recorded and used only frequency score for OIDP calculation [64].

OIDP has been proofed to use in adult and elderly Thais [18,57]. There are many studies which used OIDP for assessing OHRQoL in Thai elderly people [15,18,52,53].

OIDP has many advantages. First, it is short, and consumes less time because it contains 8 items. Second, it measures only the significant impacts from oral health on daily performances, not the minor conditions which do not impact daily performances. Third, it does not have repeated questions. Forth, it is easier to measure the behavioral impacts such as eating, speaking or cleaning teeth than the feeling-state dimension such as discomfort and worry. Lastly, it measures condition-specific impacts. If people

report that they have any impacts on daily performances, they will be asked whether the major causes of the problems (pain, discomfort, functional limitation and dissatisfaction with appearance) and the oral impairments such as tooth loss and toothache [52,54,58,63]. The disadvantage of ODP is that it has to be used by the trained interviewers because the reporter will be asked about the major causes and the oral impairments of the impacts [52,54,58,63].

The uses of ODP are to survey, to evaluate the dental treatment needs, to plan the dental treatment needs in populations, to evaluate dental treatment outcomes, and to use as a part of National Survey [52,54,58,63].

5. Tooth loss and its impacts on oral health-related quality of life

Tooth loss affects OHRQoL. There are many factors associated with tooth loss and its impacts on OHRQoL such as the number of teeth, the number of occluding pairs, the number of missing teeth, the location of missing teeth, the pattern of missing occlusal units, removable denture status, removable denture problems, dental treatment needs, dental attendance, age, education level, etc. The followings are the factors associated with OHRQoL.

- Tooth loss / the number of missing teeth [12,65-70] : Elderly people with tooth loss had lower OHRQoL than those without tooth loss [65]. The oral health related-quality of life significantly decreased when increased the number of missing teeth [12]. The prevalence of older adults affected at least one oral impact was higher among the adults with the more number of missing teeth than those with the less number of missing teeth [66]. The followings are the examples of previous studies reported the effects of the number of missing teeth on the OHRQoL. Pallegedara C et al. found that the older

individuals with 25-31, 17-24, and 9-16 missing teeth were 4.21, 3.51, and 2.13 times, respectively, greater than those with 1-8 missing teeth to have oral impacts [67]. Ekanayake I et al. reported that elderly people with 12-31 missing teeth had poorer OHRQoL than those with less than 12 missing teeth [68]. Astrøm AN et al. stated that adults with at least 5 missing teeth were 2.3 times greater than those with less than 5 missing teeth to have oral impacts [69].

- The number of NT [65,66,70-74] : There are previous studies reported the effects of the number of NT on the OHRQoL. For example, many studies found that people with at least 20 NT had better OHRQoL than those with less than 20 NT [65, 70-72]. Lahti S et al. reported that adults with 1-19 teeth and 0 teeth were 3.4 and 4.0 times, respectively, more likely than those with at least 20 teeth to have oral impacts [66]. The results of Sheiham A et al. showed that the prevalence of oral impacts was highest in the elder subjects in 1-10 NT group, followed by those in 11-20 NT group, and at least 21 NT group, respectively, and the subjects with at least 21 NT were 0.35 times more likely than those with 1-10 NT to have oral impacts [73]. Tsakos G et al. found that older population with 1-10 NT and 11-20 NT were 2.05 and 1.81 time, respectively, greater than those with at least 21 NT to have oral impacts [74].

- Position of tooth loss [18,67,74,75] : Elderly people with anterior teeth missing had lower OHRQoL than those without anterior teeth missing [67]. Walter MH et al. reported that adult dental patients who lost their anterior teeth without replacement were 21.5 times greater than those without missing anterior teeth to have impaired oral health related quality of life [75]. Pallegedara C et al. and Tsakos G et al. found that older people with anterior teeth missing were 2.76 and 2.86 times, respectively, greater than those without anterior teeth missing to have oral impacts [67,74]. Furthermore, older

people with posterior teeth missing had lower OHRQoL than those without posterior teeth missing [67].

- Accepting in tooth loss [65] : Elderly persons with difficulty in accepting tooth loss had lower OHRQoL than those without difficulty in accepting tooth loss [65].

- Occluding pairs [12,74,76,77] : The number of natural occluding pairs (NOP), anterior occluding pairs (AOP), and POP were associated with the OHRQoL [12,74,76]. For example, the prevalence of having oral impacts of the senior persons with 9-16 NOP was lower than that of senior persons with 0-8 NOP [76]. Older people with 0-8 NOP were from 1.72 to 2.66 times greater than those with 9-16 NOP to have oral impacts [74,76]. The prevalence of having oral impacts of the older people with 3-6 AOP was lower than that of the older people with 0-2 AOP, and the older people with 0-2 AOP were 3 times greater than those with 3-6 AOP to have oral impacts [76]. The OHRQoL significantly increased when increased the number of POP [12]. Elderly people with reduction of the number of POP were 1.7 times more likely than those without reduction of the number of POP to have oral impacts [12]. Senior persons with 0-3 POP were 1.57 times more likely than those with 4-10 POP to have oral impacts [74]. Moreover, the pattern of missing occlusal units could affect the OHRQoL [77]. Persons with the first molar occlusal contact were 12.8 times greater than those without this occlusal contact to have high OHRQoL, and people who lost only the second molar occlusal contact were 11.1 times more likely than those who lost more occlusal units to have high OHRQoL [77].

- Denture status [67,68,70,72] : There were different results of the studies reported the effects of denture status on the OHRQoL. McGrath C et al. and Tubert-Jeannin S et al. found that persons who did not wear dentures had better OHRQoL than

those who wear dentures [70,72]. On the other hand, Ekanayake I et al. reported that elderly people who wore denture had better OHRQoL than those who did not wear dentures [68], and Pallegedara C et al. found that non-denture wearers were 2.81 times greater than denture wearers to have oral impacts [67].

