CHAPTER II
LITERATURE REVIEW

2.1   Incidence of clefts lip and palate

Generally, the incidence of cleft lip and palate presents is about 1 to 2 cases per 1,000 newborns. In 1942, Fogh-Anderson[25] determined the incidence of cleft lip and palate as 1.47 cases per 1,000 newborns. For cleft palate alone, the incidence was 0.34 cases per 1,000 newborns. Furthermore, the incidence of cleft lip and palate was 1.5 to 3 times of the incidence of cleft palate alone.

Differences of ethnicity can influence the incidence of clefts. Vanderas[26] found the incidence of cleft lip and palate in American Blacks was 0.60 cases per 1,000 newborns. The incidence among Whites was 1.44 cases per 1,000 newborns. Chinese had 2.01 cases per 1,000 newborns, and there were 2.03 cases per 1,000 newborns among Japanese. Tan[27] studied the incidence of clefts in Singapore, and found 1.74 cases per 1,000 newborns. A survey of a large number of births at a hospital in Bangkok, Thailand, produced an incidence of 1.62 clefts per 1,000 newborns, but with a greater proportion of new-born clefts among the confinements for mothers coming from the North-East of Thailand.[28] Ruengsit et al.[29] reviewed confinements at three hospitals in Khon Kaen Province located in the North-East of Thailand, and found the incidence of clefts was 2.49 cases per 1,000 newborns. These observations of cleft birth incidence for North-East Thailand more closely matched the higher birth incidences from Asian studies quoted by Vanderas.[26]

2.2   Classification of clefts lip and palate

The classification of cleft lip and palate patients by Kernahan and Stark in 1958 was based on development of the embryonic primary and secondary palates.[30] The primary palate involved the lip, alveolar ridge and triangle of palate anterior to the incisive foramen. The secondary palate was the rest of the palate that derived from the palatal shelves of the embryo, extending from the incisive papilla to the uvula of

soft palate. They divided cleft lip and palate patients into three groups according to the principles of their classification:

2.2.1   Clefting of the primary palate

They may be complete or incomplete, and unilateral, bilateral or median. Because they present at anterior area of incisive papilla, they are described as cleft lip (CL).

2.2.2   Clefting of the secondary palate

They may be complete, incomplete or submucous. They are described as cleft palate (CP).

2.2.3   Clefting of primary and secondary palates

They may be complete or incomplete, and unilateral, bilateral or median as well as clefts of the primary palate. They are described as cleft lip and palate (CLP).

2.3   The severity of clefting

All cleft lip and/or cleft palate patients show variations in the severity of deformity. The severity of clefting at birth may affect maxillary growth and treatment outcomes. The treatment protocol could be vary according to the severity of clefting. Peltomaki et al.[9] presented their treatment results for unilateral cleft lip and palate patients who were treated with infant orthopedics followed by gingivoperiosteoplasty to close the alveolar cleft, combined with repair of the lip and nose in the single stage. Their results demonstrated less favorable maxillary growth in patients with large clefts and small arch circumference or arch length with more severe outcomes than those with small clefts and large arch circumference or arch length at birth. However, Santiago et al.[31] showed the benefits of gingivoperiosteoplasty in reducing need for secondary bone grafting when permanent canines erupted, reducing the occurrence of oronasal fistula, and improved prognosis of bone grafting. In 1992 Tang and So[32] studied the prevalence and severity of malocclusion in cleft lip and/or palate children in Hong Kong. The cleft lip and palate patients with primary and early mixed dentition were studied using the Occlusal Index of Summers.[33] Their assessment showed severe malocclusions that would probably need comprehensive orthodontic treatment at a later stage. They found that malocclusion problems do manifest early in

cleft lip and palate patients. Several studies had concluded that the assessment of severity of malocclusion could be determined in the primary and early mixed dentition.[34-36]

Furthermore, several studies mentioned about the severity of cleft impairment may be affected the facial attractiveness in cleft lip and palate patients on social perception. Tobiasen and Hiebert[37] showed that the severity of impairment did influence social perception. It means the less severe the impairment, the more positive the first impression. A severe cleft impairment has a more negative impact on social perception than a mild impairment. Therefore, the reduction of severity of impairment may be essential in cleft lip and palate patients. In 1995 Slade et al.[38] studied the relationships between cleft severity and attractiveness of unrepaired newborn cleft lip and palate patients. Their results were significantly related to the degree of severity of the primary cleft impairment.

