CHAPTER II

LITERATURE REVIEW

Class III malocclusion exhibited skeletal, dental and facial soft tissue abnormalities. To categorize and to describe the typical class III malocclusion patients, this review covers the lateral cephalometric analyses and the model analyses that deal with class III malocclusion deformities.

I. Cephalometric study of class III malocclusion

1) Skeletal and Dental components

Little definitive information is available on the dentofacial components of class III malocclusion, and what has been reported remains controversial. The terms "mandibular prognathism" and "Angle's class III malocclusion" are generally regarded as similar, if not synonymous, in the dental literature, which has tended to overemphasize the importance of occlusal relationships by using occlusal terms in describing skeletal relationships.

A class III malocclusion may often be present in mandibular prognathism, but those occlusal relationships comprise only one part of a much large syndrome. Similarly, mandibular prognathism may be present in many individuals with class III malocclusion. Previous investigations have shown that various types of skeletal pattern may exist in those with class III malocclusion.

Class III malocclusion account for the smallest percentage of any malocclusion group within the population with the incidence varying from 1.2 to 12.2% depending on the criteria used in the determination (Jacobson *et al.*, 1974)

Jacobson *et al.* (1974) reported on sex differences and differences between child and adult class III samples. They found that the largest percentage of adults with class III malocclusion (49%) had protrusive mandible with normal maxilla, 26% had retrusive maxilla and normal mandible, and 14% had normal of maxilla and mandible.

More than half of this child samples presented normal maxillary and mandibular positions, which were much less common in the adult samples.

Ellis and McNamara (1984) found a combination of maxillary retrusion and mandibular protrusion to be the most common skeletal relationships, being present in 30% of their adult class III subjects. Retrusive maxilla with normal mandible found in 19.5% of the subjects, and normal maxilla with protrusive mandible found in 19.1% of the subjects.

Others have noted differences in the class III adult population compared to the class I controls, in both the relative positions of the teeth and jaws and in other skeletal areas such as the cranial base, the morphology of the maxilla and the mandible, and vertical dimensions (Bjork, 1950; Ridell *et al.*, 1971; Droel and Isaacson, 1972).

Jacobson *et al.* (1974) compared class III subjects with class I samples control group, class III subjects showed shorter anterior cranial base, longer posterior cranial base, more acute cranial base, shorter and more retrusive maxilla, more proclined maxillary incisors, more retroclined mandibular incisors, excessive lower anterior facial height and more obtuse gonial angle.

Further evidence supported by the study of Guyer *et al.* (1986). This study was undertaken to compare class III skeletal and dental malocclusions to class I normal occlusion. The findings supported the following conclusions regarding the average characteristics of class III subjects: longer posterior cranial base length, retrusive maxillary position, shorter effective maxillary length, prognathic mandibular position, longer mandibular length, obtuse gonial angle, greater mandibular plane angle, greater vertical lower facial height, protrusive maxillary incisors and retroclined mandibular incisors. Most of the differences were found in all age groups, indicating that patients with class III malocclusion exhibited unique skeletal and dental aberrations from an early age and might grow worse with age.

Jarvinen (1988) studied the relationship between the ANB angle and the Wits appraisal by measuring the individual variations of 30 lateral cephalograms of untreated orthodontic patients with different types of skeletal and/or dentoalveolar malocclusions.

He indicated that approximately 93% of the variation of the Wits appraisal could be explained by the variation of the ANB, NSL/OL and SNA angles.

In Asia, few investigators reported about the craniofacial characteristics of class III malocclusion samples in difference races (Toms, 1989; Lew and Fong, 1993). Only one study of the incidence of class III malocclusion in the Thai population had been published in the literature (Suchato and Chaiwat, 1981).

Toms (1989) investigated the records of 500 Saudi Arabian samples. From clinically and cephalometrically examined the incidence of class III was 9.4% with mandibular prognathism being the commonest presentation of the malocclusion.

Lew and Fong (1993) analyzed cephalometrically 80 Chinese adults with true class III malocclusions to determine the percentage in each horizontal skeletal subtype by using angular (SNA/SNB) and linear (point A/B to McNamara's line) criteria. Results indicated that mandibular hyperplasia with normal anteroposterior maxillary position comprised the majority of true class III malocclusions.

The variations within a race or intraracial comparisons were also available. The evidence supported studied by Chatkupt *et al.* (1987) which worked in the Northern Thais class I normal occlusion and compared to the Central Thais subjects. This study revealed that even though there was no statistically significant difference between Northern Thais and Central Thais in terms of the prominence of upper and lower lips. The prominence of nose tip and the thickness of chin and the thickness of soft tissue at soft tissue Nasion level of the Northern Thais were different from that of the Central Thai samples.

Only one investigation reported about craniofacial form of class III malocclusions in Thai dental literature (Chareonvicha, 1992) but there was no report which analyze and/or compare data between class III malocclusion and other occlusions within Thai population in any parts of Thailand.