- Quality of denture [74,76,78] : Retention, adaptation, and the border position of denture were associated with the OHRQoL [74,76,78]. The prevalence of having oral impacts of the older persons with inadequate retention and adaptation of dentures was higher than that of older persons without these problems [76]. Elderly people with poor retention of dentures were from 2.04 to 2.41 times greater than those without this problem to experience oral impacts [74,76]. Older persons with inadequate adaptation of dentures were from 1.92 to 2.59 times greater than those without this problem to have oral impacts [74,76]. Senior people with denture overextension were 2.51 times greater than those without denture overextension to experience oral impacts [74].

- Satisfaction of denture [65] : Older people who were satisfied with their removable dentures had better OHRQoL than those who were not satisfied with their dentures [65].

- Dental treatment needs [70,73] : The prevalence of oral impacts in elder with dental treatment needs was higher than that of elder without dental treatment needs [73]. Persons who did not have dental treatment needs had better OHRQoL than those who had dental treatment needs [70].

- Prosthetic needs [72] : People without prosthetic needs had better OHRQoL than those with prosthetic needs [72].

- Dental attendance [69] : Adults who never had dental attendance were 2.2 times more likely than those who had dental attendance routinely or once a year to have

oral impacts [69]. Furthermore, persons who had dental attendance for pain or acute reasons were 2.8 times greater than those who attended for regular checking up to experience oral impacts [69].

- Age [12,66,69,70,72] : The prevalence of older adults affected at least one oral impact was higher than that of younger adults [66]. Lahti S et al. reported that people in 30-34 year-old group and 34-74 year-old group were 0.5 and 0.7 times, respectively, more likely than those in at least 75 year-old group to have oral impacts [66]. McGrath C et al. and Tubert-Jeannin S et al. found that the persons who were 20-29 years old and less than 65 years old had better OHRQoL than those who were 30-45 years old and at least 65 years old, respectively [70,72]. On the other hand, the results of Kida IA et al. showed that the older persons were 0.6 times greater than the younger persons to have oral impacts [12].

- Gender [75,79] : Women had lower oral health related quality of life than men in the physical, social, and worry dimensions [79]. Men were 0.3 times more likely than women to have impaired oral health related quality of life [75].

- Socio-economic status [66,70,72,78] : The OHRQoL was associated with social class background, education level, income, and working status [66,70,72,78]. The subjects who were from higher social class had better OHRQoL than those who were from lower social class [72]. The prevalence of having at least one oral impact was higher among adults with a lower education level than those with a higher education level [66]. People who graduated from high school had better OHRQoL than those who graduated from less than high school [70]. Persons who were working had better OHRQoL than those who were not working [70]. The study of Tubert-Jeannin S showed

that persons who earned more than €534/month had better OHRQoL than those who earned less than €534/month [70].

- Self-rating of general and oral health [12,70] : Persons who reported better self-rating of general and oral health had better OHRQoL than those who reported poorer self-rating of general and oral health [70]. Older adults who reported bad oral health status were 7.7 times greater than those who reported good oral health status [12].

- Satisfaction of oral health [70] : People who were satisfied of oral health had better OHRQoL than those who were not satisfied of oral health [70].

- Reported chewing ability [12] : People who reported chewing problems were 3.2 times greater than those who did not report chewing problems to have oral impacts [12].

- Halitosis [68] : Senior persons without halitosis had better OHRQoL than those with halitosis [68].

- Depression [79] : Elderly people with depression had lower oral health related quality of life than those without depression in the physical and social dimensions [79].

CHAPTER III

MATERIAL AND METHODS

This study was a cross-sectional study. The population in this study was Thai elderly dental patients in the Faculty of Dentistry, Chulalongkorn University, while the sample was Thai elderly dental patients in Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University who were accepted according to the following criteria:

- 1) The patients were Thai.
- 2) The patients were at least 60 years old on the day they entered the study.
- 3) The patients were current patients in the Graduate Prosthodontic Clinic at any stage of treatment prior to prosthesis insertion or delivery.
- 4) The patients had ability to communicate
- 5) The patients were healthy or with controlled systemic diseases.
- 6) The patients did not suffer from psychiatric problems or depression obviously.

The sample size was obtained by using the following formula calculation under 5% of acceptable errors and 95% of the confidence level [80].

$$n = \frac{N}{1 + (Ne^2)}$$

n = Sample size in this study

N = Number of Thai elderly dental patients in Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University in 2010 (N = 600)

e = Acceptable errors (e = 0.05)

Two hundred and forty Thai elderly dental patients who were being treated in the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University from May 2011 to June 2012, and met the aforementioned criteria were invited to participate in this study. The protocol of the study was approved by the Ethical Committee of Chulalongkorn University. Informed written consent was obtained from all subjects.

The enrolled subjects were interviewed about their demographic information (age, education, reading and writing skill), medical history, removable denture wearing history, removable denture problems, and were assessed the OHRQoL in the past 6 months.

In the process of assessing OHRQoL, in this study we decided to use the OIDP index as it is developed from Thai people in Thailand [58,62,63], and it has also been proofed to use in adult and elderly Thais [18,58]. Furthermore, there are many studies in Thailand which used the OIDP index to assess the OHRQoL [11,15,18,52,53] as it is short, no repeated questions and consumes less time because it contains only 8 items, and it measures only the significant impacts from oral health on daily performances, not the minor conditions which do not impact daily performances. Therefore, it is easier to measure the behavioral impacts such as eating, speaking or cleaning teeth than the feeling-state dimension such as discomfort and worry. Lastly, the OIDP measures condition-specific impacts. If people report that they have any impacts on daily performances, they will be asked whether the major causes of the problems (pain, discomfort, functional limitation and dissatisfaction with appearance) and the oral impairments such as tooth loss and toothache [52,54,58,63].

The OIDP data was collected on the significant impacts from oral health on the subject's ability to perform 8 daily activities (eating and enjoying food, speaking and pronouncing clearly, cleaning teeth, sleeping and relaxing, maintaining usual emotional state without being irritable, smiling laughing and showing teeth without embarrassment, enjoying contact with other people, and carrying out major work or social role) about

- frequency score of the impacts (ranges from 0 to 5 : shown in Table 5)
- severity score of the impacts (ranges from 0 to 5 : shown in Table 6)

- major symptoms (pain, discomfort, functional limitation and dissatisfaction with appearance)
- main oral impairments (such as tooth loss and toothache).

