PREVALENCE OF ABNORMAL ORAL HABITS AND ITS RELATION TO MALOCCUSION IN DENTAL PATIENS OF THE LOWER NORTHERN PART OF THAILAND.

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ABSTRACT

The main objective of this study was to determine the prevalence of abnormal oral habits among the dental patients of the lower north part of Thailand. Various types of malocclusion were also examined in order to interpret the relationship between abnormal oral habits and malocclusion.

A cross sectional study was constructed in 400 dental patients (169 males, 231 females, from 4 years and above, mean age = 31.2 $\pm$ 21.9 years) who attended at dental hospital, Naresuan university. Information about abnormal oral habits was obtained from questionnaire interview and clinical examination. Malocclusion was also examined by one trained dentist.

Seventy seven percent of all patients presented at least one abnormal oral habit. The most prevalent habit was tongue-thrust swallowing (62.3%) followed by lip-sucking and lip-biting (25.5%), mouth-breathing (16.9%), nail-biting (15.0%), digit-sucking (10.3%), other-object biting (6.5%), other-object sucking (3.5%) and pacifier-sucking (2.5%). The younger groups showed significant higher percentage of many habits (digit-sucking, lip-sucking/biting and nail-biting) than those of the older groups ($p<0.05$). Logistic regression which was adjusted by age and sex showed tongue-thrust swallowing associated with anterior open bite with odd ratio (OR = 11.3 (5.0-25.6)), anterior crossbite (OR = 4.3 (1.7-10.6)), mesioclusion (OR = 3.7 (0.1-3.7)) and

protrusion of maxillary incisors (OR = 2.9 (1.6-5.3)) compared with the absence of this habit.

The high prevalence of abnormal oral habits was found in dental patients of the lower northern part of Thailand. Tongue-thrust swallowing was the most prevalent habit which associated with various types of malocclusion. Dentist should concern for management of abnormal oral habits which could affect success and failure of the treatment.

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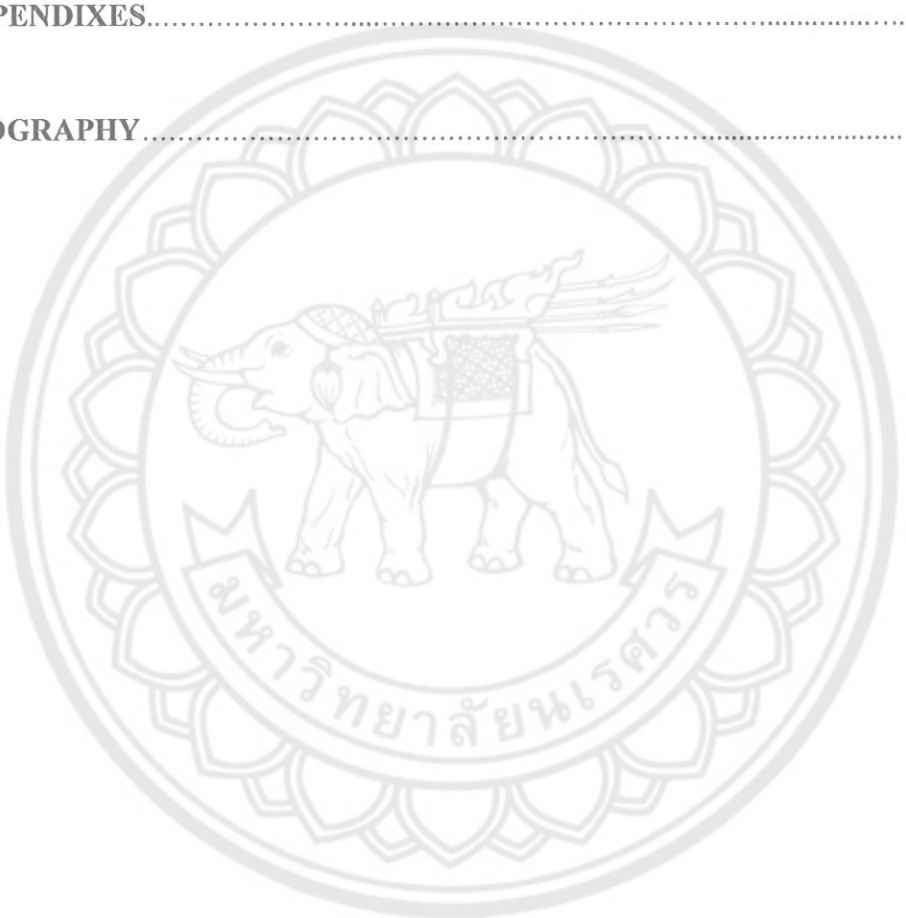

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CHAPTER I

INTRODUCTION

Rationale for the study

Abnormal oral habits are unusual repetitive behaviors occurred in an oral cavity [1]. Caused by different reasons, they are associated with anger, hunger, fear, tooth eruption and disturbed respiration [2]. They could alter a normal growth of oro-facial structure and also related to malocclusion [1, 2, 3]. They could be classified as digit-sucking, tongue-thrust swallowing, lip-sucking and lip-biting, nail-biting and mouth-breathing [3, 4]. For example, digit-sucking which caused anterior open bite [3] due to forcing maxillary incisors to tip labially and mandibular incisors to tip lingually, and increased overjet [5], tongue-thrust swallowing which affected open bite, increased overjet [6] and increased the degree of proclination/protrusion of maxillary incisors [7] and lip-sucking and lip-biting which affected lower lip to located under maxillary incisors as a result of protrusion of maxillary incisors, open bite and lingual collapsed of mandibular incisors [3]. The presence of only one abnormal oral habit may induce others [2]. They were also important factors affecting success in orthodontic treatment. In addition, they play an important role in retention and relapse during post-treatment period [8, 9, 10, 11, 12] such as tongue-thrust swallowing which was consider as a contributing factor of relapse after orthodontic treatment by many investigators [9, 10, 11].

The previous studies reported an association between the abnormal oral habits and malocclusion [13, 14, 15]. The presence of certain habits, which the duration and frequency were considered as important factors, could be a cause of development of malocclusion [7, 16]. In clinical view, if the patients' abnormal oral habits were not examined and evaluated accurately, their dental treatment especially orthodontic treatment could increase more complexity or lead to failure in treatment. Many studies reported the high percentage of prevalence of abnormal oral habits in different regions [4, 13, 14, 15, 17, 18], therefore dentists should pay more attention to evaluate them.

Although there were many studies about the prevalence of abnormal oral habits in various populations, they are still controversial according to differences in races, regions and abnormal oral habit classifications [4, 13, 14, 15, 17, 18]. In Thailand, the only one prevalence study of abnormal oral habits was carried out in the population in the central part of Thailand [4]. However, the data were obtained by using patients' chart record that might lack of a clear examination procedure. In the population of lower northern part of Thailand, the study about the prevalence of abnormal oral habits has not been available yet. If there was a study of prevalence of abnormal oral habits in this population, it would remind dentists to increase awareness to the existence of these habits in treatment planning of patients in this region. Therefore this study aims to determine the prevalence of abnormal oral habits and its relation to malocclusion in the population of the lower northern part of Thailand. In addition, this study would like to interpret the relationship between abnormal oral habits and malocclusion.

Purpose of the study

1. To determine the prevalence of abnormal oral habits in the population of the lower northern part of Thailand
2. To interpret the relationship between abnormal oral habits in the population of the lower northern part of Thailand

Expected outputs of the study

The data about prevalence of abnormal oral habits in the population of the lower northern part of Thailand

Expected outcomes

1. The data could increase dentists' awareness of the prevalence of abnormal oral habits in dental patients of the lower northern part of Thailand.
2. The data could be used as database to compare and predict the incidence of abnormal oral habits for orthodontic and other dental treatment planning. In addition, the present study could be used for educating the patients about the disadvantages of abnormal oral habits and how to be the normal oral habit.

Scope of the study

Evaluated abnormal oral habits and examined malocclusion in patients who attended for dental treatment at dental hospital, Naresuan University during October 2015 to April 2016 without history of orthodontic treatment.

Hypothesis

Each patient, who attended for dental treatment at dental hospital, Naresuan University during October 2015 to April 2016 without history of orthodontic treatment, presented at least one abnormal oral habit.

CHAPTER II

LITERATURE REVIEW

Abnormal oral habits

Habits are repetitive behaviors which people act automatically. The behaviors have been found commonly since infantile period. Most of the behaviors could appear and disappear spontaneously [19]. Certain normal habits are stimuli for normal growth of the jaws such as normal mastication [3].

Abnormal oral habits are unusual, repetitive behaviors occurred in an oral cavity due to different reasons such as abnormal functions of the masticatory system, and emotional tension [3]. Most of them occur unconsciously [1] which may alter oro-facial function [20], cranio-facial growth and occlusion [3].

Abnormal oral habits could act as a primary factor that means the habits cause a malocclusion directly [20], or a secondary factor that means an existing malocclusion contribute to an abnormal oral habit occurrence. As a result, the habits could make the worst malocclusion [21]. The relationship between abnormal oral habits and malocclusion depends on intensity, duration and frequency of habits [20].

Abnormal oral habits could be classified by as digit-sucking habit, tongue-thrust swallowing habit, lip-sucking and lip-biting habits, nail biting habit and mouth-breathing habit [3, 4].

Digit-sucking habit

Naturally, human sucking performs in responding to primitive demand when they are hungry. Some children may not start to suck until their digits are used as a teething device during the period of difficult eruption of primary molars. Moreover, some children suck their thumb or digit to release emotional tension [3].

Digit-sucking habit which is a non-nutritive sucking habits often occurs during the early period of life in 3 - 4 years of age [3]. Bishara et al. reported that the incidence of digit sucking habit significantly decreased between 1 to 4 years of age, from data collection in children between 1 to 8 years of age [22].

Digit-sucking habit can be investigated by inspection of a child's digits that may give some clue to the degree of the habit. For example calluses, blisters [23] (Figure 1) and cleaner fingernails [24] are common findings in a persistent digit-sucking habit.

Figure 1 **Digit-sucking habit (A), the presence of calluses near the end of the fingernail (B), and blister on the thumb (C)**

Source: (A) Oropeza, L. M. et al. [13], (B) http://www.orthodontists.org.nz/common-orthodontic-issues and (C) http://www.dentaltown.com/Dentaltown

Although many children express this habit without evidence of malocclusion [3], many studies reported that digit-sucking habits could associate with malocclusion such as distoclusion [20, 25], labial tipped of maxillary incisors, lingual tipped of mandibular incisors that cause open bite [3] especially anterior open bite in children between 2 to 5 years of age [26]. In addition, some children who suck their digits intermittently may not have apparent malocclusion, others who suck more than 6 hours/day can cause a significant malocclusion [27].

Brenchley reported that the patients who have digit-sucking habit beyond the 5 to 6 years of age in the mixed and/or permanent dentition, it might cause undesired tooth movement and malocclusion [28]. Warren et al. demonstrated that primary dentition children with continuous non-nutritive sucking habit over 48 months of age showed significant changes in the dental arch, such as narrower maxillary arch width and greater overjet and open bite, compared to the control group [5].

Digit-sucking habit may be an important factor of stability and relapse of anterior open bite correction. Justus reported that his anterior open bite patients, who have treated with appliances that arrest digit-sucking habit, have good long term stability [8].

Management of digit-sucking habit is to discuss with the patients and parents/caretakers to make them understand that the habit could cause many problems. As a result, they need to terminate these habits. Reinforce method can be used, for example, if the child agree to terminate the habit, parents may give him/her some reward based on duration he/she can do [29].

The using of habit reminder is a method to be used when the patient is difficult to terminate the habit himself/herself [29]. The various methods of digit-sucking habit reminder are to apply bandage to digits and removable or fixed appliances with thumb-cribs [30].

Another kind of non-nutritive sucking habit is a pacifier-sucking habit. The children who suck pacifiers are not willing to suck their digits [31]. Pacifier-sucking time was in a reverse proportion with breast-feeding time [16].

Figure 2 Pacifier-sucking habit in a child aged 5 years

Source: http://abcnews.go.com/Entertainment/suri-cruise-pacifier

Pacifier-sucking habit could cause anterior open bite [16, 19], posterior crossbite [5, 16, 32, 33], shallow palate [19, 32] and otitis media [34, 35].

Poyak reported that if pacifier-sucking habit was stopped before 2 to 3 years of age, it would not cause dental changes permanently. However the pacifier used over 3 years of age could alter a dental development, especially over 5 years of age, the outcome of pacifier used would be more severe [32]. Melink also reported that there is an association between pacifier-sucking habit and posterior crossbite in children between 4 to 5 years of age [16].

Warren and Bishara suggested that pacifier should be used in children with digit-sucking habit because the pernicious outcomes of pacifier-sucking are less than the digit sucking habit [36].

Management of pacifier sucking habit is to instruct the parents for enhancing breast-feeding and stopping the use of pacifier at least children are the 18 months of age [16].

Tongue-thrust swallowing habit

Normal swallowing in human is different in infants and adult. In infantile swallowing, the teeth are not erupted, the tongue protrudes between maxillary and mandibular gum pads and touches the lips to generate oral seal, the upper and lower lips are apart and the mandible is stabilized by muscles of facial expression [2].

Figure 3 Normal swallowing in infants: the upper and lower lips are apart (no lip seal)

Source: Singaraju, G. S. and Kumar, C. [2]

Anatomical changes during growth and development makes the human develops a type of swallowing from infantile swallowing to adult swallowing. A normal swallowing in adults is a process combined with many phases, begin with upper and lower lips close together to generate oral seal, maxillary and mandibular teeth are in contact, the mandible is stabilized by muscle of mastication, and elevation of tongue to touch anterior palate [2].

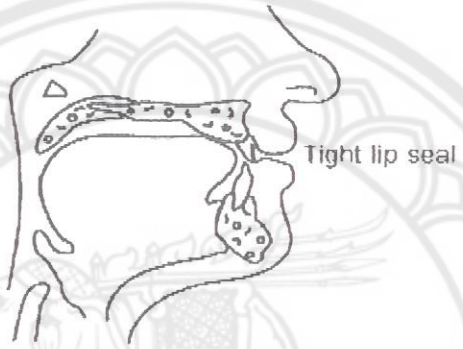

Figure 4 Normal swallowing in adults: the upper and lower lips close together (tight lip seal)

Source: Singaraju, G. S. and Kumar, C. [2]

Failure to exhibit the normal swallowing is called an abnormal swallowing, for example tongue-thrust swallowing habit.

Many causes of tongue-thrust swallowing habit in children are the large size of tongue with retrognathic mandible leading to protrusion of the tongue, enlargement of adenoid and/or palatine tonsils leading the tongue thrust during swallowing [29], improper bottle feeding, persistent thumb sucking habit, persistent tenderness of teeth or gingiva leading to change the tongue position during swallowing to avoid tender zone and functional adaptability, therefore, the tongue must be protrude to generate anterior oral seal due to missing incisors [2].

Tongue-thrust swallowing can be classified as followed [2].

1. Simple tongue-thrust swallowing habit

Simple tongue-thrust swallowing habit is defined as tongue thrusting forward to the maxillary and mandibular teeth which are in contact during swallowing. Extra-oral features usually present the swallowing without contraction of muscle of facial expression. Intra-oral features usually present anterior open bite, proclination and space between maxillary anterior teeth with normal intercuspation of posterior teeth. This type of swallowing usually relates to history of digit-sucking habits, even these habits have disappeared for many years. This could be inferred that digit sucking habits relate to open bite, therefore, the patients need to move the tongue forward to generate anterior oral seal during swallowing [2, 3].

2. Complex tongue-thrust swallowing habit

Complex tongue-thrust swallowing habit is defined as tongue thrusting forward to no contact between maxillary and mandibular teeth. Extra-oral features usually present the swallowing with contraction of muscle of facial expression and mandibular stabilization by the muscle of facial expression instead of the muscle of mastication. Intra-oral features usually present with no firm intercuspation, poor occlusal fit and probably unrevealed open bite. Moreover, this type of swallowing usually relates to chronic respiratory distress, mouth-breathing, tonsillitis and pharyngitis [2].

The differences between simple and complex tongue-thrust swallowing habits were shown in Table 1.

Table 1 The summary of differences between simple and complex tongue-thrust swallowing habits [2]

Simple tongue-thrust swallowing Habit	Complex tongue-thrust swallowing habit
1) Open bite is well defined.	1) Open bite may be absent.
2) Mandibular stabilization by muscles of mastication.	2) Mandibular stabilization by muscles of facial expression.
3) Normal intercuspation of posterior teeth	3) No firm intercuspation, poor occlusal fit of posterior teeth
4) Patients usually have history of digit sucking habits.	4) Patients usually have history of respiratory system's problems.
5) Orthodontic treatment is more simple treatment with less relapse tendency.	5) Orthodontic treatment is more difficult treatment due to more relapse tendency.
6) Occlusal equilibration may be needed.	6) Occlusal equilibration is mandatory.