2.4   Craniofacial growth in cleft lip and palate patients

Craniofacial morphology of children with clefts is different from normal children because of a combination of several factors including, morphogenetic pattern, adaptive changes, and lip and palate management.[39] Many factors could affect growth in cleft lip and palate patients, both by their primary effect on growth mechanisms and as a secondary result of their effect on function. From the initial defect, the sutural growth mechanism between the two sides of the maxilla is absent. Postoperative scarring may be an effect of the operative procedure. The speech function, and swallowing mechanisms may be impaired by a major defect. Furthermore, the possibility of tissue deficiency often adversely affects growth.[40] Investigations have been conducted on the presence of cleft lip and/or palate, the surgical repair of anomalies, and the possible effects of both the cleft and surgery on craniofacial morphology and dentition.[41,42] The facial morphology in infants, children, adolescents, and adults with cleft lip and palate deviate from the norm.[43,44] Complete clefts disturb the morphology more than incomplete clefts.[43] Therefore, more severity is found in the complete cleft lip and palate patients. By contrast, the patients with isolated cleft lip show a fairly normal facial development.[43] Some studies have reported that the deviations of facial morphology are observed in children,

adolescents, and adults with cleft lip and palate who have received the surgical interventions.[5,43] However, it is still unclear which of the deviations are caused by the surgical intervention and to what degree surgical protocols lead to differences in development of the craniofacial complex in patients with cleft lip and palate.[45]

2.5   Treatment timing protocol of Khon Kaen University Cleft Lip and Palate Center[46]

The treatment protocol is divided into 5 phases of treatment that depended on age of the cleft patients:

2.5.1   Newborn to 1 year of age

The treatment in this phase emphasizes the evaluation of craniofacial deformities. The presurgical orthopedic appliance is essential in some cases for preparing before cheiloplasty at the age of 3 to 4 months. Palatoplasty is performed at the age of 9 to 12 months.

2.5.2   1 year to 5 year of age

The results of cheiloplasty and palatoplasty are evaluated. Development of occlusion is observed.

2.5.3   5 year to 10 year of age

Preventive and interceptive orthodontics are performed if malocclusion occurs.

2.5.4   10 year to 15 year of age

In this phase, alveolar bone grafting and orthodontic treatment are performed. Temporary dental substitution is essential in some cleft cases.

2.5.5   Over 15 year of age

The orthodontic treatment is evaluated for need for orthognathic surgery. If surgical correction is indicated the subsequent treatment result is evaluated again for maintaining the occlusion in a retention phase.

2.6 Methods for evaluation of treatment outcome after primary cleft lip and palate surgery

Growth and development of the maxillary arch may be inhibited as the result of primary repair.[47,48] Although, there are different treatment protocols and surgical techniques that are used for primary management of patients with complete cleft lip and palate, varied effects of surgical technique, and timing of palatal closure have been debated.[49] Therefore, the assessment of treatment outcome is essential to evaluate the result of surgical outcome. In order to evaluate and compares the results of different approaches, it is essential to have a reliable method of assessing dental arch relationship.

The following are the most common methods that have been used for assessing treatment outcomes after primary surgery:

2.6.1 The GOSLON (Great Ormond Street, London and Oslo) Yardstick[34]

2.6.2 An index for assessing surgical outcome in unilateral cleft lip and palate subjects aged five (The 5-year-old's index)[50]

2.6.3 A modified Huddart/Bodenham scoring system for assessment of maxillary arch constriction in cleft lip and palate patients[36]

2.7 Evaluation of final outcomes of malocclusion

Close observation of individuals with clefts must be maintained until, and after, all of the permanent teeth have erupted. By late adolescence the final orthodontic positioning of all the permanent teeth should have been accomplished. At this stage, the positioning usually involves individual tooth movement by orthodontic treatment.[4] Many cleft lip and palate patients present severe skeletal discrepancy such as skeletal Class III relationship[1] that usually receive orthodontics combined with orthognathic surgery to correct this problem. With the necessary review of treatment protocols evaluation it is essential to assess all treatment outcomes.