We next examined the patients and counted the number of functional NT under dental unit's light. The inclusion and exclusion criteria of the functional NT we counted in this study shown in Table 7.

Table 7 The inclusion and exclusion criteria of the functional NT we counted in this study

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> - Natural teeth - Pathology-free teeth - Restorable pathologic teeth - Restored teeth 	<ul style="list-style-type: none"> - Unrestorable pathologic teeth - Retained root - Too loose that needs to be extracted - Implant teeth - Pontic of bridge

Then determined the number of POP under dental unit's light. An occluding pair was defined as a pair of opposing teeth which functionally met in centric occlusion of the subjects. The POP were counted based on the following criteria.

- Natural first premolars, second premolars, first molars, second molars, and third molars
- Artificial teeth, consist of first premolars, second premolars, first molars, second molars, and third molars, of removable dentures they used in their daily life while the dentures were in place
- All fixed units of first premolars, second premolars, first molars, second molars, and third molars of fixed dentures in their mouth such as crowns, bridges, and implant teeth

In the process of determining the number of POP, we used shimstock film (Bausch Arti-Fol[®] metallic Shimstock-Film-12 microns) to check the occluding pairs as it is the standard method for checking occluding pairs of dentures in the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University. We placed shimstock film between upper and lower occluding teeth while the subjects were in their centric occlusion, when the shimstock film was tight or with color on the teeth, then it was counted as one occluding pair. In this study, a pair of occluding premolars corresponds to one pair, and a pair of occluding molars also corresponds to one pair, according to the protocol for counting POP of the Thai Ministry of Public Health [47] and the article of Srisilapanan P [45].

The OIDP score for each activity in this study was calculated by multiplying the frequency score by the severity score (ranges from 0 to 25). The total score was the sum of the activity scores (ranges from 0 to 200). The higher OIDP score indicates that the subject experienced more problems and had a lower OHRQoL because all items are about the problems affected from oral health [63]. We used the Kappa statistics to test intra-examiner reliability during a pilot study (kappa = 0.90).

The data was analyzed by using the Statistics Package for the Social Sciences (SPSS) version 17.0 (SPSS (Thailand) Co., Ltd., Bangkok, Thailand). Statistical analyses were performed using the Descriptive Statistics, Kruskal-Wallis Test, Pearson Chi-Square Test, Mann Whitney U Test, and Binary Logistic Regression. Statistical significance was set at the 5% level ($p < 0.05$). All procedures in the study were performed by the only one investigator.

CHAPTER IV

RESULTS

The characteristics of the participants

The participants in the present study comprised 108 (45%) males and 132 (55%) females. The age of subjects ranged from 60–93 years old with an average age of 69.3 ± 7.0 years. About half (53%) of the subjects were in 60-69 year-old group. Nearly all (94%) of the subjects were able to read and write. Eighty percent of the subjects had at least one systemic disease. The most common systemic disease was hypertension (43%) followed by hyperlipidemia (35%), bone disease (28%), diabetes (19%), cardiovascular disease (13%), cancer (5%), and stroke (3%). Nearly all (97%) of the subjects did not receive head and neck radiation and/or chemotherapy. A majority of the subjects (60%) wore removable dentures, and 78% experienced denture problems. Ill-fitting dentures (48.7%) and poor occlusal surface of the dentures (18.8%) were the most commonly reported problems. (The entire data shown in Appendix)

Table 8 shows the average number of functional NT and POP, the distribution of the subjects according to the number of functional NT and POP, and total OIDP score of the participants. Sixty subjects (25%) were completely edentulous.

Table 8 The average number of functional NT and POP, the distribution of the subjects according to the number of functional NT and POP, and total OIDP score of the participants

	All subjects (n=240)	60-69 years old (n=128)	70-79 years old (n=90)	≥ 80 years old (n=22)
The average number of				
NT (teeth)	13.0 ± 9.5	$15.4 \pm 9.1^{a,b}$	10.4 ± 9.5^a	9.1 ± 8.5^b
POP (pairs)	3.5 ± 2.7	3.6 ± 2.6	3.5 ± 2.8	3.7 ± 2.8

Table 8 (continued)

	All subjects (n=240)	60-69 years old (n=128)	70-79 years old (n=90)	≥ 80 years old (n=22)
The number of subjects with [n (%)]				
≥ 20 NT	76 (32)	51 (40)	23 (26)	2 (9)
< 20 NT	164 (68)	77 (60)	67 (74)	20 (91)
The number of subjects with [n (%)]				
≥ 4 POP	116 (48)	62 (48)	43 (48)	11 (50)
< 4 POP	124 (52)	66 (52)	47 (52)	11 (50)
The number of subjects with [n (%)]				
≥ 20 NT and ≥ 4 POP	52 (22)	36 (28)	15 (17)	1 (5)
≥ 20 NT and < 4 POP	24 (10)	15 (12)	8 (9)	1 (5)
< 20 NT and ≥ 4 POP	64 (27)	26 (20)	28 (31)	10 (45)
< 20 NT and < 4 POP	100 (42)	51 (40)	39 (43)	10 (45)
Total OIDP score	14.51	15.16	15.26	7.73

^{a,b} p<0.001 : Kruskal-Wallis Test

We found that there was significant difference between the average number of NT in different age groups ($p<0.001$; Kruskal-Wallis Test). There were significant differences between the number of NT of 60-69 year-old group and those of at least 70-79 year-old group, and between the number of NT of 60-69 year-old group and those of at least 80 year-old group. On the other hand, there was no significant difference between the number of POP in all age groups. Moreover, there was no significant difference significant difference between the total OIDP scores in all age groups.

The daily performances affected by the oral impacts according to OIDP, main symptoms and main oral impairments causing oral impacts

We found that 139 subjects (58%) had at least one daily activity impacted by serious oral problems during the past 6 months. Eating (50%) and speaking (21%) were the most commonly reported activities affected by oral problems. No subjects had difficulty in carrying out major work. Functional limitation was the main symptom for the problem of eating (73.6%), speaking (98.2%) and maintaining their usual emotional state (55.2%). Dissatisfaction with appearance was the main symptom for the problem of smiling (100%) and enjoying contact with people (75%). Pain was the main symptom for the problem of cleaning teeth (53.3%) and sleeping (77.8%).