3. Lateral tongue-thrust (posterior tongue-thrust) swallowing habit

Lateral tongue-thrust swallowing habit is defined as tongue thrusting the lateral aspect leading to lateral open bite. Characteristics of open bite could be divided into unilateral and bilateral open bite depended on type of tongue thrusting [2].

Figure 5 Tongue-thrust swallowing habit: the tongue moves forward to anterior teeth

Source: Sivastra, V.K. [30]

Many methods have been used for identifying tongue-thrust swallowing habit. Some interesting methods were described as followed.

1. The three different methods suggested by Rao [29]

1.1 The patients will be set in the upright position, a small amount of water will be dropped on the patients' mouth and let them swallow to determine the swallowing pattern.

1.1.1 The patients will be diagnosed as normal swallowers if their mandible is elevated with teeth are in contact, upper and lower lips touch together with no or slightly contraction and no contraction of muscles of facial expression.

1.1.2 The patients will be diagnosed as tongue-thrusters if their upper and lower teeth are no contact, upper and lower lips are pursed tightly and well defined contraction and there is contraction of muscles of facial expression.

1.2 Examiner places his/her hand over the temporalis muscle and let the patients swallow the water.

1.2.1 The patients will be diagnosed as normal swallowers if the mandible is elevated by contraction of the temporalis muscle.

1.2.2 The patients will be diagnosed as tongue-thrusters if there is no contraction of the temporalis muscle.

1.3 Examiner uses his/her thumb and digit to hold patients' lower lip and let them swallow the water.

1.3.1 The patients will be diagnosed as normal swallowers if they are able to swallow water without any problems.

1.3.2 The patients will be diagnosed as tongue-thrusters if they are unable to swallow (the water will be spilled out from their mouths) or able swallow with strong mentalis and lip contraction.

2. The method suggested by Weiss and Van Houten [37]

The patients will be set in the upright position and asked to swallow the saliva followed by swallowing a 10 ml of water. While swallowing, the examiner will depress patients' lower lips with examiner's thumbs and evaluate the function of masseter muscles with his/her index digit (Figure 6).

Figure 6 Methods of Weiss and Van Houten for identifying tongue-thrust swallowing habit; the patient was asked to swallow the saliva (A) followed by swallowing a 10 ml of water (B). The lower lip was depressed by examiner's thumbs and the masseter muscles were evaluated by using examiner's index digits while patient swallowing (C).

The patients will be diagnosed as tongue-thrusters if they express at least one of the following.

2.1 Their tongues thrust against maxillary central incisors or between maxillary and mandibular incisors.

2.2 They swallow with no contact between maxillary and mandibular teeth.

2.3 They swallow with hyperfunction of the lower lip.

The relationship between tongue-thrust swallowing habit and malocclusion are still controversial. Vaden and Deewood stated that tongue-thrust swallowing might has

too short duration to affect tooth position. The pressure from tongue-thrust swallowing affecting on the teeth is only about 1 second in each time. In a day, typically individual swallowing are about 800 times while awake and only a few times/hour while asleep. The total swallows are under 1000 times. Only 1000 times of swallowing, the pressure from tongue thrust swallowing should not be an enough force to change the oral equilibrium [38]. Proffit and Norton studied the relationship between tongue function and oral morphology. They reported that there was no evidence in transverse direction muscular activity while swallowing or other functions were related to arch form [39].

Frankel reported that tongue-thrust swallowing habit was a secondary factor of malocclusion. In anterior open bite cases, the patients needed to move their tongues forward to generate anterior oral seal. As a result the tongue could cause more severely anterior open bite [21]. Mason and Proffit described that correction of malocclusion in patients tongue-thrust swallowing habit usually showed disappearance of this habit without any therapy affecting the tongue [40].

However, many investigators consider that function of the tongue have some effects on oral equilibrium or even act as an etiological factor in malocclusion development. Alexander and Sudha found that there is a significant increase in degree of proclination at the maxillary anterior teeth. This was a result of increased electrical activity of genioglossus muscle (muscle of tongue) in tongue-thrusters compared to non-tongue thrusters [7]. A longitudinal study of Hanson and Adrianopoulos reported that the force from the tongue affect in over-eruption of posterior teeth, open bite and increased overjet [6]. Jalaly et al. indicated that the force from tongue might have an effect on oral equilibrium due to a significantly increased of overjet in the tongue-thrusters [41]. Many studies also reported the effects of tongue-thrust swallowing habit to malocclusion such as increased overjet [24, 41, 42], open bite [24, 42, 43], distoclusion [24, 42], posterior crossbite [24] and anterior teeth spacing [42].

Although the relationship between tongue-thrust swallowing habit and malocclusion was still debated, many studies pointed out that tongue-thrust swallowing habit might be a contributing factor of relapse after orthodontic treatment. Adrianopoulos and Hanson who studied in tongue-thrusters reported that there was a significant relapse of overjet in orthodontic treated patients without tongue-thrust therapy group compared to the therapy group [9]. Fotis et al. who studied in dental

patients with large overjet and deep bite founded that dental relapse as a consequence of skeletal relapse was not found in the groups with corrected tongue-thrust swallowing [10]. Bishara reported that the relapse of diastema closure occurred in a high percentage of tongue-thrust cases [11].

From many studies, tongue-thrust swallowing habit is still remains the abnormal oral habit that should be managed before dental treatments such as diastema closure and orthodontic treatment.

Management of tongue-thrust swallowing habit is to instruct patients to improve their swallowing habit to be normal. This could be done by various methods as followed [29].

1. The patient will be instructed to correct tongue position, swallowing with lips close together, while their maxillary and mandibular teeth are in contact. They need to exercise in the right position about 40 times/day by divided into 2 to 3 sessions. This method could help them to learn a new reflex at a conscious level.

2. Sugarless fruit drop was placed on the dorsal area (back side) of the tongue. The patients need to do about 1 to 2 times/day. It could guide the tongue against the palate in the correct position until complete solved the abnormal oral habit.

3. The fixed or removable appliance with tongue crib which is suitable for children are above 9 years of age, could help the patient to correct tongue position in an unconscious level.

Lip-sucking and lip-biting habits

Expression of normal lip function is an important factor for speaking, eating and especially maintaining balance of occlusion. Lip biting habit expression may extend from mild welting of the lip by the tongue to biting of the lip [29] (Figure 7).

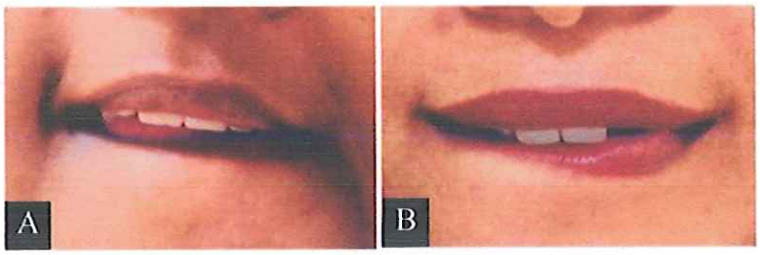

Figure 7 Lip-sucking and lip-biting habits: mild welting of the lip by the tongue (A) and biting of the lip (B)

Source: Rao, A. [29]

Lip-sucking and lip-biting habits are resulting in the inflammation and dryness of lips. Especially, in severe case will cause hypertrophy of vermillion and sometimes can cause lip crack [44] (Figure 8).

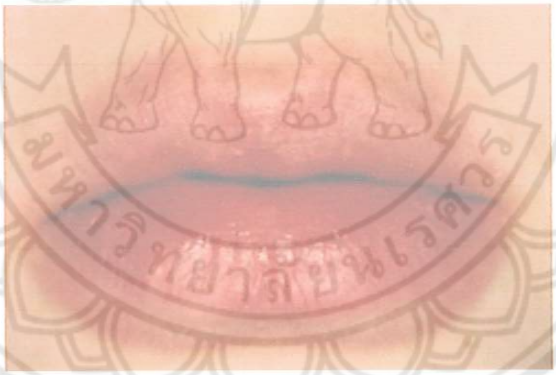

Figure 8 Dryness of the lip and hypertrophy of vermillion border

Source: http://www.rdhmag.com

It should be recognized that occurrence of dried or cracked lips may be induced by various factors. Some diseases or conditions such as xerostomia, salivary gland hypofunction, Sjogren's syndrome, rheumatoid arthritis, systemic lupus erythematosus, scleroderma, endocrine diseases and sarcoidosis affect the lips lack of moisture leading to dried or cracked lips [45]. Many drugs also induced the lips crack or dry, for example,

the drugs used in treatment of irritable bladder, obstructive pulmonary disease, hypertension and some opioid [46].

Lip-sucking and lip-biting habits usually involve lower lip [47] and may occur with or without digit-sucking habits. These habit could affect the lower lip to locate under maxillary incisors as a result labioversion of maxillary incisors, open bite and lingual collapsed of mandibular incisors [3].

Management of lip-sucking and lip-biting habits includes education for patients and parents, using of lip bumper to make it difficult to locate the lower lip under maxillary incisors, fabrication of proper overjet and using oral screen [29].

Nail-biting habit

Nail-biting is a common untreated habit seen in children. This habit is a reaction that response to psychological disorders. Some children may shift from the digit-sucking habit to the nail-biting habit [19]. The nervous children could also express the nail biting habit [3]. In contrast to other habits, an occurrence of the nail-biting habit increases in adolescence [48].

Nail biting can be investigated by inspection of patient's fingernails that most of them often show a sever manner (Figure 9) [24].

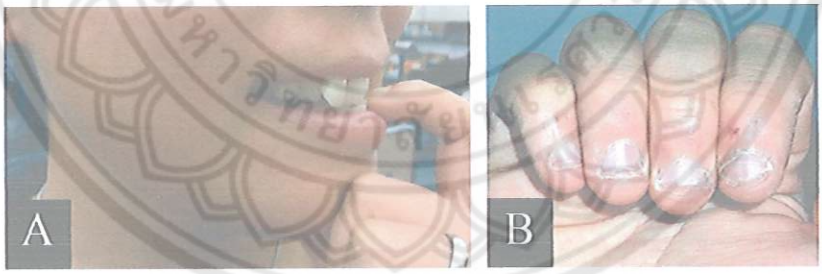

Figure 9 Nail biting habit (A) and the sever manner of fingernails (B)

Source: (A) http://www.npr.org/sections/health-shots and (B) http://yxhealth.com

Nail-biting habit is not only a cosmetic issue but also it could cause malocclusion of anterior teeth, root resorption [49], temporomandibular joint pain [50] and alteration of oro-facial development [51].

Pacan et al. reported that onychophagia (chronic nail-biting behavior) could affect a quality of life. This study evaluated the patients with and without onychophagia to answer the questionnaires for assessing a quality of life consisted of symptoms, emotions and function. Patients with onychophagia significantly increased in the symptoms, with increased the impairment of emotions and functions compared to patients without onychophagia. It was concluded that patients with onychophagia showed impaired quality of life compared to the other groups [52].

Management of nail biting habit is similar to digit sucking habit that is to discuss with the patients and parents and using of habit reminders (see the management of digit-sucking habits) [29].

Mouth-breathing habit

Breathing is one of the most important body's vital functions which move air in and out of the lung. Normal breathing takes place through the nose. This is an important factor to determine the position of tongue, mandible and head. The mouth does not usually contribute to respiratory system. Breathing through the mouth is called mouth breathing [53].

Sim and Finn classified the mouth-breathing as followed [54].

1. **Obstructive mouth-breathing**

The patient's airway is obstructed or increased in resistance to the normal flow of air through the nose. According to adenoid gland enlargement and tonsillitis, the patient may shift from nasal breathing to mouth-breathing.

2. **Habitual mouth-breathing**

Some patients continually breathe through the mouth by force of habit, although the obstructions had been removed already.

3. **Anatomical mouth-breathing**

This type of mouth-breathing can be found in patients with short upper lip which does not permit closure.

The facial appearances of mouth-breathers usually express the unique faces called "Adenoid facies"(Figure 10). The characteristics of adenoid facies include long narrow face, flaccid and short upper lip, dolichofacial skeletal pattern, nose tip superiorly, expressionless face, narrowed maxillary arch, labial flaring of maxillary incisors, mouth-breathing gingivitis and anterior open bite. It could increase caries

incidence of maxillary anterior teeth [29] because it decreases salivary auto-cleaning which is an important factor related to dental caries [55].

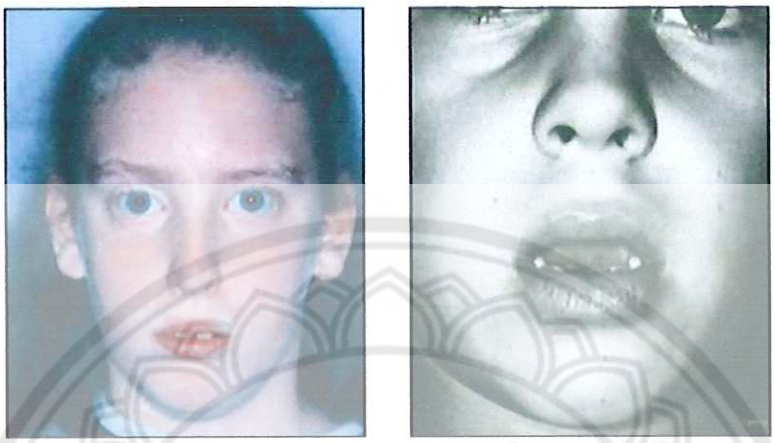

Figure 10 Adenoid facies

Source: Jefferson, Y. [56]

Various methods for identifying mouth-breathing habit will be described as followed.

1. **Mirror test (fog test)** [53]: examiner holds a double sided mirror between the nose and mouth of the patient.

1.1 The patients will be diagnosed as nasal breathers if the fogging appear on the nasal side of the mirror.

1.2 The patients will be diagnosed as mouth-breathers if fogging appears on the oral side of the mirror.

2. **Massler's water holding test** [57]: the patient will be asked to hold full of water in their mouth for 3 minutes.

2.1 The patients will be diagnosed as nasal breathers if they are able to hold the water in the mouth.

2.2 The patients will be diagnosed as mouth-breathers if they are unable to hold water in the mouth for more than 2 to 3 minutes.

3. Rashmdeep's method [58]**:** This is a more recently method used to confirm nasal breathing. The examiner will wear the cut glove, which it's cutting area covers two nostrils of the patient, on his/her left hand. After that examiner will place his/her left hand over patient's lips with exposed area of thumb is below the nostrils of patients (Figure 11) then observe the expired air from patient.

Figure 11 Rashmdeep's method for confirming nasal breathing

Source: Prajapati, D. and Nayak, R. [58]

3.1 The patients will be diagnosed as nasal-breathers if the examiner can feel an expired air from the patients easily.

3.2 The patients will be diagnosed as mouth-breathers if the examiner cannot feel an expired air from the patients.

*In case of patient is suspected to have the unilateral blockage of the nostrils, the examination will be confirmed by pressing each nostril by right index digit. The expired air from other nostril can be felt, then the patients will be diagnosed as nasal breathers.

Mouth-breathing could change the position of the tongue, mandible and head, resulted in the abnormal growth involving respiration, mastication, deglutition and speech. The major effects on oro-facial structures are forward displacement of head, long and narrow face, flattened nose, small nostril, open and/or closed and dry lips, reduced function and short upper lip, voluminous and everted lower lip, increased gonial angle (the angle between posterior and lower borders of mandible), low tongue position, open bite, crossbite and maxillary anterior teeth protrusion [59].

The first management of mouth-breather is to investigate and solve the underlying causes. The physical exercise such as the respiratory exercise and lip exercise for the habitual mouth-breather and mouth-breather with short upper lip can be used respectively. The oral screen is a removable appliance could improve the patient to breathe through the nasal airway [29].

Prevalence of abnormal oral habits

In the study of Quashie-Williams et al. carried out in 928 children aged between 4 to 15 years from both rural and urban areas in Lagos state, Nigeria. A classification of the abnormal oral habits was divided into digit sucking habit, lip-sucking and lip-biting habits and tongue-thrust swallowing habit. It showed that 34.1% of children presented at least one abnormal oral habit. The digit-sucking habit was the most frequent finding or about 50% of children with the abnormal oral habits. Followed by lip habit (sucking and lip-biting habits) was about 15% and the last one was tongue-thrust swallowing habit or about 4%. The highest prevalence of abnormal oral habits presented in 4 to 5 years of age with the decreased rate when the age increased [17].