The gender difference was the important factor, when we study about the craniofacial characteristics in human by use the cephalometric analysis that revealed to the differences between males and females. The differences in body build between males and females resulted from different timing and duration of growth, particularly during the pubertal period. The overall body size of males tended to be larger than that of females. This applied to facial features (Enlow and Hans, 1996).

Evidence of gender differences was offered by the report of Lew and Fong in 1993. They showed that the majority of classes III in males were due to hyperplasia mandible and normal maxillary anteroposterior relationship. Most of the female class III malocclusions were due to normal mandible and hypoplastic maxilla.

In Thailand, the results of these gender difference investigations were confirmed by the work of Chatkupt *et al.* (1987); Jotikasthira (1989). The studies were carried out in the northern Thai adults with class I normal occlusion, and revealed that Thai males exhibited more convex profile and more prominent chin than Thai females. Furthermore, the mandibular rotation was more forward in the males than in the females. Patanaporn (1996) also suggested that there were dentofacial differences between both genders, particularly in linear measurements. However, these findings were not in agreement with the conclusion drawn by Suchato and Chaiwat (1984) that there was an insignificant difference in the measurements obtained from the Central Thai males and the Central Thai females.

2) Facial soft tissue component

One of the most important components of orthodontic diagnosis and treatment planning was the evaluation of the patient's soft tissue. Hwang (2000) and McClintock Robison *et al.* (1986) have recommended that the analysis of the soft tissue should be taken into consideration for the proper evaluation of an underlying skeletal discrepancy because individual differences in soft tissue thickness. Unlike in other malocclusion groups, in class III malocclusions the profile rather than the occlusion may be the main focus of concern for the patient. Thus achieving a more harmonious profile was an important goal for treatment class III malocclusions (Kilicoglu and Kirlic, 1998).

McClintock Robison *et al.* (1986) investigated the relationship of skeletal facial pattern and soft tissue nasal form. Measurements were made from cephalometric radiographs, posteroanterior radiographs and the physioprint photographs. This analysis indicated that more than 86% of patients in the sample of 123 demonstrated the correlation of nasal shapes to specific skeletal groupings. Patients with straight profiles tended to have straight noses. Patients with convex profiles accompanied convex nasal shapes and patients with concave profiles were found with concave nasal shapes.

Bergman (1999) stated the orthodontic analysis most commonly relied on skeletal and dental measurement, placing far less emphasis on facial feature measurement. From his study presented a cephalometric-based facial analysis and discussed on facial or soft tissue traits, suggested several factors would influence the facial trait values: skeletal pattern, dental pattern, soft tissue thickness, ethnic and cultural origin, gender difference, and age.

The reviewing dental literature about soft tissue facial profile, investigators had developed numerous analyses to interpret the diagnostic information that the lateral cephalogram provides (Steiner, 1953; Steiner, 1959; Burstone, 1978; Holdaway, 1983).

No dental literature reported about soft tissue facial profile in class III malocclusion group, especially compare to normal occlusion group or other type of malocclusion.

II. Dental arch study of class III malocclusion

The size and shape of the dental arch had considerable implications in orthodontic diagnosis and treatment planning, affecting the space available, dental esthetics and stability of the dentition (Lee, 1999).

Although a number of researchers had attempted to study an arch form unique to a certain ethnic or occlusion groups, most of their studies compared average clinical arch forms derived from normal untreated samples or research arch forms established by measuring arch dimensions using the incisal edges and cusp tips as landmarks (Nummikoski *et al.*, 1988; Merz *et al.*, 1991; Raberin and Brunner, 1993; Kahl-Nieke and Schwarze, 1996; Nojima *et al.*, 2001).

Nojima *et al.* (2001) clarified morphological differences between Caucasian and Japanese mandibular clinical arch forms in class I, II and III malocclusions. The Caucasian population had a statistically significant decreased arch width and increased arch depth compared those with the Japanese population. No statistically significant difference in arch dimension between the 2 ethnic groups in any of the arch form samples and no single arch form specific to any of the Angle classifications or ethnic groups.

The study of ethnic and gender differences worked by Nummikoski *et al.* (1988) revealed that ethnic and gender differences in the dental and mandibular arch widths were statistically significant.

In 1996, Kahl-Nieke and Schwarze studied in orthodontically treated patients to analyze postretention changes in arch width dimension and to isolate factors that might serve as predictors of long term prognosis by used pretreatment, end of treatment and postretention models of 226 cases with different malocclusions. The measurements, that had been used, were the intercanine width, intermolar width, arch length, sum of the mesiodistal dimension of the incisors, irregularity index, crowding, molar and canine relationship, overjet and overbite. The findings indicated that postretention arch width relapse occurred more frequently in the upper intermolar and lower intercanine region than in the lower intermolar and upper intercanine regions.

In summary, population age and gender differences in the pattern of facial structure had been pointed out in the review literatures. It is important to realize the variations among difference races, the variations within a race and the variations between genders could be impacted to the craniofacial morphology.