Ill-fitting denture was the main oral impairment for the problem of eating (48.1%), speaking (44.4%) and maintaining their usual emotional state (50%). Tooth loss was the main oral impairment for the problem of smiling (65%) and enjoying contact with people (55%). Tooth spacing was the main oral impairment for the problem of cleaning teeth (40%). Tooth pain was the main oral impairment for the problem of sleeping (66.7%). The daily performances affected by the oral impacts according to OIDP, main symptoms, main oral impairments, and OIDP scores are shown in Table 9.

Table 9 Daily performances affected by the oral impacts according to OIDP, main symptoms, main oral impairments, and OIDP scores

Daily performances	OIDP scores	Main symptoms % (n)	Main oral impairments % (n)	
1. Eating (n = 119, 50%)	6.81	Functional limitation	73.6 (103)	Ill-fitting denture 48.1 (64)
		Pain	23.6 (33)	Tooth loss 40.6 (54)
		Discomfort	2.9 (4)	Tooth fracture 2.2 (3)
				Poor occlusion 2.2 (3)
				Tooth sensitivity 1.5 (2)
				Tooth mobility 1.5 (2)
				Loss of filling 1.5 (2)

Table 9 (continued)

Daily performances	OIDP scores	Main symptoms % (n)	Main oral impairments % (n)
1. Eating (n = 119, 50%)	6.81	Functional limitation 73.6 (103) Pain 23.6 (33) Discomfort 2.9 (4)	Dry mouth 0.8 (1) Tooth pain 0.8 (1) Gingivitis 0.8 (1)
2. Speaking (n = 51, 21%)	2.64	Functional limitation 98.2 (54) Discomfort 1.9 (1)	Ill-fitting denture 44.4 (24) Tooth loss 38.9 (21) Wearing denture 14.8 (8) Dry mouth 1.9 (1)
3. Cleaning teeth (n = 15, 6%)	0.64	Pain 53.3 (8) Functional limitation 46.7 (7)	Tooth spacing 40.0 (6) Gum pain 13.3 (2) Tooth wear 13.3 (2) Crowding 13.3 (2) Tooth sensitivity 6.7 (1) Tooth loss 6.7 (1) Wearing denture 6.7 (1)
4. Carrying out major work (n = 0)	0	-	-
5. Sleeping (n = 8, 3%)	0.43	Pain 77.8 (7) Functional limitation 11.1 (1) Discomfort 11.1 (1)	Tooth pain 66.7 (6) Tooth loss 11.1 (1) Dry mouth 11.1 (1) Bruxism 11.1 (1)

Table 9 (continued)

Daily performances	OIDP scores	Main symptoms % (n)	Main oral impairments % (n)
6. Maintaining usual emotional state (n = 26, 11%)	1.06	Functional limitation 55.2 (16) Pain 27.6 (8) Discomfort 13.8 (4) Dissatisfaction with appearance 3.4 (1)	Ill-fitting denture 50.0 (13) Tooth loss 30.8 (8) Tooth pain 3.8 (1) Dry mouth 3.8 (1) Tooth mobility 3.8 (1) Gingivitis 3.8 (1) Food impaction 3.8 (1)
7. Smiling (n = 39, 16%)	2.02	Dissatisfaction with appearance 100.0 (39)	Tooth loss 65.0 (26) Poor natural teeth esthetics 10.0 (4) Poor denture esthetics 10.0 (4) Ill-fitting denture 10.0 (4) Wearing denture 5.0 (2)
8. Enjoying contact with people (n = 20, 8%)	1.08	Dissatisfaction with appearance 75.0 (18) Functional limitation 25.0 (6)	Tooth loss 55.0 (11) Ill-fitting denture 25.0 (5) Wearing denture 10.0 (2) Poor esthetics 5.0 (1) Wearing denture 5.0 (1)

Descriptive Statistics

The relationship between the number of functional NT and OIDP scores

The Thai Ministry of Health has set a goal of elderly persons having at least 20 NT. We found that there were significant differences between the mean total OIDP score ($p=0.001$), the mean OIDP score in eating problem ($p=0.003$), and the mean OIDP

score in speaking problem ($p=0.006$) of the subjects with at least 20 NT and those of the subjects with less than 20 NT (Table 10). These results indicated that the subjects who had at least 20 NT had higher OHRQoL than those who had less than 20 NT. Furthermore, there was statistically significant association between the number of functional NT and OIDP scores as analyzed using the Pearson Chi-Square Test ($p=0.008$).

When analyzed by using Binary Logistic Regression, we found that the presence of oral impacts on the ability to perform daily activities (OIDP score > 0) was associated with the number of functional NT. The subjects with less than 20 NT were 2.07 times greater than those with at least 20 NT to have oral impacts on their abilities to perform daily activities (OR = 2.1, 95% CI 1.10-3.92).

The relationship between the number of POP and OIDP scores

The Thai Ministry of Public Health has proposed that the elderly should have at least 4 POP. We found that there were significant differences between the mean of total OIDP score ($p<0.001$), the mean OIDP scores concerning eating problem ($p=0.001$), speaking problem ($p=0.005$), cleaning problem ($p=0.005$), smiling problem ($p<0.001$), and in contacting with people problem ($p=0.002$) of the subjects with at least 4 POP and those of the subjects with less than 4 POP (Table 10). These results indicated that the subjects with at least 4 POP had higher OHRQoL than those with less than 4 POP. Moreover, there was statistically significant association between the number of POP and total OIDP scores when analyzed using the Pearson Chi-Square Test ($p<0.001$). When analyzed by using Binary Logistic Regression, we found that the presence of oral impacts on the ability to perform daily activities (OIDP score > 0) was associated with the number of POP. The subjects with less than 4 POP were 2.74 times greater than those with at least 4 POP to have oral impacts on their abilities to perform daily activities (OR = 2.7, 95% CI 1.55-4.86).