Oropeza et al. studied in 147 Mexican children aged between 2 to 15 years, reported that 96.6% of children presented an abnormal oral habit. Most of them were the 4 years of age and the 6 to 11 years of age. The most frequent finding was the tongue-thrust swallowing habit or about 66.2% [13].

Another study of Macho et al. carried out in the 1176 children aged between 3 to 13 years in Porto city, Portugal. They reported that the children presented abnormal oral habits in 33.8%. The nail-biting habit was mostly presented or about 29.3%. Followed by lip biting habit was 7.6%. Pacifier-sucking habit, thumb-sucking habit and other digit sucking habit were found in similar prevalence or about 2.4%, 4.5 % and 2.3% respectively [14].

In Asia, Pruthi studied in the 961 children aged 12 to 15 years in Shimla city, the northern of India. The result showed that 25.9% of children presented an abnormal oral habit. The pen/pencil/nail biting habits were the most frequent finding or about 12.1%. Followed by tongue-thrust swallowing habit and mouth-breathing habit were 6.3% and 5.7% respectively. Moreover, the tongue-thrust swallowing habit and mouth-breathing showed a significant impact on malocclusion, resulting in a high frequency of spacing of anterior teeth and open bite [15].

Another study of Shetty et al., in the 1891 children aged 6 to 11 years in Rajnandgaon city, the central of India. The results showed that 33.2% of children presented an abnormal oral habit. The tongue-thrust swallowing habit was the most prevalent habit with 17.4% of children, followed by the mouth-breathing habit was about 13% of children. They found that these two habits were etiological factors for

development of malocclusion. Therefore, these habits should be diagnosed and planned for treatment at the early stage, it could reduce the malocclusion [18].

The only one study in Thailand carried out in 300 children between 5 to 7 years of age who attended for dental treatment at the faculty of dentistry, Srinakarinwirot University. The results showed that 39.7% of children presented an abnormal oral habit. The most prevalent habit was nail-biting habit with 13.6% and the tongue-thrust swallowing habit was 8% of children [4].

Several studies, many authors stated that the abnormal oral habits related to the malocclusion. Whether the primary factor or secondary factor [21], the abnormal oral habits were a very important factor to affect the success in orthodontic treatment and play an important role in retention and relapse during post-treatment period [8, 9, 10, 11, 12]. Therefore, in treatment planning dentists should pay more attention and aware of the abnormal oral habits.

From previous studies about the prevalence of abnormal oral habit in various populations, the results were still controversial due to differences in race, social condition, the geographic factor (region) and also various inclusion criteria and classifications [4, 13, 14, 15, 17, 18] (Table 2). There was only one study about the prevalence of abnormal oral habits in Thailand. The study of Kaewsutha et al. was carried out in population of the central part of Thailand [4]. However, the data were obtained by using patients' chart record that might lack of a clear examination procedure. In the population of lower northern part of Thailand, there was no study about the prevalence of abnormal oral habits. If there was a study of prevalence of abnormal oral habits in this population, it would remind dentist to increase awareness the existence of these habits in treatment planning of patients in this region. Therefore, the main objective of this study was to determine the prevalence of abnormal oral habits in the population of lower northern part of Thailand. Furthermore, this study aimed to interpret the relationship between abnormal oral habits and malocclusion.

Table 2 The summary of different factors of all reviewed prevalent studies

Authors, year	Sample	Sample size	Classification
Quashie-Williams et al., 2007 [17]	People aged 4 to 15 years in Lagos state, Nigeria	928	Digit-sucking Tongue-thrust swallowing Lip-sucking and lip-biting
Oropeza et al., 2014 [13]	Mexican people aged 2 to 15 years who attended dental school of the National Autonomous University of Mexico, Mexico city, Mexico	147	Thumb-sucking Tongue-thrust swallowing Lip-sucking Nail-biting Mouth-breathing Baby's bottle Body posture
Macho et al., 2012 [14]	People aged 3 to 13 years in Porto city, Portugal	1176	Thumb-sucking Other digit-sucking Tongue-thrust swallowing Lip-biting Lip-sucking Cheek-biting

Table 2 (cont.)

Authors, year	Sample	Sample size	Classification
Pruthi et al., 2013 [15]	People aged 12 to 15 years in Shimla city, Himachal Pradesh, India	961	Thumb-sucking Tongue-thrust swallowing Lip-biting Mouth-breathing Others (pen/pencil/nail biting)
Shetty et al., 2013 [18]	People aged 6 to 11 years in Rajnandgaon city, Chhattisgarh, India	1891	Thumb-sucking Tongue-thrust swallowing Lip-biting Nail-biting Mouth-breathing Bruxism

Table 2 (cont.)

Authors, year	Sample	Sample size	Classification
Kaewsutha et al., 2013 [4]	People aged 5 to 7 years who attended for dental treatment at faculty of dentistry Srinakarinwirot University, Bankok, Thailand	300	Digit-sucking Abnormal swallowing Lip-biting Nail-biting Mouth-breathing Bruxism Others (not described)

CHAPTER III

RESEARCH METHODOLOGY

Sample

The study was approved by Naresuan University ethical committee, Phitsanulok, Thailand (IRB No. 405/58). The patients who attended for dental treatment at dental hospital, Naresuan University from October 2015 to April 2016 without history of orthodontic treatment were evaluated the abnormal oral habits which divided into 1) digit-sucking habit, 2) pacifier-sucking habit, 3) tongue-thrust swallowing habit, 4) lip-sucking and lip-biting habits, 5) nail-biting habit 6) mouth-breathing habit, 7) other-object sucking habit and 8) other-object biting habit.

Inclusion criteria

1. The patients who resided in the lower northern part of Thailand. The provinces located in the lower part of Thailand included Kamphaeng Phet, Nakhon Sawan, Phetchabun, Pichit, Phitsanulok, Sukhothai, Tak, Uthai Thani and Uttaradit.
2. All sexes were included.
3. Aged 4 years and above.
4. Presenting at least four teeth in oral cavity
5. No history of orthodontic treatment.
6. No history of oro-facial trauma or surgery.
7. No mental retardation.
8. No respiratory infection
9. No seasonal allergy

Exclusion criteria

1. The patients who did not reside in the lower northern part of Thailand.
2. Aged under 4 years
3. Presenting less than four teeth in oral cavity
4. History of orthodontic treatment
5. History of oro-facial trauma or surgery
6. Mental retardation

7. Active respiratory infection
8. Active seasonal allergy

All patients were measured the body temperature with ear thermometer (Microlife®, version IR1DE1-1) before attend this study. When the patients' body temperature was higher or lower than normal range (36.5-37.5 °C), they were excluded from this study.

Sample size and sampling method

The size of population in the provinces located in lower northern part of Thailand, collected from Registry office, Department of Provincial Administration, was about 6,137,178 people [60].

Population size in each province was shown in Table 3 [60]

Table 3 The size of population in each province of the lower northern part of Thailand.

Provinces	Population Size
1) Kamphaeng Phet	729,522
2) Nakhon Sawan	1,072,756
3) Phetchabun	995,807
4) Phichit	547,513
5) Phitsanulok	858,988
6) Sukhothai	602,460
7) Tak	539,553
8) Uthai Thani	330,179
9) Uttaradit	460,400
Total	6,137,178

According to Yamane, sample size for precision of ± 5% for population size over one hundred thousand, the number of patients was conducted in this study was 400 patients [61].

All patients were randomized by using a non-probability sampling method. The samples were determined by purposive sampling.

Ages of the patients were classified into 5 groups followed by the modified method of Havighurst's Developmental task theory [62].

1. Childhood: 4 to 12 years
2. Adolescence: 13 to 18 years
3. Early adulthood: 19 to 29 years
4. Middle adulthood: 30 to 60 years
5. Later maturity or elderly person: over 60 years

Four hundred patients were conducted in this study, therefore the number of patients in was eighty in each group.

Data collection

The aim of study was described and the consent was informed to all patients, or parents and caretakers in the case of patients under 13 years old.

Abnormal oral habits

All data was obtained from history taking by using questionnaire for a structural interview and a clinical examination except pacifier-sucking habit, other-object sucking habit and other-object biting habit which were no method to investigate. The patient were diagnosed with the abnormal oral habits when they presented any abnormal oral habits from either questionnaire or clinical examination.

Both history taking and clinical examination will be assessed by one examiner (Mr. Udom Sasigornwong, DDS.).

1. **History taking by using questionnaires for a structural interview**

1.1 Questionnaire development

1.1.1 Constructing a set of question and questionnaire format about 1) digit-sucking habit, 2) pacifier-sucking habit, 3) tongue-thrusting habit, 4) lip-sucking and lip-biting habit, 5) nail biting habit and 6) mouth-breathing habit

1.1.2 Having the initial pool review by the expert – An instrument should cover all possible attributes of the concept intended to measure. It was more or less subjective and it was practically verified by the group of experts. For this study, the selected experts were chosen in the fields as orthodontics, pediatric dentistry and

occlusion. The questionnaire was evaluated for content validity by item correlation and construct validity by factor analysis. The pilot study was tried out the questionnaires in 30 patients with a cognitive interview. The reliability test for the questionnaire was assessed by test-retest with item-total correlation and a test for internal consistency by Cronbach's coefficient alpha.

1.2 Use of questionnaire

All patients were interviewed by one examiner to complete the questionnaires to detect the abnormal oral habits. In the case of children under 12 years of age, parents or caretakers were asked to complete the questionnaires on behalf of their children.

The diagnosis of patient with abnormal oral habits by using the questionnaire was difference between the report of prevalence and the prevalence used to interpret their relation to malocclusion. In the report of prevalence, the presence of abnormal oral habits was diagnosed when the patients gave a history of abnormal oral habit within the range of their age group only. For example, a 25-year-old man who was classified in the early adulthood presented a history of mouth-breathing habit during the 14-16 years of age. This patient was not diagnosed as a mouth-breather because he did not present the habit in the range of early adulthood (19-29 years) which was his present age group. Since the duration of abnormal oral habits influenced to the occurrence of malocclusion [7, 16], the prevalence used for interpretation the relationship was diagnosed when the patients gave a history of abnormal oral habits over 4 years of age without limiting in the range of their age group.

2. Clinical examination:

2.1 Digit-sucking habit

Digit-sucking habit was investigated by inspection of patients' digits. The patients were diagnosed as digit-suckers when their digits expressed calluses and/or blisters [23].

2.2 Tongue-thrust swallowing habit

Tongue-thrust swallowing habit was investigated with modifying the method suggested by Weiss and Van Houten [37].

The patients were set in the upright position and asked to swallow the saliva followed by swallowing a 10 ml of water. While swallowing, the examiner

depressed the patients' lower lips with the examiner's thumbs (Figure 6). The patients were diagnosed as tongue-thrusters when they present at least one of the following characteristics.

2.2.1 Their tongues thrust against maxillary central incisors or between maxillary and mandibular incisors.

2.2.2 They swallowed with no contact between maxillary and mandibular teeth.

2.2.3 They swallowed with hyperfunction of the lower lip.

This method was done in triplicate. If the patients presented at least one of the above characteristics for twice or over, they would be diagnosed as tongue-thrusters.

2.3 Lip-sucking and lip-biting habits

Lip-sucking and lip-biting habits were investigated by inspection of patients' lips. The lip-suckers or lip biters may present the following characteristics; inflammation of lips, dryness of lips, lip crack and hypertrophy of vermillion border [44]. Due to the occurrence of dried or cracked lip could be induced by various factors, the patients were diagnosed as lip-suckers or lip-biters when they presented at least three of the above characteristics.

2.4 Nail-biting habit

Nail-biting habit was investigated by inspection of patient's fingernails. The patients were diagnosed as nail-biters when their fingernails show a sever manner [24].

2.5 Mouth-breathing habit

Mouth-breathing habit was investigated by modifying the Rashmdeep's method which is a method to confirm nasal breathing [58].

The examiner wore the cut glove, which the cutting area covered two nostrils of the patient, on his/her left hand. After that the examiner placed his left hand over patient's lips with the cut area of thumb was below the nostrils of patients (Figure 10) then observed the expired air from patient.

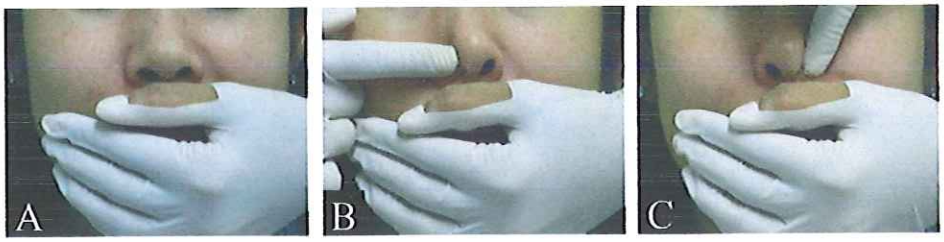

Figure 12 **Modified Rashmdeep's method for confirming nasal breathing; examiner placed his left hand with the exposed area of cutting glove was below nostrils of the patient (A). The patient's right and left nostrils were pressed by examiner's right index finger to find unilateral blockage of nostril (B and C).**

2.5.1 The patients were diagnosed as nasal-breathers when the examiner could feel an expired air from the patients easily.

2.5.2 The patients were diagnosed as mouth-breathers when the examiner could not feel an expired air from the patients.

In case of patients were suspected to have unilateral blockage of the nostrils, the examination confirmed by pressing each nostril by using a right index digit. When the expired air from another nostril could be felt, the patients were diagnosed as nasal breathers.

The method of Gay et al. study to detect an adult capacity in a breath holding duration reported that the mean breath-hold time were 25 seconds in the patients who were the heavy smokers, obstructive pulmonary disease (COPD) and congestive heart failure (CHF). Other patients' mean breath-hold time were 45 seconds [63].

According to Gay et al., the duration which examiner placed his left hand over patient's lips was 25 seconds for patients who were heavy smokers or have obstructive pulmonary disease (COPD) or congestive heart failure (CHF). Other patients were placed over the lips for 45 seconds.

This method was done in triplicate. If the examiner could not feel an expired air from the patients along that time twice or over, the patients were diagnosed as mouth-breathers.

*It was cautioned that there is a risk during the process of this method. The mouth-breathing patients may breathe difficultly. For the safety of patients, they were asked to raise their right or left hand when they felt uncomfortable or unable to breathe during the examination before the examination was performed. If the patients raised their hands, the examination would be stopped.

Both history taking by using questionnaires for a structural interview and clinical examination were conducted in a pilot study for 30 patients. The number of patients were 6 patients in each age group.

Clinical examination of malocclusion was also investigated in this study included Class II molar relationship (distoclusion), Class III molar relationship (mesioclusion), protrusion of maxillary incisors, large overjet, anterior open bite, posterior open bite, anterior crossbite and posterior crossbite.

Malocclusion

1. Molar relationships

Molar relationships were defined by using Angle's classification [64]. The classification is based on the relationship between mesiobuccal cusp of maxillary first molar and buccal groove of mandibular first molar. In the case of primary-dentition patients, molar relationships were classified with maxillary and mandibular deciduous molars.

1.1 Class II molar relationship

Class II molar relationship was defined when the mesiobuccal cusp of maxillary first molar locates anterior to the buccal groove of mandibular first molar.

1.2 Class III molar relationship

Class II molar relationship was defined when the mesiobuccal cusp of maxillary first molar locates posterior to the buccal groove of mandibular first molar.

2. Protrusion of maxillary incisors

The maxillary incisors protrusion was defined when the two conditions were found: 1) the upper lip was prominent and everted and 2) the upper lip was separated more than 3 to 4 mm from the lower lip at the rest position [65].

3. Large overjet

Overjet means the length of horizontal overlap from maxillary to mandibular incisors. Large overjet was diagnosed when the length of overlap from maxillary to mandibular incisors was greater than 3.0 mm [65].

4. Anterior open bite

Anterior open bite was examined by vertical overlap between maxillary and mandibular incisors. Failure to overlap between maxillary and mandibular incisors was diagnosed as anterior open bite [65]

5. Posterior open bite

Failure of occlusion between maxillary and mandibular posterior teeth either unilateral or bilateral was diagnosed as posterior open bite [65].

6. Anterior crossbite

Anterior crossbite was diagnosed when mandibular incisors were located in front of maxillary incisors [65].