The following are the most commonly used occlusal indices for assessing final treatment outcomes in permanent dentition:

2.7.1 The Peer Assessment Rating Index (PAR)

2.7.2 The Index of Orthodontic Treatment Need (IOTN)

2.7.3 The Handicapping Labio-lingual Deviation (HLD) Index

2.7.1   The Peer Assessment Rating (PAR) Index
Use of the PAR Index

The PAR Index was initially designed to evaluate objectively outcomes of malocclusion correction.[21] According to DeGuzman, the PAR Index evaluated treatment difficulty and malocclusion severity.[23] Pae stated that the PAR Index appeared to be the gold standard in evaluating a malocclusion.[51] However, it was found to be equally useful for assessing malocclusion before correction.[24] The difference between the pre- and post-treatment scores reflects the degree of improvement and the relative success of treatment. Kirby et al. compared pre-treatment and post-treatment the PAR scores to evaluate the improvement of orthodontic treatment.[52] In 1999, Baker et al. used the PAR Index to evaluate the treatment outcome from orthodontics combined orthognathic surgery group and an orthodontics alone group.[17] This Index offers uniformity and standardization in assessing the outcome of orthodontic treatment. It can be used to record the malocclusion at any stage of treatment.[53] The Index components comprise contact point displacement of the anterior dental segment; anteroposterior, vertical, and transverse relationships of the right and left buccal segments; overjet, overbite, and midline deviations. It was originally developed by British orthodontists and was also validated by American orthodontists.[53]

Richmond et al. found that the mean PAR reduction should be greater than 70 percent when they proposed criteria for high standard orthodontic treatment.[54] In 1993, in another trial of the PAR Index, Richmond and Andrews found that specialist orthodontic treatment reduced the malocclusion on average 78 percent.[55] Baker et al., in 1999 compared the treatment outcomes in non-cleft patients with only orthodontic treatment and those with orthognathic surgery using the PAR Index. Their results showed the PAR Index scores were greatly improved and were not significantly different for the either patients undergoing orthognathic surgery or orthodontic treatment alone.[17]

2.7.2   The Index of Orthodontic Treatment Need (IOTN)

IOTN is another malocclusion index developed, as it indicates, for determining need as well as priority for public-funded orthodontic treatment. Because

orthodontic treatment needs to be justified on either dental health or aesthetic needs, this index is composed of two components:

The Dental Health Component (DHC)

The Aesthetic Component (AC)

The aesthetic component of the IOTN depends on the use of a series of the clinical photographs of non-cleft patients is and so is not appropriate for use of patients with cleft conditions.

The IOTN is designed so that a malocclusion may be quickly assessed clinically or from clinical models, but it is most widely used clinically. Brook and Shaw, 1989, stated that the IOTN defined specific, distinct categories of treatment need.[56] Holmes, in 1992, studied the prevalence of orthodontic treatment need and found that the IOTN was easy to use for epidemiological studies and acceptable for statistical analysis.[57]

2.7.3   The Handicapping Labio-lingual Deviation (HLD) Index

In 1958, 1960, Draker[58,59] developed the original Handicapping Labio-lingual Deviations (HLD) Index for the public-funded New York State Handicapped Children's service program. It was designed to identify and give priority for orthodontic treatment to children with malocclusions particularly those associated with congenital cranio-facial deformities that included cleft lip and palate, as well as major deformities resulting from disease or trauma. Several State authorities in the USA have adapted the principles of the HLD Index for use in their public-funded health services. Apart from the report of Thesis, Huang et al., in 2005, the HLD Index has not had as wide application as PAR as a means of evaluating orthodontic treatment outcomes with focus on oral cleft conditions.[60]