Table 10 Relationship between the number of functional NT and the number of POP, and the OIDP scores

Daily performances	The number of functional NT			The number of POP		
	≥ 20 NT	< 20 NT	p-value	≥ 4 POP	< 4 POP	p-value
Total OIDP score [mean (median)]	9.38 (0)	16.89 (10)	0.001 ^a	9.04 (0)	19.63 (14.5)	< 0.001 ^a
Eating	4.55 (0)	7.85 (10)	0.003 ^a	5.09 (0)	8.41 (10)	0.001 ^a
Speaking	1.21 (0)	3.30 (0)	0.006 ^a	1.56 (0)	3.65 (0)	0.005 ^a
Cleaning teeth	0.76 (0)	0.58 (0)	0.496	0.26 (0)	0.99 (0)	0.005 ^a
Sleeping	0.79 (0)	0.26 (0)	0.251	0.43 (0)	0.43 (0)	0.550
Maintaining usual emotion	0.66 (0)	1.25 (0)	0.155	0.78 (0)	1.32 (0)	0.279
Smiling	1.32 (0)	2.35 (0)	0.188	0.67 (0)	3.28 (0)	< 0.001 ^a
Enjoying contact with people	0.49 (0)	1.36 (0)	0.220	0.24 (0)	1.87 (0)	0.002 ^a

^a p < 0.05; Mann-Whitney U Test

The relationship between the number of functional NT plus the number of POP and OIDP scores

Besides comparing the OHRQoL of the subjects who had at least 20 NT with those who have less than 20 NT, and comparing the OHRQoL of the subjects who had at least 4 POP with those who have less than 4 POP according to the objectives of this study, we studied more by categorizing the subjects into 4 groups;

- Group A : the subjects with at least 20 NT and at least 4 POP
- Group B : the subjects with at least 20 NT and less than 4 POP
- Group C : the subjects with less than 20 NT and at least 4 POP
- Group D : the subjects with less than 20 NT and less than 4 POP

Then used Kruskal-Wallis Test to determine the relationship between the subjects in 4 groups and the OIDP scores.

We found that there were significant differences between the OIDP scores of the subjects in group A and D, and between those in group C and D ($p < 0.001$). When considering the eating problem which is the most commonly reported activities affected by oral problems, we found that there was significant difference between the OIDP scores of the subjects in group A and D.

Table 11 The relationship between the number of functional NT plus the number of POP and OIDP scores

Daily performances	≥ 20 NT and ≥ 4 POP (Group A)	≥ 20 NT and < 4 POP (Group B)	< 20 NT and ≥ 4 POP (Group C)	< 20 NT and < 4 POP (Group D)	p-value
Total OIDP score [mean (median)]	6.81 (0) ^a	14.96 (10)	10.86 (8.5) ^b	20.75 (15) ^{a,b}	< 0.001*
Eating	3.17 (0) ^a	7.54 (8)	6.66 (0)	8.62 (10) ^a	0.001*
Speaking	0.71 (0) ^a	2.29 (0)	2.25 (0)	3.97 (0) ^a	0.006*
Cleaning teeth	0.58 (0)	1.17 (0) ^a	0 (0) ^a	0.95 (0)	0.017*
Sleeping	0.96 (0)	0.42 (0)	0 (0)	0.43 (0)	0.337
Maintaining usual emotion	0.77 (0)	0.42 (0)	0.80 (0)	1.54 (0)	0.313
Smiling	0.58 (0) ^{a,b}	2.92 (0) ^a	0.75 (0) ^c	3.37 (0) ^{b,c}	0.001*
Enjoying contact with people	0.04 (0) ^a	1.46 (0)	0.41 (0) ^b	1.97 (0) ^{a,b}	0.019*

* p < 0.05; Kruskal-Wallis Test,

^{a,b,c} A pair of statistically significant difference

CHAPTER V

DISCUSSION

When comparing the characteristics of the participants enrolled in this study with those in the 2007 survey of the older persons in Thailand [1], we found that the percentages of the subjects in 60-69 year-old group, 70-79 year-old group, and at least 80 year-old group in this study (53, 38, and 9, respectively) were quite similar to those in the national survey (58.8, 31.7, and 9.5, respectively). When we considered the educational level of the subjects, we found that the number of the elderly subjects who graduated from at least secondary school (56%) in this study was more than those in the national survey (9.5%). This may indicate that Thai senior people with higher education would pay more concern their oral health and seek for the proper treatment than those with the lower one. When considered the medical history of the enrolled subjects, hypertension was the most common systemic disease. This was similar to the national survey and the result of Youdying W et al. [81] which studied in new-registered elderly patients in Faculty of Dentistry, Chulalongkorn University during 2007 to 2009. Besides hypertension, we found hyperlipidemia and diabetes which are diet-related and habit-related diseases. By the way, it's really interesting that the number of remaining NT in the oral cavity related with the physical health or not. However, there was no association between the number of NT and systemic disease in this study. It might be because we studied in Thai elderly dental patients in the Faculty of Dentistry, Chulalongkorn University who were healthy or with controlled systemic diseases.

Our subjects, there were 22 subjects of removable denture wearers who did not have removable denture problems. They came to the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University to receive other prosthodontics works.

In this study, we found that the number of POP was quite constant, and the number of subjects with at least 4 POP was quite similar to those with less than 4 POP in all age groups. On the other hand, the number of NT decreased continuously in older

age groups, and the number of subjects with at least 20 NT was lower than those with less than 20 NT obviously. These results could be implied in two ways. First, the extracted teeth in older age were anterior teeth. Second, the extracted teeth were posterior teeth, and the subjects tried to maintain the chewing ability by wearing the removable dentures for fulfilling the lost teeth.