7. Posterior crossbite

When maxillary posterior teeth were located at the buccal or lingual position compared to mandibular posterior teeth, posterior crossbite were diagnosed [66].

Data analysis

Obtained data was analyzed by computer software; SPSS (Version 17.0, Copyright) 1993-2007, SPSS Inc., Chicago, United States of America. The presences of abnormal oral habit were reported with the descriptive statistics. One-Way ANOVA was used for identifying the difference of abnormal oral habits between ages and sexes. Logistic regression was used for identifying relationship and quantifying how strongly the presence or absence of each abnormal oral habit is associated with the presence or absence of malocclusion. This was performed by using the number of patients who presented malocclusion without habit as the reference compared to the number of patients who presented malocclusion with habit, then the calculated data was shown in term of odd ratio (OR). All statistics were conducted by using 95% confident interval. (P-value < 0.05)

Prevalence calculation [67]

Prevalence (P) of abnormal oral habits in this study was calculated as followed.

$$P = \frac{\text{Number of people with abnormal oral habits at the specified time x100}}{\text{Number of patients who have come for dental treatment at the specified time}}$$

Instruments

Questionnaire for a structural interview and a clinical examination form were used as the instruments for the assessment of abnormal oral habit and its relation to malocclusion (APPENDIXES E and F).

CHAPTER IV

RESULTS AND DISCUSSION

Results

Prevalence of abnormal oral habits

Four hundred patients which were included in this study, 169 (42.3%) were males and 231 (57.7%) were females. Mean age of the samples was 31.2 ± 21.9 years. Distribution of ages and sexes of the patients was shown in Table 4.

Three hundred and two patients presented at least one abnormal oral habit (75.5%). In addition, one patient could present only one until five habits (Table 5).

Table 4 Distribution of patients according to ages and sexes

	Male N (%)	Female N (%)	Total N (%)	Mean age ± SD
Childhood (4-12)	47 (58.8)	33 (41.2)	80 (20)	8.3 ± 2.6
Adolescence (13-18)	28 (35.0)	52 (65.0)	80 (20)	16.0 ± 1.7
Early adulthood (19-29)	35 (43.8)	45 (56.2)	80 (20)	21.8 ± 3.0
Middle adulthood (30-60)	26 (32.5)	54 (67.5)	80 (20)	43.6 ± 10.0
Elderly person (over 60)	33 (41.3)	47 (58.7)	80 (20)	66.4 ± 5.4
Total	169 (42.3)	231 (57.7)	400 (100)	31.2 ± 21.9

Table 5 Prevalence of abnormal oral habit(s)

	Number of patients	Percent
No habit	98	24.5
One habit	171	42.8
Two habits	77	19.3
Three habits	35	8.8
Four habits	13	3.3
Five habits	6	1.5
Total	400	100.0

This study found many habits' characteristics such as the tongue thrusting between maxillary and mandibular incisors in a tongue-thruster, lip inflammation and bite mark in a lip-biter, a sever manner in certain digits in a nail-biter and long narrow face with flaccid and short upper lip in a mouth-breather (Figure 13).

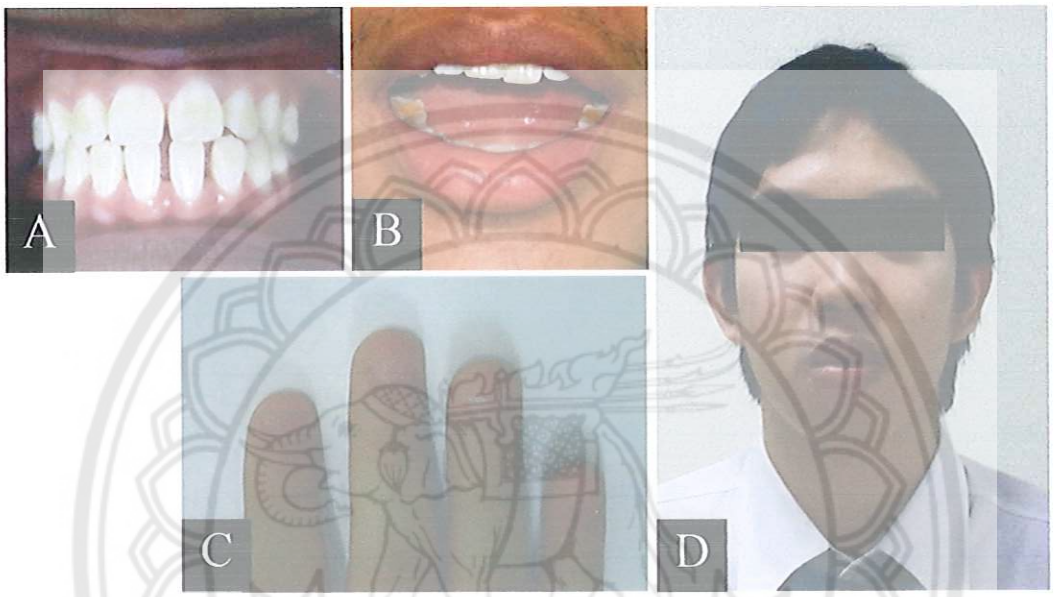

Figure 13 **Characteristics of certain abnormal oral habits: tongue-thrust between maxillary and mandibular incisors in a tongue-thrusters (A), dried, cracked and inflamed lips in a lip-biter (B), sever manner in a nail-biter (C) and Adenoid facies in a mouth-breather (D).**

The most prevalent habit was tongue-thrust swallowing habit or about 62.3%. The second was lip-sucking and lip-biting habits which were 25.3%. Mouth-breathing habit was 14.3% followed by nail-biting habit which was 11.8%. The prevalence of other-object biting habit, digit-sucking habit and other-object sucking habit was found 5.8%, 4.0% and 3.0% respectively. The least prevalent habit was pacifier-sucking habit which was found only 0.3%. In addition, the objects which were suck or bit included towels, clothes, pens, pencils, and amulets. The prevalence of each abnormal oral habit was shown in Figure 14, 15 and Table 6.

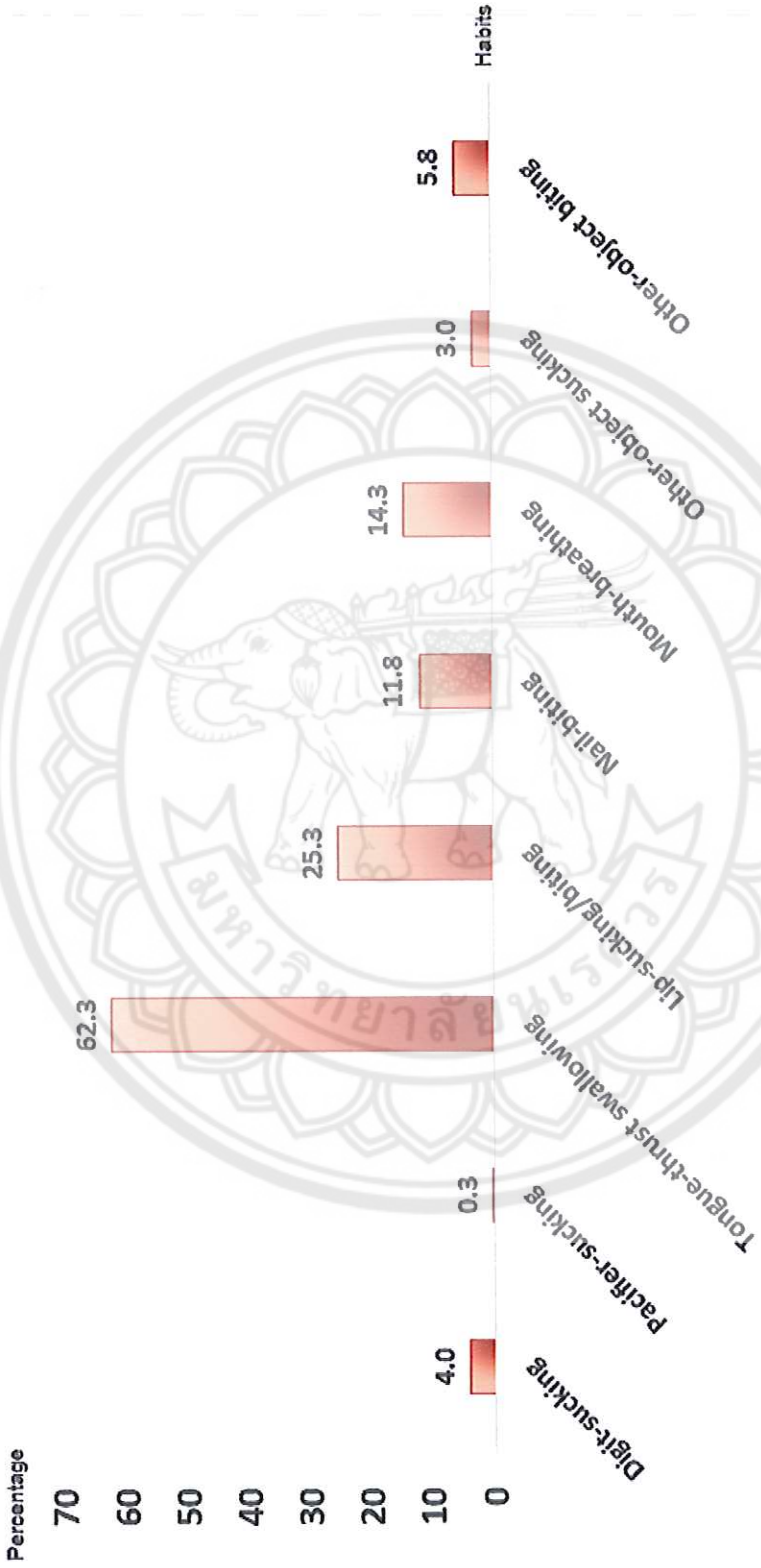

Figure 14 Prevalence of abnormal oral habits (%)

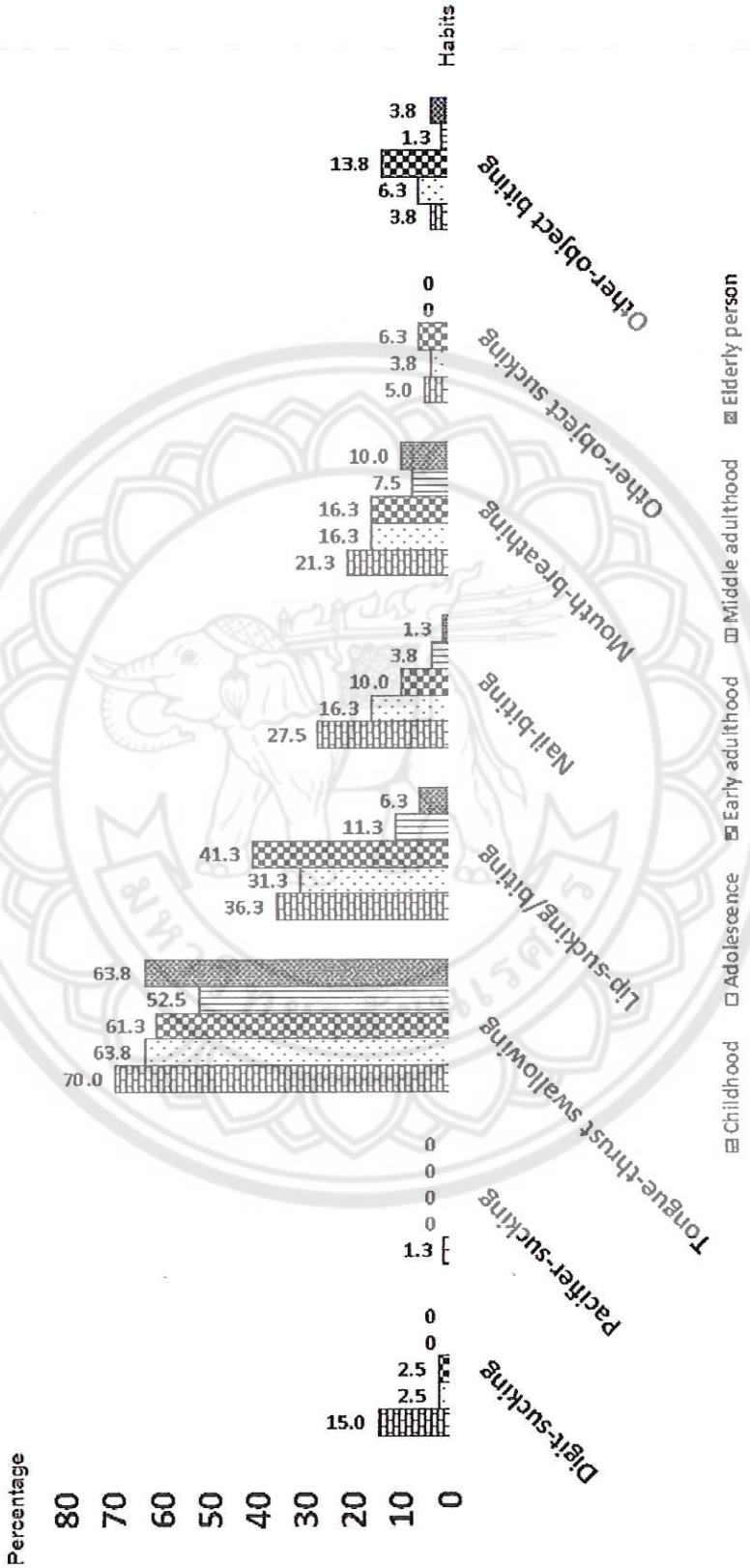

Figure 15 Prevalence of abnormal oral habits according to ages (%)

Table 6 Prevalence of abnormal oral habits according to ages and sexes

	Number of patients presenting the abnormal oral habits (N (%))																							
	Digit-sucking			Pacifier-sucking			Tongue-thrust swallowing			Lip-sucking and lip-biting			Nail-biting			Mouth-breathing			Other-object sucking			Other-object biting		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Childhood (4-12)	9 (16.1)	3 (9.1)	12 (15.0)	0	1 (3.0)	1 (1.3)	32 (68.1)	24 (72.7)	56 (70.0)	14 (29.8)	15 (45.5)	29 (36.3)	8 (17.0)	14 (42.4)	22 (27.5)	10 (21.3)	7 (21.2)	17 (21.3)	2 (4.3)	2 (6.1)	4 (5.0)	1 (2.1)	2 (6.1)	3 (3.8)
Adolescence (13-18)	1 (3.6)	1 (1.9)	2 (2.5)	0	0	0	18 (64.3)	33 (63.5)	51 (63.8)	9 (32.1)	16 (30.8)	25 (31.3)	5 (17.9)	8 (15.4)	13 (16.3)	4 (14.3)	9 (17.3)	13 (16.3)	1 (3.6)	2 (3.8)	3 (3.8)	1 (3.6)	4 (7.7)	5 (6.3)
Early adulthood (19-29)	0	2 (4.4)	2 (2.5)	0	0	0	19 (54.3)	30 (66.7)	49 (61.3)	16 (45.7)	17 (37.8)	33 (41.3)	1 (2.9)	7 (15.6)	8 (10.0)	3 (8.6)	10 (22.2)	13 (16.3)	1 (2.9)	4 (8.9)	5 (6.3)	7 (20.0)	4 (8.9)	11 (13.8)
Middle adulthood (30-60)	0	0	0	0	0	0	14 (53.8)	28 (51.9)	42 (52.5)	0	9 (16.7)	9 (11.3)	0	3 (5.6)	3 (3.8)	1 (3.8)	5 (9.3)	6 (7.5)	0	0	0	0	1 (1.9)	1 (1.3)
Elderly person (over 60)	0	0	0	0	0	0	16 (48.5)	35 (74.5)	51 (63.8)	2 (6.1)	3 (6.4)	5 (6.3)	1 (3.0)	0	1 (1.3)	3 (9.1)	5 (10.6)	8 (10.0)	0	0	0	2 (6.1)	1 (2.1)	3 (3.8)
Total	10 (5.9)	6 (2.6)	16 (4.0)	0	1 (0.4)	1 (0.3)	99 (58.6)	150 (64.9)	249 (62.3)	41 (24.3)	60 (26.0)	101 (25.3)	15 (8.9)	32 (13.9)	47 (11.8)	21 (12.4)	36 (15.6)	57 (14.3)	4 (2.4)	8 (3.5)	12 (3.0)	11 (6.5)	12 (5.2)	23 (5.8)

Relationship between ages and abnormal oral habits

The study found that the prevalence of abnormal oral habits was non-statistically significant difference between sexes (p-value = 0.14) in all groups. However, there were statistically significant difference between ages and abnormal oral habits (Table 7). The younger patients tended to present more prevalence of certain abnormal oral habits included digit-sucking habits, lip-sucking and lip-biting habits and nail-biting habit than the older patients. The childhood group showed the most prevalence of digit-sucking habit (15.0%) which was statistically significant difference to all other age groups including the middle adulthood and elderly person groups which no patient presented this habit. The prevalence of lip-sucking and lip-biting habits in the younger groups (4-29 years of age) showed a significant higher prevalence than the older groups (over 30 years of age). The prevalence of nail-biting habit reduced overtime when the patients' ages increased. This habit was mostly found in childhood (27.5%) which was significantly higher than early adulthood, middle adulthood and elderly person groups. Moreover, the adolescence group showed a significantly higher prevalence of this habit than the elderly person group. Another abnormal oral habit which was statistically significant difference between age groups was the other-object biting habit. The prevalence of this habit was mostly found in early adulthood group (13.8%) that was statistically significant higher than the middle adulthood group (1.3%).