When comparing the number of NT and the number of POP in this study with those in the 6th National Oral Health Survey in 2006-2007 [6], we found that the average number of NT, the percentage of people who had at least 20 NT, and the percentage of people who had at least 4 POP in this study (13 teeth, 32%, and 48%, respectively) were less than those in the national survey (18.1 teeth, 54.8%, and 77.6%, respectively). Moreover, in our study, the percentage of subjects who were completely edentulous (25%) was higher than that of the national survey (10.47%). These differences might be because the participants in our study were patients in the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University and were thus seeking dental care. This might have resulted in a study population that had greater dental care needs and a higher proportion of subjects without teeth than it is presented in the general public. Additionally, the majority of the study participants lived in an urban setting where the consumption of foods that cause dental caries such as soft drinks, sweets, and candy is more common [82]. If dental caries is untreated, this can result in tooth loss. We assumed that the majority of the participants were urban dwellers because this clinic was conducted in an urban setting. However, the average number of POP in the present study (3.5 pairs) was an approximate one that found in the national survey (3.27 pairs) [6].

We found that 58% of the participants had at least one daily activity impacted by a serious oral problem during the past 6 months. This prevalence was quite similar to the previous studies in elderly Thais of Srisilapanan P et al. (52.8%) [18], Gherunpong S et al. (53.1%) [15], and Krisdapong S et al. (53.6%) [53]. However, this prevalence was lower than the result of Adulyanon S et al. (73.6%) which studied in adult Thais [11].

Similar to the previous studies in Thai elderly people [15,18,53], the most commonly reported activity affected by oral problems in this study was eating (50%). The percentage of this impact was quite relate to the previous studies in elderly Thais of Gherunpong S et al. (50%) [15], Srisilapanan P et al. (47.2%) [18], and Krisdapong S et al. (40.9%) [53], and also similar to the study in adult Thais of Adulyanon S et al. (49.7%) [11]. As eating problems was the most commonly reported activity affected by oral problems, this suggests that dental treatment should mainly focus on improving patients' OHRQoL in eating and enjoying food. For example, a two-implant retained mandibular overdenture should be the treatment of choice for a completely edentulous mandible [83] as this can improve chewing ability compared to a conventional mandibular complete denture and increase the quality of life [84]. Moreover, choosing easy-to-chew food and cutting food into small pieces are also necessary. There are many kinds of food suitable for complete denture wearers [85]. Furthermore, similar to the study of Srisilapanan P et al. [18], we found that functional limitation was the major main symptom of eating problem. This finding was different from the study in adult Thais of Adulyanon S et al. which reported that the major main symptom of eating problem in adult Thais was pain [11].

The second rank of the most commonly reported activity affected by oral problems from this study was speaking (21%). It was similar to the results of Krisdapong S et al. (21.8%) [53] and Sheiham A et al. (2% and 5% of dentate and edentate participants of the free-living, and 14% and 4% dentate and edentate institutional participants) [73].

When considering the average OIDP scores of all enrolled subjects, we could categorize the OIDP score into 4 groups according to the study of Srisilapanan P et al. [18]. The 4 groups were the zero group (OIDP score = 0), the low OIDP impact group (OIDP = 0.1-7.9), the moderate OIDP group (OIDP = 8.0-15.9), and the high OIDP impact group (OIDP score \geq 16) [18]. We found that the average of total OIDP score in this study (14.51) was in the moderate OIDP group. The average OIDP scores of eating, speaking, cleaning teeth, sleeping, maintaining usual emotional state, smiling, and

enjoying contact with people were in the low OIDP impact group. The OIDP of carrying out major work (0) was in zero group. These results indicated that oral impacts which affected quality of life of the Thai elderly dental subjects in the Faculty of Dentistry, Chulalongkorn University in this study were relatively common but not severe.

Although the International Classification of Impairments, Disabilities and Handicaps (ICIDH), which has been the conceptual framework supporting the OIDP, was replaced by the International Classification of Functioning, Disability and Health (ICF) in 2001 [86,87], the OIDP is still available. ICF recognizes the influence of anatomical, psychological, and environmental factors on health and disease, and on people's functioning, activities, and participation positively and negatively [83-85]. It has been used to map and assess the person's abilities and performance in the daily activities and participations of life [86-88]. In the same way, the purpose of OIDP conforms to the concept of ICF. The OIDP focuses on measuring the serious oral impacts on the person's abilities to perform daily activities [56,63,86].

When considering the relationship between the number of functional NT and the OHRQoL, and between the number of POP and the OHRQoL based on the goals of the Thai Ministry of Public Health, we found that the subjects with at least 20 NT had a significantly higher OHRQoL in entire dimension (total OIDP score) and in physical aspects (eating and speaking) than those with less than 20 NT. Furthermore, there was statistically significant association between the number of functional NT and OIDP scores. These findings are similar to previous studies such as the studies of Wong MC et al. [65], Lahti S et al. [66], Tubert-Jeannin S et al. [70], Akifusa S et al. [71], McGrath C et al. [72], Sheiham A et al. [73], and Tsakos G et al. [74].

By the way, the results showed that the subjects in at least 20 teeth group had more problems in cleaning teeth (higher OIDP score) than those in less than 20 teeth group. It might be because the higher number of NT, the more difficult it is to clean teeth. The causes of problems might be tooth spacing, tooth wear, crowding and tooth sensitivity. Moreover, our results showed that subjects with at least 20 NT had more problems in sleeping (higher OIDP score) than those with less than 20 NT. Patients with

a greater number of NT might be subject to a greater amount of severe decay or periodontal disease, which can be painful than patients with fewer teeth. This might account for the greater difficulty in sleeping reported by subjects with more than 20 NT. These results indicated that although the patients with at least 20 NT had better OHRQoL in eating, speaking, and overall dimension, they might have more difficulty in oral health care, such as tooth brushing, than those with less than 20 NT.

Moreover, we found the subjects with at least 4 POP had a significantly higher OHRQoL than those with less than 4 pairs in entire dimension (total OIDP), physical dimension (eating, speaking and cleaning teeth) and social dimension (smiling and enjoying interaction with people). And there was statistically significant association between the number of POP and total OIDP scores. These findings are similar to the results of previous studies such as the study of Kida IA et al. [12], Tsakos G et al. [74], and Baba K et al. [77], but not similar to the study of Tsakos G et al. which reported that the OHRQoL was not associated with the number of POP [76].

However, when categorized the OIDP scores of the participants in at least 20 NT group, less than 20 NT group, at least 4 POP, and less than 4 POP into 4 groups according to the study of Srisilapanan P et al. [18], we found that the almost all OIDP scores were in the low OIDP impact group (OIDP = 0.1-7.9). Only three scores (the total OIDP score in at least 20 NT group, total OIDP score in at least 4 POP group, and OIDP score of eating in less than 4 POP group) were in the moderate OIDP group (OIDP = 8.0-15.9), and only two OIDP scores (the total OIDP scores in less than 20 NT group and in less than 4 POP group) were in the high OIDP impact group (OIDP score \geq 16). These findings might indicate that although the number of functional NT and the number of POP affected the OHRQoL, these effects were not severe. These outcomes indicated that, in professional's aspect, elderly people should have 20 NT and 4 POP to have a good quality of life. On the other hand, in elderly patients' aspect, they did not have severe problems from their lesser NT and POP.

Furthermore, when considered the relationship between the number of functional NT plus the number of POP and the OHRQoL, we found that the subjects in group A and

group C had better OHRQoL than those in group D. In case of eating which was the most commonly reported activity affected by oral problems, the subjects in group A had lower eating problem than those in group D. These results indicated that we should consider the effect of the number of NT plus the number of POP on the OHRQoL, not only the number of NT or only the number of POP, because both number of NT and number of POP affect the OHRQoL. Moreover, in case of less than 20 NT group, we found that the subjects with at least 4 POP had better OHRQoL than those with less than 4 POP. This finding indicated that we should concern more about the effect of the number of POP on OHRQoL as the number of POP had much effect on the OHRQoL. Some dental professionals believed that the number of functional NT could not represent the oral function of elderly people completely because those functional NT had different distribution, so the number of POP might be more important than the number of NT [45]. However, this study is preliminary in nature, and our study suggests further investigations to assess the effects of the number of NT plus the number of POP on the OHRQoL deeply.

From the aforementioned, the results of this study showed that the number of functional NT and the number of POP were associated with the OHRQoL of the Thai elderly dental patients in the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University, but not severe. The findings could indicate that the normative needs were quite related to the subjective needs of these subjects. This might be because the subjects in this study were Thai elderly dental patients in the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University who had dental treatment needs and came to this clinic to seek proper dental care.

However, in case of the determining of the number of POP, the scoring of a POP in this study was different from the scoring of a posterior occlusal unit in the shortened dental arch concept of Käyser [46] which might be the origin of Thai strategic planning [9]. We decided to use the scoring according to the protocol for counting POP of the Thai Ministry of Public Health [47] and the article of Srisilapanan P [45] as this study is done in Thai elderly patients in Thailand, so the results could be compared with the Thai

national oral health survey. However, this study is preliminary in nature, so it might be useful to study by scoring a POP based on the scoring of a posterior occlusal unit in the shortened dental arch concept in the future.

By the way, in this study, we did not determine the effect of the unpleasant characteristics of removable dentures on the OHRQoL because we only asked the subjects about the removable denture problems they experienced, not to examine the clinical characteristics of those dentures such as denture retention, overextension of denture flange, etc. There were previous studies which reported that the unpleasant characteristics of removable dentures had effects on the OHRQoL. For example, Tsakos G et al. [74,76] found that inadequate retention of dentures, inadequate adaptation of dentures, and overextension of dentures were associated with the low OHRQoL. Hassel AJ et al. [78] reported that the OHRQoL was associated with denture retention, the number of teeth in static occlusion of denture, and age of denture. Therefore, it might be useful to study the effect of the unpleasant characteristics of removable dentures on the OHRQoL of Thai elderly dental patients in this clinic in the future.

Moreover, we did not determine the effects of the location and distribution of missing teeth and occluding pairs on the OHRQoL because we did not collect the data about the location and distribution of the missing teeth and occluding pairs. There were previous studies which reported that the location and distribution of missing teeth and occluding pairs affected on the OHRQoL. For example, Srisilapanan P et al. [18], Pallegedara C et al. [67], Tsakos G et al. [74], and Walter MH et al. [75] found that the subjects with anterior teeth missing had lower OHRQoL than those without this problem. Srisilapanan P et al. [18] and Pallegedara C et al. [67] reported posterior teeth missing had effects on the OHRQoL. Tsakos G et al. [76] found that the number of anterior occluding pairs were associated with the OHRQoL. Baba K et al. [77] reported that the pattern of missing occlusal units was related with the OHRQoL. Therefore, our study suggests further investigations to assess the effects of the location and distribution of

missing teeth and occluding pairs on the OHRQoL of Thai elderly dental patients in this clinic.

The whole process of this study consumed only a short time. It took approximately 10 minutes per subject. All subjects understood the process and questions they were interviewed, and they could follow through the process of the study. The only one examiner was tested the intra-examiner reliability of assessing OHRQoL by using the OIDP questionnaire in the pilot study. The Kappa statistic was 0.90 which considered the almost perfect agreement [89].

Based on our results, we suggested Thai elderly dental patients in this clinic attempt to maintain as many of their natural teeth as possible to eliminate the consequences of tooth loss. They have to recognize that their own natural teeth are the best and worthy of keeping, and tooth loss is preventable or prolongable. They should always maintain good oral hygiene and have routine dental examinations to evaluate their oral health. If they lost their teeth and had any oral impacts on their daily performances, they should seek a dental care to get proper treatment for their conditions, such as fixed or removable dentures, in order that they could perform daily activities normally.