No statistically significant difference between the age groups was found in tongue-thrust swallowing, mouth-breathing and other-object sucking habits in this study. Tongue-thrust swallowing habit was the most prevalent habit compared to the other habits with more than a half (52.5% to 70.0%) of patients in every age group. However, this wide range of prevalence was non-statistically significant difference between age groups. Mouth-breathing habit was also mostly found in the childhood group but no statistically significant difference was found between age groups. Although there was only the younger groups (4-29 years of age) presented other-object sucking habit, there were no significant differences between other groups. Pacifier-sucking habit which was the least prevalent habit in this study presented only in the childhood group, about 1.3% of patients.

Table 7 Differences of abnormal oral habits between age groups

	Number of patients presenting the abnormal oral habits (N (%))							
	Digit-sucking	Pacifier-sucking	Tongue-thrust swallowing	Lip-sucking and lip-biting	Nail-biting	Mouth-breathing	Other-object sucking	Other-object biting
Childhood (4-12)	12 (15.0)	1 (1.3)	56 (70.0)	29 (36.3)	22 (27.5)	17 (21.3)	4 (5.0)	3 (3.8)
Adolescence (13-18)	2 (2.5)	0	51 (63.8)	25 (31.3)	13 (16.3)	13 (16.3)	3 (3.8)	5 (6.3)
Early adulthood (19-29)	2 (2.5)	0	49 (61.3)	33 (41.3)	8 (10.0)	13 (16.3)	5 (6.3)	11 (13.8)
Middle adulthood (30-60)	0	0	42 (52.5)	9 (11.3)	3 (3.8)	6 (7.5)	0	1 (1.3)
Elderly person (over 60)	0	0	51 (63.8)	5 (6.3)	1 (1.3)	8 (10.0)	0	3 (3.8)

*The line(s) between N (%) of each age group indicated statistically significant difference between age groups ($p < 0.05$)

Relationship between abnormal oral habits and malocclusion

Anterior open bite was the most prevalent malocclusion (25.7%) followed by protrusion of maxillary incisors (21.5%), large overjet (20.5%) and Class III molar relationship (19.2%). In addition, class II molar relationship, anterior crossbite, posterior crossbite and posterior open bite were found 16.0%, 11.0%, 2.7% and 1.6% of patients, respectively (Table 8).

Logistic regression showed that the tongue-thrust swallowing was the most effective habit which associated with malocclusion. Strong association, the presence of this habit associated to anterior open bite (p-value = 0.000) about 11 times (OR=11.3) compared to an absence of this habit. This habit also associated with protrusion of maxillary incisors, anterior crossbite and Class III molar relationship with 2.9, 4.3, 3.7 times respectively compared to an absence of this habit. Moreover, other-object sucking was associated with the posterior crossbite with 25 times compared to an absence of this habit (Table 9).

Table 8 Number of patients presenting malocclusion according to ages and sexes

	Number of patients presenting the malocclusion (N (%))																							
	Class II molar			Class III molar			Protrusion of maxillary incisors			Large overjet			Anterior open bite			Posterior open bite			Anterior crossbite			Posterior crossbite		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Childhood (4-12)	5 (17.9)	5 (24.2)	10 (20.0)	7 (14.9)	9 (27.3)	16 (20.0)	7 (15.6)	6 (18.5)	13 (16.9)	5 (17.9)	5 (15.6)	10 (16.9)	2 (4.4)	6 (18.2)	8 (10.4)	2 (4.3)	0	2 (2.5)	9 (20.0)	4 (12.5)	13 (16.9)	1 (2.2)	0	1 (1.3)
Adolescence (13-18)	8 (28.6)	5 (15.7)	13 (20.3)	4 (14.3)	5 (9.8)	9 (11.4)	5 (17.9)	12 (23.1)	17 (21.3)	9 (32.1)	11 (21.2)	20 (25.0)	10 (35.7)	22 (42.3)	32 (40.0)	0	1 (1.9)	1 (1.3)	4 (14.3)	3 (5.8)	7 (8.8)	0	1 (1.9)	1 (1.3)
Early adulthood (19-29)	4 (11.4)	6 (14.3)	10 (13.0)	9 (25.7)	12 (28.6)	21 (27.3)	9 (25.7)	10 (22.2)	19 (23.8)	9 (25.7)	7 (15.6)	16 (20.0)	16 (45.7)	13 (28.9)	29 (36.3)	1 (2.9)	0	1 (1.3)	5 (14.3)	3 (6.7)	8 (10.0)	1 (2.9)	3 (6.7)	4 (5.0)
Middle adulthood (30-60)	1 (7.7)	2 (5.3)	3 (5.9)	5 (38.1)	8 (21.1)	11 (21.6)	6 (15.8)	10 (26.4)	16 (22.9)	4 (19.0)	9 (15.4)	13 (19.4)	1 (4.8)	9 (15.4)	10 (14.3)	1 (4.2)	0	1 (1.5)	2 (9.5)	8 (13.5)	10 (12.9)	1 (4.8)	2 (3.3)	3 (3.9)
Elderly person (over 60)	2 (28.6)	2 (15.4)	4 (20.0)	2 (28.6)	0	2 (10.0)	2 (9.5)	10 (33.3)	12 (25.5)	4 (21.1)	7 (25.9)	11 (22.4)	2 (11.1)	10 (34.5)	12 (25.5)	1 (4.5)	0	1 (2.0)	2 (11.1)	1 (3.4)	3 (6.4)	1 (4.5)	0	1 (2.0)
Total	25 (17.7)	26 (14.7)	49 (16.0)	25 (19.2)	34 (19.2)	59 (19.2)	29 (19.3)	48 (23.1)	77 (21.5)	34 (23.0)	39 (15.5)	73 (20.5)	31 (21.1)	60 (29.0)	91 (25.7)	5 (3.2)	1 (0.5)	6 (1.6)	20 (13.4)	19 (9.2)	39 (11.0)	4 (2.5)	6 (2.9)	10 (2.7)

Table 9 Logistic regression of abnormal oral habits on malocclusion

		Class II molar				Class III molar				Protrusion of maxillary incisors				Large overjet			
		N (%)	OR	Lower-upper	p-value	N (%)	OR	Lower-upper	p-value	N (%)	OR	Lower-upper	p-value	N (%)	OR	Lower-upper	p-value
Digit-sucking	No (Ref.)	59 (79.6)	1.571	0.642-3.842	0.322	36 (94.9)	0.412	0.180-0.412	0.180	67 (87.0)	1.146	0.498-2.634	0.749	65 (86.3)	1.076	0.471-2.457	0.862
	Yes	10 (20.4)				5 (5.1)				10 (13.0)				10 (13.7)			
Pacifier-sucking	No (Ref.)	48 (98.0)	0.414	0.045-3.835	0.438	37 (96.6)	0.921	0.924-0.921	0.924	74 (96.1)	1.539	0.370-6.407	0.554	71 (97.3)	1.009	0.199-5.117	0.992
	Yes	1 (2.)				2 (3.4)				3 (3.9)				2 (2.7)			
Tongue-thrust swallowing	No (Ref.)	13 (30.6)	1.762	0.378-8.538	0.111	10 (16.9)	3.695	0.001-3.695	0.001*	16 (20.8)	2.868	1.565-5.256	0.001*	27 (37.0)	1.038	0.604-1.785	0.893
	Yes	34 (69.4)				49 (83.1)				61 (79.2)				46 (63.0)			
Lip-sucking and lip-biting	No (Ref.)	26 (57.8)	1.649	0.315-3.547	0.166	39 (66.1)	1.505	0.238-1.505	0.238	52 (67.5)	1.296	0.713-2.335	0.389	50 (68.5)	1.160	0.637-2.112	0.627
	Yes	18 (42.2)				20 (33.9)				25 (32.5)				23 (31.5)			
Nail-biting	No (Ref.)	58 (77.6)	0.989	0.436-2.248	0.980	50 (84.7)	0.653	0.340-0.653	0.340	64 (83.1)	0.926	0.450-1.905	0.836	59 (80.8)	1.194	0.587-2.427	0.625
	Yes	11 (22.4)				9 (15.3)				13 (16.9)				14 (19.2)			
Mouth-breathing	No (Ref.)	46 (93.9)	0.311	0.069-1.389	0.068	44 (74.6)	1.572	0.242-1.572	0.242	66 (85.7)	0.751	0.360-1.568	0.446	65 (89.0)	0.551	0.243-1.249	0.153
	Yes	3 (6.1)				15 (25.4)				11 (14.3)				8 (11.0)			
Other-object sucking	No (Ref.)	45 (91.8)	2.183	0.515-9.261	0.290	56 (94.9)	1.769	0.498-1.769	0.498	74 (96.1)	0.829	0.203-3.344	0.792	69 (94.5)	1.492	0.468-5.449	0.545
	Yes	4 (8.2)				3 (5.1)				3 (3.9)				4 (5.5)			
Other-object biting	No (Ref.)	42 (85.7)	1.481	0.496-4.424	0.481	57 (96.6)	0.384	0.237-0.384	0.237	69 (89.6)	1.359	0.527-3.505	0.526	65 (89.0)	1.614	0.630-4.136	0.319
	Yes	7 (14.3)				2 (3.4)				8 (10.4)				8 (11.0)			

Table 9 (cont.)

		Anterior open bite				Posterior open bite				Anterior crossbite				Posterior crossbite			
		N (%)	OR	Lower-upper	p-value	N (%)	OR	Lower-upper	p-value	N (%)	OR	Lower-upper	p-value	N (%)	OR	Lower-upper	p-value
Digit-sucking	No (Ref.)	81 (89.0)	0.784	0.323-1.899	0.589	5 (83.3)	2.390	0.222-25.780	0.473	37 (94.9)	0.530	0.117-2.408	0.411	10 (100)	0.000	0.000	0.997
	Yes	10 (11.0)				1 (16.7)				2 (5.1)				0			
Pacifier-sucking	No (Ref.)	87 (95.6)	1.950	0.481-7.910	0.350	6 (100)	0.000	0.000	0.999	39 (100)	0.000	0.000	0.999	10 (100)	0.000	0.000	0.999
	Yes	4 (4.4)				0				0				0			
Tongue-thrust swallowing	No (Ref.)	7 (7.7)	11.316	4.996-25.626	0.000*	6 (100)	4.430	0.000	0.996	6 (15.4)	4.268	1.719-10.597	0.002*	2 (20)	1.963	0.386-9.973	0.416
	Yes	84 (92.3)				0				33 (84.6)				8 (80)			
Lip-sucking and lip-biting	No (Ref.)	58 (63.7)	1.741	0.962-3.150	0.067	5 (83.3)	0.228	0.012-4.231	0.321	27 (69.2)	1.583	0.729-3.444	0.247	7 (70)	0.812	0.144-4.559	0.813
	Yes	33 (36.3)				1 (16.7)				12 (30.8)				3 (30)			
Nail-biting	No (Ref.)	74 (81.3)	0.940	0.462-1.909	0.863	5 (83.3)	1.234	0.133-11.423	0.853	36 (92.3)	0.342	0.097-1.205	0.095	8 (80)	1.149	0.191-6.920	0.879
	Yes	17 (18.7)				1 (16.7)				3 (7.7)				2 (20)			
Mouth-breathing	No (Ref.)	71 (78.0)	1.463	0.751-2.850	0.263	6 (100)	0.000	0.000	0.997	33 (84.6)	0.940	0.358-2.465	0.900	8 (80)	0.715	0.100-5.114	0.738
	Yes	20 (22.0)				0				6 (15.4)				2 (20)			
Other-object sucking	No (Ref.)	87 (95.6)	0.773	0.203-2.947	0.706	6 (100)	0.000	0.000	0.998	38 (97.4)	1.039	0.109-9.874	0.974	8 (80)	24.749	2.426-252.495	0.007*
	Yes	4 (4.4)				0				1 (2.6)				2 (20)			
Other-object biting	No (Ref.)	80 (87.9)	1.649	0.643-4.225	0.298	5 (83.3)	5.406	0.294-99.511	0.256	38 (97.4)	0.244	0.030-1.962	0.185	10 (100)	0.000	0.000	0.998
	Yes	11 (12.1)				1 (16.7)				1 (2.6)				0			

* Level of significant at $p<0.05$

Discussion

Prevalence of abnormal oral habits

The present research is the first cross-sectional study investigating the prevalence of abnormal oral habits and its relationship with malocclusion among patients in the lower northern part of Thailand. We collected data from 400 dental patients (169 males and 231 females, mean age = 31.2 $\pm$ 21.9 years). This sample size was adequate to be reported of the prevalence of the people who resided in nine provinces of the lower northern part of Thailand.

The advantages of cross-sectional design which was conducted in this study included inexpensive cost, took a little time to conduct, no concerning in loss of follow up and many abnormal oral habits and various types of malocclusion could be assessed without recall of the patients. However, it also had some disadvantages. The data was obtained in one time point. It could not be concluded that the presence of habit caused the presence of malocclusion. Therefore, only 'association' could be interpreted. In addition, some factors such as duration and frequency depended on patients' memory which might be lack of obvious data.

This study was also designed to increase the accuracy of data collection by using a development of questionnaire, a gathering from expert reviews in orthodontics, pediatric dentistry and occlusion to increase the content validity. Furthermore, the pilot study was made to increase an experience of the researcher. Therefore, the content reliability of data collection should increase.

The prevalence of abnormal oral habits was reported in various population which was 25.9% [15] or reach up to 96.6% [13] of patients (Table 8). These differences might be caused of racial difference and/or inclusion criteria of sample such as age of the patients and/or classification of abnormal oral habits and/or various methods used for data collection. Moreover, it may be that each region presented a unique pattern.

About seventy five percent of patients presented at least one abnormal oral habit in this study was higher than the other similar studies which reported 39.7% [4], 33.8% [13], 25.9% [15] and 33.2% [18] of patients. but lower than the study of Oropeza et al. which reported 96.6% [13] of patients presented at least one abnormal oral habit. Differences in the data collection methods might explain the high prevalence of abnormal oral habits result of this research. In this study, history taking and clinical

examination were used to obtain the prevalence of abnormal oral habits. History taking had the great benefit especially when the habits had been disappeared. The clinical examination was designed to solve the problem in the case of lack of awareness of abnormal oral habits. Both two methods helped to increase the sensitivity of investigation.

Almost previous studies were constructed in young patients between 2 and 15 years of age [4, 13, 14, 15, 17, 18]. The only one study about the prevalence of abnormal oral habits in Thailand was carried out in the people ages 5 to 7 years of the central part of the country [4]. The reason that they studied in the specific age might be caused it was well known that abnormal oral habits usually occurred in young people [2, 19, 66]. However, this study which was constructed in patients of all ages of the lower northern part of Thailand, showed that the high prevalence of certain habits was also found in all age groups.

In the topic of classification, the abnormal oral habits in this study was classified as digit-sucking habit, pacifier-sucking habit, tongue-thrust swallowing habit, lip-sucking and lip-biting habits, nail-biting habit, mouth-breathing habit, other-object sucking habit and other-object biting habit. This was modified from Moyer's classification [3] and the study of Kaewsutha et al. which was carried out in Thailand [4]. This classification was also similar to many studies included the study of Oropeza et al. carried out in Portugal [13], the studies of Pruthi et al. [15] and Shetty el al. [18] which both of them were carried out in different regions of India.