The number and location of restored or replaced teeth in this study should be considered from the data of the location and distribution of missing teeth and occluding pairs of these subjects. Therefore, our study suggests further investigations to collect the data about the location and distribution of the missing teeth and occluding pairs as mentioned above to determine the number and location of restored or replaced teeth for Thai elderly dental patients in the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University. However, some professionals believed that the patients should be restored or replaced to a complete dentition, or at least 28 teeth, because that complete dentition was necessary to satisfy oral function needs [86]. On the other hand, other professionals believed in shortened dental arch concept [44,90]. They thought that the anterior teeth and premolars are necessary and earned the best preventive and restorative care because anterior teeth and premolars could fulfill the

requirements of a functional dentition (biting, mastication, speech, esthetics, and mandibular stability) [44]. Molars should also deserve the same priority as long as there are no limiting factors, such as poor general health status and financial problems [44,90,91]. As molars had the highest risks of dental caries and were most frequently absent, shortened dental arch concept was developed [44]. The shortened dental arch concept avoids the risk of overtreatment of the posterior teeth while still providing a high standard of care and decreasing cost [91]. Moreover, it is believed that the shortened dental arch concept might be suitable for caring of the elderly patients who had limited possibilities for complicated restorative care such as poor general health and financial problems [44].

Furthermore, elderly people should have dietary education. They should be directed to the registered dietician for monitoring the diets closely to ensure that they do not have dietary inadequacy.

Finally, we must stress that the present study is preliminary in nature. The results of this study were from Thai elderly dental patients in Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University. Consequently, they all had dental treatment needs, so they might not represent a representative sample of elderly people in Thailand in general. Therefore, our study suggests further investigations to study in the general elderly population in Thailand, and to determine if there is significant improvement in OHRQoL after regaining the proper number of NT and POP after prosthodontic treatment. By the way, the findings of this study, such as OIDP scores, could be the baseline data for the future studies.

CHAPTER VI

CONCLUSION

According to the goal of the Thai Ministry of Public Health, we concluded that Thai elderly dental patients in the Graduate Prosthodontic Clinic at the Faculty of Dentistry, Chulalongkorn University who had at least 20 functional NT had better OHRQoL than those who had less than 20 functional NT, and the patients with at least 4 POP had higher OHRQoL than those with less than 4 POP. Furthermore, the subjects with at least 20 NT and at least 4 POP and those with less than 20 NT and at least 4 POP had better OHRQoL than those with less than 20 NT and less than 4 POP. These findings indicated that we should consider the effect of the number of NT plus the number of POP on the OHRQoL, not only the number of NT or only the number of POP, because both number of NT and number of POP affect the OHRQoL. Although the number of functional NT and the number of POP affected the OHRQoL, these effects were not severe.

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APPENDIX

APPENDIX

	Page
1. General characteristics of the participants.....	60
2. A medical history of the participants.....	61
3. A denture wearing history of the participants.....	62
4. A diagram of removable denture wearing status of the participants.....	63

1. General characteristics of the participants

Characteristics	n (%)
<i>Gender</i>	
Male	108 (45)
Female	132 (55)
<i>Age group</i>	
60-69 years old	128 (53)
70-79 years old	90 (38)
≥ 80 years old	22 (9)
<i>Education</i>	
No education	20 (8)
Primary school	85 (35)
Secondary school	18 (8)
High school / Vocational certificate	51 (21)
High vocational certificate / Diploma	11 (5)
Bachelor's degree	46 (19)
Master's degree	9 (4)
<i>Reading and writing skill</i>	
Able to read and write	226 (94)
Able to read but unable to write	3 (1)
Unable to read and write	5 (2)
Only able to write their own name	6 (3)

Descriptive Statistics

2. A medical history of the participants

Characteristics	n (%)
<i>Disease</i>	
Hypertension	102 (43)
Hyperlipidemia	84 (35)
Bone disease	67 (28)
Diabetes	45 (19)
Cardiovascular disease	30 (13)
Cancer	11 (5)
Stroke	6 (3)
Lung disease	4 (2)
Kidney disease	3 (1)
Other diseases	50 (21)
<i>Head & neck radiation / Chemotherapy</i>	
No	232 (97)
Yes	8 (3)

Descriptive Statistics

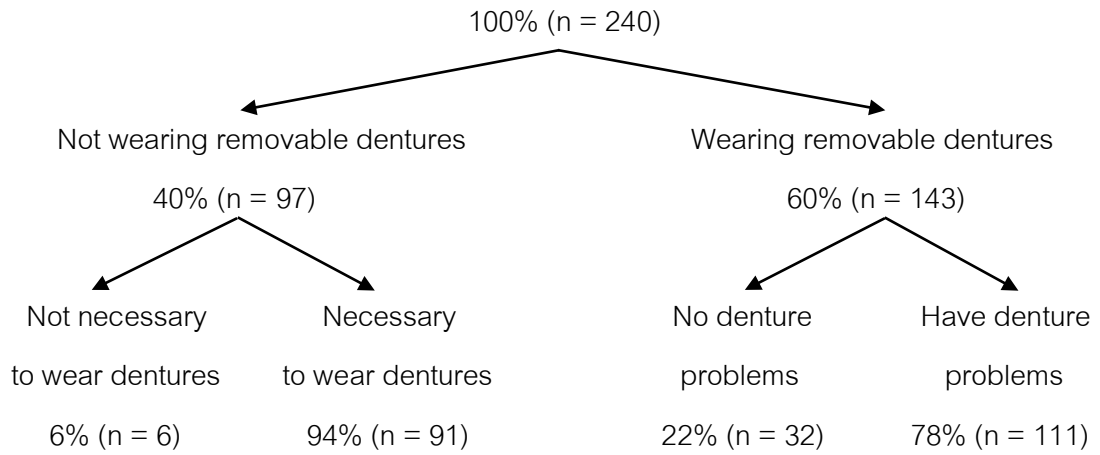
3. A denture wearing history of the participants

Characteristics	n (%)
<i>Removable denture wearing</i>	
Never	52 (22)
Ex wearer	45 (19)
Current wearer	143 (60)
No denture problems	32 (22)
Have denture problems	111 (78)
<i>Removable denture problems</i>	
Ill-fitting denture	75 (48.7)
Poor occlusion (unsharpened/worn teeth)	29 (18.8)
Extracted natural teeth	20 (13.0)
Broken denture part(s)	18 (11.7)
Poor esthetics	6 (4.0)
Pain	4 (2.6)
Broken abutment	2 (1.3)

Descriptive Statistics

P.S. One participant could report more than one denture problem. For example, the subject A's denture was ill-fitting and poor esthetics.

4. A diagram of removable denture wearing status of the participants



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