Tongue-thrust swallowing habit was the most prevalent of abnormal oral habit in the people of the lower northern part of Thailand. All age groups presented this habit more than 50% of patients. The reason for this highest prevalence might be caused from the clinical characteristics of this habit which did not depend on duration or frequency. Therefore, it was found frequently. In addition, the patients with anterior teeth spacing or the patients with loss of anterior teeth that might develop anterior open bite needed to move their tongues forward to generate anterior oral seal [21]. As a result, the prevalence of this habit increased. The highest percentage of this habit was found in childhood group with 70.0% of patients. The similar studies of Oropeza et al. and Shetty et al. showed that most prevalence of this habit was also found in childhood patients [13, 18]. Our result showed that the prevalence of this habit decreased when the age

increased. However, the elderly person group who are more likely lost their anterior teeth might develop the tongue-thrust swallowing habit. It might be a compensation of swallowing by protruding the tongue to seal the space from the missing anterior teeth [2]. Many patients in this study were not usually aware of their tongue-thrust swallowing habit. However, their habits were revealed by clinical examination. This study agreed with the study of Shetty et al. which presented the diagnosis of tongue-thrust swallowing based on a clinical examination because patients might not aware of this habit [18].

Lip-sucking and lip-biting habits were found 25.3% of patients in this study. The childhood group presented the highest prevalence of this habit compared to the other groups or about 21.3% which approximated to the study of Quashie-Williams carried out in Nigeria (23.0%) [17]. However, this result was lower than the studies in Mexico [13] and Portugal [14], but higher than the two studies in India [18] and central part of Thailand [4]. Although previous studies were carried out only in childhood and adolescent people, our result showed that the early adulthood group was the most prevalent group presenting this habit or about 41.3% of patients which was not included in those of studies [4, 13, 14, 15, 17, 18].

The prevalence of mouth-breathing habit in this study was 14.3%. The childhood group was the most prevalent group which presented this habit with 21.3% of patients. This result was lower than the study carried out in Mexico [13] but higher than the study in the central part of Thailand [4]. Moreover, The adolescence group presented this habit about 16.3% which was lower than the study in India [15]. Since the patients with seasonal allergy were excluded from this study in order to limit the patients with a temporary mouth breathing habit, the prevalence of this habit might be lower than the previous studies.

Almost twelve percent of the patients in this study presented the nail-biting habit, which the highest prevalence was found in the childhood group. The result was not correspond to the study of Tanaka et al. which reported the highest occurrence of this habit was found in the adolescence group [48]. About twenty seven percent in the childhood group in this study was lower than the study of Oropeza et al. who studied in Mexico [13], however it was higher than the studies of Shetty et al. who studied in India [18]. The result was lower than the study of Kaewsutha et al. from the central part of Thailand [4]. Since this habit might related to psychological disorders [19], it might be

influenced from a social condition which the rural dwellers might have a lower risk of depression than the urban dwellers [68]. Therefore, the samples in this study which were constructed in the rural area tended to express this habit less than another sample who was constructed in the urban area.

Other-object biting and other-object sucking habits were found 5.8% and 3.0% of patients respectively. The most prevalence of both habits was found in the early adulthood group which was higher than the other groups. The reason might be the patients shifted from digit-sucking habit or pacifier-sucking habit to the other non-nutritive sucking/biting habits [31]. These two habits were not reported in the previous studies conducted in childhood people, therefore there was no data to compare. This study showed the adolescence group presented other-object biting habit 6.3% which was lower than the study of Pruthi et al. who studied in India (46.6%) [15].

The prevalence of digit-sucking habit was 4.0% in this study. The prevalence in childhood group (15.0%) was higher than the other studies which were carried out in the central part of Thailand [4], India [18] and Portugal [14] but lower than the studies of Nigeria [17] and Mexico [13]. This result corresponded to previous knowledge that the digit-sucking which is a non-nutritive sucking habit usually presents during the early period of life or about 3-4 years of age [3] and significantly decreased when the child was 4 years old [22].

This study found the pacifier-sucking habit only 0.3%. The only one patient presenting this habit was found in the childhood group or about 1.3%. There was no previous data to compare according to no report from our reviews.

In addition, non-statistically significant difference of abnormal oral habits between sexes which was found in this study was correspond to many studies [4, 13, 14, 15, 17, 18].

Table 10 Comparison of prevalence of the abnormal oral habits among various studies

Authors, year	Sample age, country, n	Prevalence of the abnormal oral habits (%)												
		Digit-sucking	Pacifier-sucking	Tongue-thrust swallowing	Lip-sucking and lip-biting	Nail-biting	Mouth-breathing	Other-object sucking	Other-object biting	Baby's bottle	Body posture	Cheek-biting	Bruxism	Overall
Quashie-Williams et al., 2007	4-5years, Nigeria, n=928	50.0	-	27.0	23.0	-	-	-	-	-	-	-	-	34.1
Oropeza et al., 2014	2-15 years, Mexico, n=147	23.1	-	66.2	49.3	41.9	31.8	-	-	2.01	25.2	-	-	96.6
Macho et al., 2012	3-13 years, Portugal, n=1179	9.9	-	1.4	31.2	-	-	-	-	-	-	1.4	-	33.8
Pruthi et al., 2013	12-15 years, India, n=961	8.8	-	24.5	-	46.6	22.1	-	46.6*	-	-	-	-	25.9
Shetty et al., 2013	6-11 years, India, n=1891	5.3	-	52.5	1.2	0.8	-	-	-	-	-	-	1.17	33.2
Kaewsutha et al., 2013	5-7 years, Thailand, n=300	12.6	-	20.17	3.4	34.5	1.7	-	-	-	-	-	15.97	39.7
This study	4-12 years, Thailand, n=80	15.0	1.3	70.0	36.3	27.5	21.3	5.0	3.8	-	-	-	-	83.7
	13-18 years, Thailand, n=80	2.5	0	63.8	31.3	16.3	16.3	3.8	6.3	-	-	-	-	86.2
	19-29 years, Thailand, n=80	2.5	0	61.3	41.3	10.0	16.3	6.3	13.8	-	-	-	-	76.2
	30-60 years, Thailand, n=80	0	0	52.5	11.3	3.8	7.5	0	1.3	-	-	-	-	62.5
	Over 60 years, Thailand, n=80	0	0	63.8	6.3	1.3	10.0	0	3.8	-	-	-	-	68.7
	4 years and over, Thailand, n=400	4.0	0.3	62.3	25.3	11.8	14.3	3.0	5.8	-	-	-	-	75.5

* The prevalence of the habit was obtained from others (pen/pencil/nail-biting).

Relationship between abnormal oral habits and malocclusion

Sixteen percent of Class II molar relationship in this study was higher than the study of Sridharan et al. from India [69] but lower than the study of Aslam et el. from Pakistan [70]. The prevalence of Class III molar relationship was shown in a high percentage with 19.2% of patients. This result was approximate to a systematic review of prevalence of Class III malocclusion which reported the population of Southeast Asian countries presented the high prevalence of Class III malocclusion or about 16.0% [71]. According to Thailand is located in the Southeast Asian region, it showed the approximate prevalence compared to this systematic review. Anterior open bite which was the most prevalent malocclusion in this study was found 25.7% of patients. This result corresponded to the highest percentage of tongue-thrust swallowing habit which presented a strong association with anterior open bite [24, 42, 43]. Moreover, the prevalence of anterior open bite in this study was higher than the reviewed study of Ngan and Fields [72].

Logistic regression was adjusted by age and sex to determine the relationship between the abnormal oral habits and various types of malocclusion (Table 10). The absence of abnormal oral habits were used as a reference compared to the presence of the habits. Odd ratio (OR) showed how strongly the presence of each habit is associated with the presence of malocclusion. The terms 'lower 'and 'upper' mean as the lowest effect and the highest effect of each habit on each type of malocclusion respectively.

This result showed that the tongue-thrust swallowing habit was the most influence habit which associated with malocclusion. Strong association, the presence of this habit associated with anterior open bite (p-value = 0.000) about 11 times (OR=11.3) compared to an absence of this habit. In addition, there was about only seven percent (7.7%) presenting anterior open bite without tongue-thrust swallowing habit. Therefore, the occurrence of anterior open bite might be affected from other factors such as skeletal discrepancy. This habit also associated with protrusion of maxillary incisors, anterior crossbite and Class III molar relationship with 2.9, 4.3, 3.7 times respectively compared to an absence of this habit. Moreover, other-object sucking habit was associated with posterior crossbite with 25 times compared to an absence of this habit.

The association between abnormal oral habits and malocclusion was reported in many studies. Digit sucking habit associated with large overjet and open bite [5].

Pacifier-sucking habit associated with anterior open bite [16, 19] and posterior crossbite [5, 16, 32, 33]. Tongue-thrust swallowing habit associated with proclination/protrusion of maxillary incisors [7], large overjet [6, 24, 41, 42], anterior open bite [24, 42, 43], Class II molar relationship or distoclusion [24, 42], posterior crossbite [24] and spacing of maxillary incisors [42]. Lip-sucking and lip-biting habits associated with proclination/protrusion of maxillary incisors, open bite and lingual collapse of mandibular incisors [66]. Nail-biting habit associated with malocclusion of anterior teeth [28]. Mouth-breathing habit associated with proclination/protrusion of maxillary incisors and anterior open bite [29]. This study found the tongue-thrust swallowing associated with various types of malocclusion included anterior open bite (OR = 11.3), protrusion of maxillary incisors (OR = 2.9), anterior crossbite (OR =4.3) and Class III molar relationship or mesioclusion (OR = 3.7) compared to an absence of this habit. Similar results were reported in the study of Hanson and Adrianopoulos who also found anterior open bite [6] and the study of Alexander and Sudha that found protrusion of maxillary incisors [7] whereas the association between tongue-thrust swallowing habit with anterior crossbite and Class III molar relationship has never been reported. It might be the effect of a high prevalence of Class III malocclusion in southeast Asian countries [71]. Moreover, other-object sucking habit associated with posterior crossbite (OR = 25.7) has also never been reported. The reason might be that the other-object sucking was a type of non-nutritive sucking similar to pacifier-sucking which a previous study reported that this habit associated with posterior crossbite [16].

Other types of malocclusion associated with tongue-thrust swallowing habit which were not found in this study included large overjet [24, 41, 42], Class II molar relationship [24, 42] and posterior crossbite [24]. The reason might be that most of tongue-thrusters in this study were found that their tongues protruded against both maxillary and mandibular incisors. Therefore, the overjet were not increased. In addition, it should be recognized that the frequency and duration of the abnormal oral habits which were considered as factors associated with malocclusion [5, 16, 27, 28, 32] could not be obtained in this study due to lack of obvious history which was a limitation of cross-sectional study.

It should be recognized for odd ratio usage. The obtained data did not exhibit that the presence of malocclusion appeared before or after the presence of abnormal oral

habits. Therefore, it could not be concluded that the presence of abnormal oral habits is a cause of malocclusion development. The data show that there was association between abnormal oral habits and malocclusion.

This study showed the prevalence of abnormal oral habits in the lower northern part of Thailand was different with previous studies [4, 13, 14, 15, 17, 18] constructed in various populations and regions. Therefore, it might be concluded that race, social condition, inclusion criteria, geographic factor and also methods for data collection played the important roles in these differences even the studies were carried out in different region of the same country.

CHAPTER V

CONCLUSION

Conclusion

Abnormal oral habits were commonly found in dental patients of the lower northern part of Thailand. Although most of previous studies were constructed in childhood and adolescence, this study showed that the high prevalence of certain habits was not only found in young patients, but also in those of elderly patients. Tongue-thrust swallowing habit was the most prevalent habit which associated with various types of malocclusion.

Recommendations

This is the first prevalence study of abnormal oral habits carried out in the patients of the lower northern part of Thailand. The data from this study could be used as a database for comparison to the other studies. In addition, it can be used to predict the incidence of abnormal oral habits in further studies.

Dentist should increase an awareness of the high prevalence of abnormal oral habits which was found in this study and emphasize for management of them before an orthodontic treatment. These habits could affect success and failure of the orthodontic treatment such as the occurrence of relapse during retention period [8, 9, 10, 11]. Emphasis of dentists and parents on management of abnormal oral habits in children could decrease a severity of malocclusion which lead to decrease the need of orthodontic treatment. Moreover, abnormal oral habits could alter tooth position. Therefore, its effects are not only in the fields of orthodontics, occlusions and pediatric dentistry, but they are also in all fields of dentistry such as operative treatment in treatment of diastema closure

Limitations

The cross-sectional design was a limitation of this study. The collected data especially the duration and frequency of abnormal oral habits that were the important factors influencing malocclusion [5, 32], depended on patients' memory which might be lack of accurate histories. Further studies should be designed to obtain these two factors in order to evaluate their effects on the presence of malocclusion.

Since the collected data was obtained by only one researcher, the patients/parents/caretakers might be guided for corresponding of the presence of abnormal oral habits to increase the prevalence of the abnormal oral habits. However, the pilot study increased the researcher's experience and the reliability.

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APPENDIXES

APPENDIX A THE PROTOCOL WAS APPROVED BY THE ETHICAL REVIEW COMMITTEE OF NARESUAN UNIVERSITY

COA No. 503/2015
ศก ที่ No. 503/58

คณะกรรมการจริยธรรมการวิจัยในมนุษย์
มหาวิทยาลัยนเรศวร
99 หมู่ 9 ตำบลท่าโพธิ์ อำเภอเมือง จังหวัดพิษณุโลก 65000 โทรศัพท์ 05596 8642

เอกสารรับรองโครงการวิจัย

คณะกรรมการจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยนเรศวร ดำเนินการให้การรับรองโครงการวิจัยตามแนวทางหลักจริยธรรมการวิจัยในคนที่เป็นมาตรฐานสากล ได้แก่ Declaration of Helsinki, The Belmont Report, CIOMS Guideline และ International Conference on Harmonization in Good Clinical Practice หรือ ICH-GCP

ชื่อโครงการ	: ความชุกของนิสัยที่ผิดปกติที่เกี่ยวข้องกับการสบฟันของผู้ป่วยที่เข้ารับการรักษาทางทันตกรรมในเขตภาคเหนือตอนล่าง
Study Title	: Prevalence of abnormal oral habits in dental patients of the lower northern part of Thailand
ผู้วิจัยหลัก	: ทันตแพทย์อุดม ศศิกรวงศ์
Principal investigator	: Dentist Udom Sasikornvong
สังกัดหน่วยงาน	: คณะทันตแพทยศาสตร์
วิธีพิจารณา	: แบบเร่งรัด (Expedited Review)
รายงานความก้าวหน้า	: ส่งรายงานความก้าวหน้าอย่างน้อย 1 ครั้ง/ปี หรือ ส่งรายงานฉบับสมบูรณ์เมื่อสิ้นสุดโครงการหรือสิ้นสุดอย่างน้อย 1 ปี

เอกสารรับรอง

1. AF 01-10 เวอร์ชั่น 1.0 วันที่ 10 กันยายน 2558
2. AF 02-10 เวอร์ชั่น 1.0 วันที่ 03 กันยายน 2558
3. AF 03-10 เวอร์ชั่น 1.0 วันที่ 10 กันยายน 2558
4. AF 04-10 เวอร์ชั่น 2.0 วันที่ 13 ตุลาคม 2558
5. AF 05-10 เวอร์ชั่น 2.0 วันที่ 13 ตุลาคม 2558
6. AF 06-10 เวอร์ชั่น 2.0 วันที่ 13 ตุลาคม 2558
7. สรุปโครงการเพื่อการพิจารณาทางจริยธรรมการวิจัยในมนุษย์ เวอร์ชั่น 1.0 วันที่ 10 กันยายน 2558
8. โครงการวิจัย เวอร์ชั่น 2.0 วันที่ 13 ตุลาคม 2558
9. ประวัติผู้วิจัย เวอร์ชั่น 1.0 วันที่ 03 กันยายน 2558
10. สรุปรายละเอียดโครงการใช้ยาที่ได้รับ เวอร์ชั่น 1.0 วันที่ 03 กันยายน 2558
11. แบบยินยอม เวอร์ชั่น 2.0 วันที่ 13 ตุลาคม 2558

ลงนาม .....
(นายแพทย์สันทัด ศับสุภอรัคคิกุล)
ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์
มหาวิทยาลัยนเรศวร

วันที่รับรอง	: 30 ตุลาคม 2558
Date of Approval	: October 30, 2015
วันหมดอายุ	: 30 ตุลาคม 2559
Approval Expire Date	: October 30, 2016

หมายเหตุ การรับรองนี้ให้ไว้บนพื้นฐานข้อมูลที่ได้ส่งมาพิจารณาทุกขั้นตอน (ดูรายละเอียดของเอกสารในการรับรองโครงการวิจัย)

นักวิจัยทุกท่านที่ผ่านการรับรองจริยธรรมการวิจัยต้องปฏิบัติดังต่อไปนี้

1. ดำเนินการวิจัยตามที่ระบุไว้ในโครงการวิจัยอย่างเคร่งครัด
2. ใช้เอกสารแนะนำอาสาสมัคร ใบยินยอม (และเอกสารเชิญเข้าร่วมวิจัยหรือใบโฆษณาถ้ามี) แบบสัมภาษณ์ และหรือแบบสอบถาม เฉพาะที่มีตราประทับของคณะกรรมการวิจัยในมนุษย์ เท่านั้น
3. รายงานเหตุการณ์ไม่พึงประสงค์ร้ายแรงที่เกิดขึ้นหรือการเปลี่ยนแปลงกิจกรรมวิจัยใดๆ ต่อคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ ภายในระยะเวลาที่กำหนดไว้ในวิธีดำเนินการมาตรฐาน (SOPs)
4. ส่งรายงานความก้าวหน้าต่อคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ ตามเวลาที่กำหนดเพื่อต่อใบรับรอง
5. หากการวิจัยไม่สามารถดำเนินการเสร็จสิ้นภายในกำหนด ผู้วิจัยต้องยื่นขอขยายเวลาก่อน อย่างน้อย 1 เดือน ก่อนใบรับรองหมดอายุ
6. หากการวิจัยเสร็จสมบูรณ์ผู้วิจัยต้องแจ้งปิดโครงการตามแบบฟอร์มของคณะกรรมการจริยธรรมในมนุษย์มหาวิทยาลัยนเรศวร

* รายชื่อของคณะกรรมการจริยธรรมการวิจัยในมนุษย์ เพื่อนำเสนอหน่วยงานที่ดูแลในพื้นที่ประกอบกับที่รับรองโครงการวิจัยให้เรียบร้อยแล้ว (หากโครงการมีหลายหน่วยงาน) เอกสารที่รับรองทั้งหมดจะถูกส่งไปยังผู้วิจัยหลัก

APPENDIX B PARTICIPANTS INFORMATION SHEET

AF 04-10/3.0

Naresuan University Institutional Review Board	ข้อมูลคำอธิบายสำหรับผู้เข้าร่วมในโครงการวิจัย (Information Sheet for Research Participant)

ชื่อโครงการวิจัย ความชุกของนิสัยที่ผิดปกติทางช่องปากของผู้ป่วยที่เข้ารับการรักษาทางทันตกรรมเขตภาคเหนือตอนล่าง
(Prevalence of abnormal oral habits in dental patients of the lower northern part of Thailand)

ผู้สนับสนุนการวิจัย บัณฑิตศึกษา มหาวิทยาลัยนเรศวร

ผู้ทำวิจัย
ชื่อ อุดม ศศิกรวงศ์
ที่อยู่ 20/19 ถ.วิสุทธิกษัตริย์ ต.ในเมือง อ.เมือง จ.พิษณุโลก 65000
เบอร์โทรศัพท์ 086-9333645

เรียน ผู้เข้าร่วมโครงการวิจัยทุกท่าน

ท่านได้รับเชิญให้เข้าร่วมในโครงการวิจัยนี้เนื่องจากท่านเป็นผู้ป่วยที่มีอายุตั้งแต่ 4 ปีขึ้นไป และภูมิลำเนาอยู่ในจังหวัดเขตภาคเหนือตอนล่างที่เข้ารับการรักษาทางทันตกรรม ณ โรงพยาบาลทันตกรรม มหาวิทยาลัยนเรศวร ในช่วงเดือนตุลาคม พ.ศ.2558 ถึงเดือนตุลาคม พ.ศ.2559 ซึ่งเป็นช่วงเวลาของการทำวิจัยนี้ ก่อนที่ท่านจะตัดสินใจเข้าร่วมในการศึกษาวิจัยดังกล่าว ขอให้ท่านอ่านเอกสารฉบับนี้อย่างถี่ถ้วน เพื่อให้ท่านได้ทราบถึงเหตุผลและรายละเอียดของการศึกษาวิจัยในครั้งนี้ หากท่านมีข้อสงสัยใดๆ เพิ่มเติม กรุณาซักถามจากทีมแพทย์ผู้ทำวิจัยซึ่งจะเป็นผู้สามารถตอบคำถามและให้ความกระจ่างแก่ท่านได้

ท่านสามารถขอคำแนะนำในการเข้าร่วมโครงการวิจัยนี้จากครอบครัว เพื่อน หรือแพทย์ประจำตัวของท่านได้ ท่านมีเวลาอย่างเพียงพอในการตัดสินใจโดยอิสระ ถ้าท่านตัดสินใจแล้วว่าจะเข้าร่วมในโครงการวิจัยนี้ ขอให้ท่านลงนามในเอกสารแสดงความยินยอมของโครงการวิจัยนี้

เหตุผลความเป็นมา

นิสัยที่ผิดปกติทางช่องปากมีหลายประเภท เช่น นิสัยดูดนิ้ว นิสัยดูดจุกนมปลอม นิสัยลิ้นดุนหรือกลืนนิสัยดูดริม.ผิปาก/กัดริม.ผิปาก นิสัยกัดเล็บ และนิสัยหายใจทางปาก นิสัยเหล่านี้อาจรบกวนการเจริญเติบโตและพัฒนาการของอวัยวะต่างๆบนใบหน้าและในช่องปาก เช่น ทำให้เกิดการสบฟันที่ผิดปกติ และยังส่งผลต่อความสำเร็จในการรักษาและการคงสภาพภายหลังการรักษาทางทันตกรรมจัดฟัน เช่น ทำให้ฟันกลับมาซ้อนเกอีกครั้งหลังการรักษาเสร็จสิ้นแล้วอีกด้วย

ในทางคลินิก หากทันตแพทย์ผู้ทำการรักษาไม่ประเมินนิสัยที่ผิดปกติทางช่องปากอย่างถูกต้อง การวางแผนการรักษาโดยเฉพาะอย่างยิ่งการรักษาทางทันตกรรมจัดฟันอาจมีความซับซ้อนเพิ่มมากขึ้น หรือนำไปสู่ความล้มเหลวในการรักษาได้

จากการศึกษาที่ผ่านมาหลายการศึกษาในหลายประเทศ พบว่าผู้ป่วยจำนวนมากมีนิสัยที่ผิดปกติทางช่องปากถึงร้อยละ 25.9 ถึง 96.6 แต่ข้อมูลมีที่ได้มีความแตกต่างกันในเรื่องของเชื้อชาติ ปัจจัยทางภูมิศาสตร์ และการแบ่งประเภทของนิสัยที่ผิดปกติทางช่องปากที่แตกต่างกัน ขณะที่ในประเทศไทยมีการศึกษาเกี่ยวกับความชุกของนิสัยที่ผิดปกติทางช่องปากเพียงการศึกษาเดียวซึ่งทำในกลุ่มประชากรภาคกลางของประเทศไทย และยังไม่มีการศึกษาในกลุ่มประชากรภาคเหนือตอนล่างมาก่อน ดังนั้นผู้วิจัยจึงมีจุดมุ่งหมายเพื่อศึกษาความชุกของนิสัยที่ผิดปกติทางช่องปากในกลุ่มประชากรภาคเหนือตอนล่างของประเทศไทย

<u>วัตถุประสงค์ของการศึกษา</u>

วัตถุประสงค์หลักจากการศึกษาในครั้งนี้คือเพื่อศึกษาความชุกของนิสัยที่ผิดปกติทางช่องปากในกลุ่มประชากรภาคเหนือตอนล่างของประเทศไทย

<u>วิธีการที่เกี่ยวข้องกับการวิจัย</u>

หลังจากท่าน หรือผู้ปกครองหรือผู้ดูแลของท่าน (กรณีผู้ป่วยอายุต่ำกว่า 12 ปี) ให้ความยินยอมที่จะเข้าร่วมในโครงการวิจัยนี้ ผู้วิจัยจะขอซักประวัติข้อมูลทั่วไป เพื่อคัดกรองว่าท่านมีคุณสมบัติที่เหมาะสมที่จะเข้าร่วมในการวิจัย

หากท่านมีคุณสมบัติตามเกณฑ์คัดเข้า ท่านจะได้รับการสัมภาษณ์เกี่ยวกับนิสัยที่ผิดปกติทางช่องปากที่มีอยู่ทั้งในปัจจุบันและอดีต และตรวจเกี่ยวกับนิสัยที่ผิดปกติทางช่องปากและการสบฟันที่ผิดปกติ ได้แก่ ตรวจนิ้วมือเลีย ริมฝีปาก สภาพการสบฟัน ทดสอบการกลืนและการหายใจทางปาก

<u>ความเสี่ยงที่อาจได้รับ</u>

ความเสี่ยงจากการเข้าร่วมงานวิจัยนี้มีเพียงหนึ่งอย่าง นั่นคือความเสี่ยงขณะทดสอบการนิสัยหายใจทางปาก ซึ่งจะมีการปิดปากของท่านไว้ตามระยะเวลาอันสั้นที่บุคคลสามารถกลั้นหายใจได้ซึ่งเป็นผลมาจากการศึกษาด้วยภาพรังสีส่วนคัดอาศัยคอมพิวเตอร์ (Computed tomography) แต่เพื่อความปลอดภัยของผู้เข้าร่วมวิจัย ก่อนการทดสอบผู้จัยจะให้คำแนะนำท่านว่า หากรู้สึกหายใจไม่ออก หรือหายใจลำบาก ให้ท่านยกมือข้างใดก็ได้ขึ้นมา ผู้วิจัยจะหยุดทำการทดสอบครั้งนั้นทันที

<u>ประโยชน์ที่อาจได้รับ</u>

การเข้าร่วมในโครงการวิจัยนี้อาจทำให้ท่านมีความรู้เกี่ยวกับนิสัยที่ผิดปกติทางช่องปากเพิ่มมากขึ้น โดยท่านจะได้รับคำแนะนำเกี่ยวกับผลที่อาจเกิดขึ้นจากการมีนิสัยที่ผิดปกติทางช่องปาก และคำแนะนำเกี่ยวกับวิธีการจัดการนิสัยที่ผิดปกติทางช่องปากนั้น อันจะเป็นประโยชน์ต่อท่านเองในการหยุดหรือบรรเทาผลที่เกิดขึ้นจากนิสัยที่ผิดปกติทางช่องปากนั้น

<u>ค่าใช้จ่ายของท่านในการเข้าร่วมการวิจัย</u>

ไม่มีค่าใช้จ่ายเพิ่มเติมนอกเหนือจากค่าใช้จ่ายตามปกติที่ท่านเข้ารับการรักษาทางทันตกรรม

ค่าตอบแทนสำหรับผู้เข้าร่วมวิจัย

ท่านจะไม่ได้รับเงินค่าตอบแทนจากการเข้าร่วมในการวิจัย

การปกป้องรักษาข้อมูลความลับของอาสาสมัคร

ข้อมูลที่อาจนำไปสู่การเปิดเผยตัวท่าน จะได้รับการปกปิดและจะไม่เปิดเผยแก่สาธารณชน ในกรณีที่ผลการวิจัยได้รับการตีพิมพ์ ชื่อและที่อยู่ของท่านจะได้รับการปกปิดอยู่เสมอ โดยจะใช้เฉพาะรหัสประจำโครงการวิจัยของท่าน

จากการลงนามยินยอมของท่าน ผู้ทำวิจัยสามารถเข้าไปตรวจสอบบันทึกข้อมูลทางการแพทย์ของท่านได้ แม้จะสิ้นสุดโครงการวิจัยแล้วก็ตาม หากท่านต้องการยกเลิกการให้สิทธิ์ดังกล่าว ท่านสามารถแจ้ง หรือเขียนบันทึกขอยกเลิกการให้คำยินยอม โดยส่งไปที่ พท.อุดม ศศิกรวงศ์ บ้านเลขที่ 20/19 ถ.วิสุทธิกษัตริย์ ต.ในเมือง อ.เมือง จ. พิษณุโลก 65000

จากการลงนามยินยอมของท่าน ทันตแพทย์ผู้ทำวิจัยสามารถขอรายละเอียดของท่านที่เกี่ยวกับการเข้าร่วมโครงการวิจัยนี้ได้

สิทธิ์ของผู้เข้าร่วมในโครงการวิจัย

ในฐานะที่ท่านเป็นผู้เข้าร่วมในโครงการวิจัย ท่านจะมีสิทธิ์ดังต่อไปนี้

1. ท่านจะได้รับทราบถึงลักษณะและวัตถุประสงค์ของการวิจัยในครั้งนี้
2. ท่านจะได้รับการอธิบายเกี่ยวกับระเบียบวิธีการของการวิจัยทางการแพทย์ รวมทั้งยาและอุปกรณ์ที่ใช้ในการวิจัยครั้งนี้
3. ท่านจะได้รับการอธิบายถึงความเสี่ยงและความไม่สบายที่จะได้รับจากการวิจัย
4. ท่านจะได้รับการอธิบายถึงประโยชน์ที่ท่านอาจจะได้รับจากการวิจัย
5. ท่านจะได้รับการเปิดเผยถึงทางเลือกในการรักษาด้วยวิธีอื่น ยา หรืออุปกรณ์ซึ่งมีผลดีต่อท่านรวมทั้งประโยชน์และความเสี่ยงที่ท่านอาจได้รับ
6. ท่านจะได้รับทราบแนวทางในการรักษา ในกรณีที่ทบโรคแทรกซ้อนภายหลังการเข้าร่วมในโครงการวิจัย
7. ท่านจะมีโอกาสได้ซักถามเกี่ยวกับงานวิจัยหรือขั้นตอนที่เกี่ยวข้องกับงานวิจัย
8. ท่านจะได้รับทราบว่าการยินยอมเข้าร่วมในโครงการวิจัยนี้ ท่านสามารถขอถอนตัวจากโครงการเมื่อใดก็ได้ โดยผู้เข้าร่วมในโครงการวิจัยสามารถขอถอนตัวจากโครงการโดยไม่ได้รับผลกระทบใด ๆ ทั้งสิ้น
9. ท่านจะได้รับเอกสารข้อมูลคำอธิบายสำหรับผู้เข้าร่วมในโครงการวิจัยและสำเนาเอกสารในยินยอมนี้ทั้งลายเซ็นและวันที่
10. ท่านมีสิทธิ์ในการตัดสินใจว่าจะเข้าร่วมในโครงการวิจัยหรือไม่ก็ได้ โดยปราศจากการใช้อิทธิพลบังคับขู่เข็ญหรือการหลอกลวง

หากท่านไม่ได้รับการชดเชยอันควรต่อการบาดเจ็บหรือเจ็บป่วยที่เกิดขึ้นโดยตรงจากการวิจัย หรือท่านไม่ได้รับการปฏิบัติตามที่ปรากฏในเอกสารข้อมูลคำอธิบายสำหรับผู้เข้าร่วมในการวิจัย ท่านสามารถร้องเรียนได้ที่

คณะกรรมการจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยนเรศวร หมายเลขโทรศัพท์ 055968642 โทรสาร 055968637 ในเวลาราชการ

ขอขอบคุณในการร่วมมือของท่านมา ณ ที่นี้

APPENDIX C INFORMED CONSENT FORM

AF 05-10/3.0

Naresuan University Institutional Review Board	ข้อมูลคำอธิบายสำหรับผู้เข้าร่วมในโครงการวิจัย (Information Sheet for Research Partidpant)

การวิจัยเรื่อง ความชุกของนิสัยที่ผิดปกติทางช่องปากของผู้ป่วยที่เข้ารับการรักษาทางทันตกรรมเชด ภาคหนึ่งตอนล่าง

วันให้คำยินยอม วันที่.....เดือน.....พ.ศ.....

ข้าพเจ้า นาย/นาง/นางสาว.....ได้อ่านรายละเอียดจากเอกสารข้อมูลสำหรับผู้เข้าร่วมโครงการวิจัยวิจัยที่แนบมาฉบับวันที่..... และข้าพเจ้ายินยอมเข้าร่วมโครงการวิจัยโดยสมัครใจ

ข้าพเจ้าได้รับสำเนาเอกสารแสดงความยินยอมเข้าร่วมในโครงการวิจัยที่ข้าพเจ้าได้ลงนาม และ วันที่ พร้อมด้วยเอกสารข้อมูลสำหรับผู้เข้าร่วมโครงการวิจัย ทั้งนี้ก่อนที่จะลงนามในใบยินยอมให้ทำการวิจัยนี้ ข้าพเจ้าได้รับการอธิบายจากผู้วิจัยถึงวัตถุประสงค์ของการวิจัย ระยะเวลาของการทำวิจัย วิธีการวิจัย อันตราย หรืออาการที่อาจเกิดขึ้นจากการวิจัย รวมทั้งประโยชน์ที่จะเกิดขึ้นจากการวิจัย ข้าพเจ้ามีเวลาและโอกาสเพียงพอในการซักถามข้อสงสัยจนมีความเข้าใจอย่างดีแล้ว โดยผู้วิจัยได้ตอบคำถามต่าง ๆ ด้วยความเต็มใจไม่ปิดบังซ่อนเร้นจนข้าพเจ้าพอใจ

ผู้วิจัยรับรองว่าจะไม่มีความเสี่ยงใดเพิ่มเติมนอกเหนือจากความเสี่ยงจากการหายใจลำบากจากการทดสอบการหายใจทางปาก ซึ่งท่านสามารถยกนิ้วเพื่อเป็นสัญญาณให้ผู้ทำวิจัยหยุดทำการทดสอบได้ทันทีดังที่ได้แจ้งไว้แล้ว

ข้าพเจ้าได้อ่านข้อความข้างต้นและมีความเข้าใจดีทุกประการแล้ว ยินดีเข้าร่วมในการวิจัยด้วยความเต็มใจ จึงได้ลงนามในเอกสารแสดงความยินยอมนี้

.....ลงนามผู้ให้ความยินยอม

(.....)

วันที่ .....เดือน.....พ.ศ.....

ข้าพเจ้าได้อธิบายถึงวัตถุประสงค์ของการวิจัย วิธีการวิจัย อันตราย หรืออาการไม่พึงประสงค์หรือความเสี่ยงที่อาจเกิดขึ้นจากการวิจัย หรือจากยาที่ใช้ รวมทั้งประโยชน์ที่จะเกิดขึ้นจากการวิจัยอย่างละเอียด ให้ผู้เข้าร่วมในโครงการวิจัยตามข้างต้นได้ทราบและมีความเข้าใจดีแล้ว พร้อมลงนามลงในเอกสารแสดงความยินยอมด้วยความเต็มใจ

.....ลงนามผู้ทำวิจัย

(พันตรีแพทย์อุดม ศศิกรวงศ์)

วันที่ .....เดือน.....พ.ศ.....

.....ลงนามพยาน

(.....)

วันที่ .....เดือน.....พ.ศ.....

APPENDIX D QUESTIONNAIRE FOR A STRUCTURAL INTERVIEW

General Information

Date: ...../...../.....

DN: ..... Sex.....

Date of birth: ...../...../..... Age: .....years

Place of birth: .....

Address: .....

.....

Occupation: ..... Salary: .....

Medical History

Past and present systemic medical condition: .....

.....

Current medication: .....

History of orthodontic treatment: .....

History of orofacial trauma, orofacial surgery: .....

.....

Body temperature: ..... ° C

Questionnaire for a Structural Interview

for Abnormal Oral Habit Assessment

A set of questions about abnormal oral habits

1) Digit-sucking habit

A. Do you usually suck your digit? ☐ Yes ☐ No

(ท่านดูดนิ้วตนเองอยู่เป็นประจำหรือไม่)

- How long do you suck your digit? .....

(ท่านดูดนิ้วมาเป็นระยะเวลานานเท่าใด)

- How often do you suck your digit? .....

(ท่านดูดนิ้วบ่อยเพียงใด)

B. Did you usually suck your digit in the past? ☐ Yes ☐ No

(ในอดีตท่านเคยดูดนิ้วตนเองอยู่เป็นประจำหรือไม่)

- What age did you stop sucking your digit? .....

(ท่านเลิกดูดนิ้วเมื่ออายุเท่าใด)

- How long did you suck your digit? .....

(ในอดีตท่านเคยดูดนิ้วมาเป็นระยะเวลานานเท่าใด)

- How often did you suck your digit? .....

(ในอดีตท่านเคยดูดนิ้วบ่อยเพียงใด)

Diagnosis: ☐ Digit-sucker ☐ Non-digit sucker

2) Pacifier-sucking habit

A. Do you usually suck the pacifier? ☐ Yes ☐ No

(ท่านดูดจุกนมปลอมอยู่เป็นประจำหรือไม่)

- How long do you suck the pacifier? .....

(ท่านดูดจุกนมปลอมมาเป็นระยะเวลานานเท่าใด)

- How often do you suck the pacifier? .....

(ท่านดูดจุกนมปลอมบ่อยเพียงใด)

B. Did you usually suck the pacifier in the past? ☐ Yes ☐ No

(ในอดีตท่านดูดจุกนมปลอมอยู่เป็นประจำหรือไม่)

- What age did you stop sucking the pacifier? .....

(ท่านเลิกดูดจุกนมปลอมเมื่ออายุเท่าใด)

- How long did you suck the pacifier? .....

(ในอดีตท่านเคยดูดจุกนมปลอมเป็นระยะเวลานานเท่าใด)

- How often did you suck the pacifier? .....

(ในอดีตท่านเคยดูดจุกนมปลอมบ่อยเพียงใด)

Diagnosis: ☐ Pacifier-sucker ☐ Non-pacifier sucker

C. Do you usually suck other objects? ☐ Yes ☐ No

(ท่านดูดวัตถุ หรือสิ่งของอื่นๆอยู่เป็นประจำหรือไม่)

- What object do you usually suck? .....

(วัตถุ หรือสิ่งของอื่นๆที่ท่านดูดคืออะไร)

- How long do you suck that object? .....

(ท่านดูดวัตถุ หรือสิ่งของดังกล่าวมาเป็นระยะเวลานานเท่าใด)

- How often do you suck that object? .....

(ท่านดูดวัตถุ หรือสิ่งของดังกล่าวบ่อยเพียงใด)

D. Did you usually suck other objects in the past? ☐ Yes ☐ No

(ในอดีตท่านดูดวัตถุ หรือสิ่งของอื่นๆเป็นประจำหรือไม่)

- What object did you usually suck? .....

(วัตถุ หรือสิ่งของอื่นๆที่ท่านเคยดูดในอดีตคืออะไร)

- What age did you stop sucking that object? .....

(ท่านเลิกดูดวัตถุ หรือสิ่งของดังกล่าวเมื่ออายุเท่าใด)

- How long did you suck that object? .....

(ในอดีตท่านเคยดูดวัตถุ หรือสิ่งของดังกล่าวมาเป็นระยะเวลานานเท่าใด)

- How often did you suck that object? .....

(ในอดีตท่านเคยดูดวัตถุ หรือสิ่งของดังกล่าวบ่อยเพียงใด)

Diagnosis: ☐ Other object-sucker ☐ Non-other object sucker

3) Tongue-thrust swallowing habit

A. Do you usually protrude the tongue against the teeth during swallowing?

(ในอดีตท่านยื่นลิ้นมาดุนฟันขณะกลืนอยู่เป็นประจำหรือไม่) ☐ Yes ☐ No

- How long do you protrude the tongue against the teeth during swallowing? .....

(ท่านยื่นลิ้นมาดุนฟันขณะกลืนมาเป็นระยะเวลานานเท่าใด)

- How often do you protrude the tongue against the teeth during swallowing? .....

(ท่านยื่นลิ้นมาดุนฟันขณะกลืนบ่อยเพียงใด)

B. Did you usually protrude the tongue against the teeth during swallowing in the past?

(ในอดีตท่านยื่นลิ้นมาดุนฟันขณะกลืนอยู่เป็นประจำหรือไม่) ☐ Yes ☐ No

- What age did you stop protruding the tongue against the teeth during swallowing? .....

(ท่านเลิกยื่นลิ้นมาดุนฟันขณะกลืนเมื่ออายุเท่าใด)

- How long did you protrude the tongue against the teeth during swallowing? .....

(ในอดีตท่านเคยยื่นลิ้นมาดุนฟันขณะกลืนมาเป็นระยะเวลานานเท่าใด)

3.2 How often did you protrude the tongue against the teeth during swallowing? .....

(ในอดีตท่านเคยยื่นลิ้นมาดุนฟันขณะกลืนบ่อยเพียงใด)

Diagnosis: ☐ Tongue thruster ☐ Normal swallower

4) Lip-sucking and lip-biting habits

A. Do you usually suck or bite your lip? ☐ Yes ☐ No

(ท่านกัดเม้ม หรือดูดริมฝีปากอยู่เป็นประจำหรือไม่)

- How long do you suck or bite your lip? .....

(ท่านกัดเม้ม หรือดูดริมฝีปากมาเป็นระยะเวลานานเท่าใด)

- How often do you suck or bite your lip? .....

(ท่านกัดเม้ม หรือดูดริมฝีปากบ่อยเพียงใด)

B. Did you usually suck or bite your lip in the past? ☐ Yes ☐ No

(ในอดีตท่านกัด เม้ม หรือดูดริมฝีปากอยู่เป็นประจำหรือไม่)

- What age did you stop sucking or biting your lip? .....

(ท่านเลิกกัด เม้ม หรือดูดริมฝีปากเมื่ออายุเท่าใด)

- How long did you suck or bite your lip? .....

(ในอดีตท่านเคยกัด เม้ม หรือดูดริมฝีปากมาเป็นระยะเวลานานเท่าใด)

- How often did you suck or bite your lip? .....

(ในอดีตท่านกัด เม้ม หรือดูดริมฝีปากบ่อยเพียงใด)

Diagnosis: ☐ Lip-sucker/biter ☐ Non-lip sucker/biter

5) Nail-biting habit

A. Do you usually bite your fingernail? ☐ Yes ☐ No

(ท่านกัดเล็บตนเองอยู่เป็นประจำหรือไม่)

- How long do you bite your fingernail? .....

(ท่านกัดเล็บมาเป็นระยะเวลานานเท่าใด)

- How often do you bite your fingernail? .....

(ท่านกัดเล็บบ่อยเพียงใด)

B. Did you usually bite your fingernail in the past? ☐ Yes ☐ No

(ในอดีตท่านกัดเล็บตนเองอยู่เป็นประจำหรือไม่)

- What age did you stop biting your fingernail? .....

(ท่านเลิกกัด แม้ม หรือดูดริมฝีปากเมื่ออายุเท่าใด)

- How long did you bite your fingernail? .....

(ในอดีตท่านเคยกัดเล็บมาเป็นระยะเวลานานเท่าใด)

- How often did you bite your fingernail? .....

(ในอดีตท่านเคยกัดเล็บบ่อยเพียงใด)

Diagnosis: ☐ Nail-biter ☐ Non-nail biter

C. Do you usually bite other objects? ☐ Yes ☐ No

(ท่านกัดวัตถุ หรือสิ่งของอื่นๆอยู่เป็นประจำหรือไม่)

- What object do you usually bite? .....

(วัตถุ หรือสิ่งของอื่นๆที่ท่านกัดคืออะไร)

- How long do you bite that object? .....

(ท่านกัดวัตถุ หรือสิ่งของดังกล่าวมาเป็นระยะเวลานานเท่าใด)

- How often do you bite that object? .....

(ท่านกัดวัตถุ หรือสิ่งของดังกล่าวบ่อยเพียงใด)

D. Did you usually bite other objects in the past? ☐ Yes ☐ No

(ในอดีตท่านกัดวัตถุ หรือสิ่งของอื่นๆเป็นประจำหรือไม่)

- What object did you usually bite? .....

(วัตถุ หรือสิ่งของอื่นๆที่ท่านเคยกัดอยู่เป็นประจำในอดีตคืออะไร)

- What age did you stop biting that object? .....

(ท่านเลิกกัดวัตถุ หรือสิ่งของดังกล่าวเมื่ออายุเท่าใด)

- How long did you bite that object? .....

(ในอดีตท่านเคยกัดวัตถุ หรือสิ่งของดังกล่าวมาเป็นระยะเวลานานเท่าใด)

- How often did you bite that object? .....

(ในอดีตท่านกัดวัตถุ หรือสิ่งของดังกล่าวบ่อยเพียงใด)

Diagnosis: ☐ Other object-biter ☐ Non-other object biter

6) Mouth-breathing habit

A. Do you usually breathe through the mouth? ☐ Yes ☐ No

(ท่านหายใจทางปากอยู่เป็นประจำหรือไม่)

- How long do you breathe through the mouth? .....

(ท่านหายใจทางปากมาเป็นระยะเวลานานเท่าใด)

- How often do you breathe through the mouth? .....

(ท่านหายใจทางปากบ่อยเพียงใด)

B. Did you usually breathe through the mouth in the past?

(ในอดีตท่านหายใจทางปากอยู่เป็นประจำหรือไม่) ☐ Yes ☐ No

- What age did you stop breathing through the mouth? .....

(ท่านเลิกหายใจทางปากเมื่ออายุเท่าใด)

- How long did you breathe through the mouth? .....

(ในอดีตท่านหายใจทางปากมาเป็นระยะเวลานานเท่าใด)

- How often did you breathe through the mouth? .....

(ในอดีตท่านหายใจทางปากบ่อยเพียงใด)

Diagnosis: ☐ Mouth-breather ☐ Nasal-breather

APPENDIX E CLINICAL EXAMINATION FORM

Clinical Examination Form for Abnormal Oral Habits Assessment

1) Digit-sucking habit

Clinical presence on patient's digits

☐ Calluses

☐ Blisters

☐ None of above

Diagnosis: ☐ Digit-sucker ☐ Non-digit sucker

2) Tongue-thrust swallowing habit

Characteristics during swallowing of 10 ml of water (test for 3 times)

	1st time	2nd time	3rd time
- Patient's tongue thrusts against maxillary central incisors or between maxillary and mandibular incisors.	☐	☐	☐
- Patient swallows with no contact between maxillary and mandibular teeth.	☐	☐	☐
- Patient swallows with hyperfunction of lower lip.	☐	☐	☐
- None of above	☐	☐	☐
Patient presents at least one of tongue-thrust swallowing characteristics for ..... times			

Diagnosis: ☐ Tongue thruster ☐ Normal swallower

3) Lip-sucking and Lip-biting habits

Clinical presence on patient's lips

☐ Inflammation

☐ Dry

☐ Crack

☐ Hypertrophy of vermillion border

☐ None of above

Diagnosis: ☐ Lip-sucker/biter ☐ Non-lip sucker/biter

4) Nail-biting habit

Clinical presence on patient's fingernails

☐ Sever manner

☐ None of sever manner

Diagnosis: ☐ Nail-biter ☐ Non-nail biter

5) Mouth-breathing habit

Characteristics of an expired air from the patient's nostrils (test for 3 times)

	1st time	2nd time	3rd time
- Examiner cannot feel an expired air from the patient's nostril.	☐	☐	☐
- Examiner can feel an expired air from the patient's nostrils. ☐ Right nostril ☐ Left nostril	☐	☐	☐
Examiner cannot feel an expired from the patient for ..... times			

Diagnosis: ☐ Mouth-breather ☐ Nasal-breather

Summary of patient's abnormal oral habits

	Duration	Frequency
☐ Digit-sucking habit		
☐ Pacifier-sucking habit		
☐ Tongue-thrust swallowing habit		
☐ Lip-sucking and lip-biting habits		
☐ Nail-biting habit		
☐ Mouth-breathing habit		
☐ Other habits 1. ..... 2. ..... 3.		

Intra-Oral Examination

Dental chart

Occlusal identification: first permanent molar relationship

1. Primary dentition

Neutroclusion	End to End	Distoclusion	Mesioclusion
			
☐ Rt. ☐ Lt.	☐ Rt. ☐ Lt.	☐ Rt. ☐ Lt.	☐ Rt. ☐ Lt.
Unclassified: ☐ Rt. ☐ Lt.			

2. Mixed or permanent dentition

Class I	End to End	Class II	Class III
			
☐ Rt. ☐ Lt.	☐ Rt. ☐ Lt.	☐ Rt. ☐ Lt.	☐ Rt. ☐ Lt.
Unclassified: ☐ Rt. ☐ Lt.			

Summary of malocclusion

1. First Permanent Molar relationship

   1.1 Primary dentition

   Rt. ..... Lt. .....

   1.2 Mixed or permanent dentition

   Rt. ..... Lt. .....

2. Other characteristics of malocclusion

   ☐ Large overjet (Overjet = ... mm)

   ☐ Protrusion of maxillary anterior teeth

   ☐ Anterior open bite ☐ Posterior open bite

   ☐ Anterior crossbite ☐ Posterior crossbite

   ☐ Spacing of maxillary anterior teeth (Patient with fully erupted maxillary canines)

   ☐ Lingual collapse of maxillary anterior teeth

   ☐ Lingual collapse of mandibular anterior teeth

.....

(Mr. Udom Sasigornwong, DDS.)
Interviewer and examiner