CHAPTER V
DISCUSSION

The results of this study showed the differences of craniofacial morphologies between class III malocclusion and normal occlusion groups and there were also the differences between genders. Furthermore, the differences among the skeletal vertical patterns of class III malocclusion group (skeletal class III normal overbite, deepbite and openbite) were presented as well. Class III malocclusion could exist with any number of combinations of skeletal, dental and facial soft tissue components. The discussions of this study are presented as follows.

1. DIFFERENCES BETWEEN CLASS III MALOCCLUSION AND NORMAL OCCLUSION THAI ADULTS

1.1 The lateral cephalometric measurements

1.1.1 Skeletal pattern

The lateral cephalometric values of class III malocclusion and normal occlusion for Thai adults were different in various aspects. The present study indicated that the SNA angle was not statistically significant different between class III malocclusion and normal occlusion groups which it was similar to the investigation in United Kingdom adult samples by Battagel (1993) but it was not in agreement with the investigations in Caucasian samples (Jacobson *et al.*, 1974) and Saudi Arabians samples (Toms, 1999). The SNB angle was statistically significant greater in class III malocclusion group than normal occlusion group. According to the minus values of ANB angle in class III malocclusion group, it indicated that Thai adults with class III malocclusion had normal maxilla and more protrusive mandible which they were in agreement with the investigation in class III Chinese adults (Lew and Fong, 1993). Several investigators had commented on the majority of class III malocclusion. Jacobson *et al.* (1974), Battagel (1993) and Toms (1999) indicated that the most commonly presentation of class III

malocclusion was normal maxilla and protrusive mandible which it was consistence with this study. Others (Ellis and Mcnamara, 1984 and Guyer *et al.*, 1986) suggested that the majority of class III malocclusion was the combination of retrusive maxilla and protrusive mandible.

A reduced cranial base angle had been frequently, but not universally associated with class III malocclusion. Despite using basion in this study, rather than the more usual articulare (Hopkin *et al.*, 1968; Jarvinen, 1984), an acute cranial base angle was a consistent finding which it was similar to the studies of Jacobson et al. (1974), Guyer *et al.* (1986) and Battagel (1993). The shorter anterior and posterior cranial base lengths were found in this study that they were difference from the findings of Jacobson et al. (1974) and Guyer *et al.* (1986), which those studies found the shorter anterior cranial base length but it contrasted for longer posterior cranial base length.

There was significantly shorter of the maxillary length in class III malocclusion group than that in normal occlusion group. Interestingly, the mandibular length and the effective mandibular length were not affected in class III Thai adults that they were difference from the other studies (Droel and Isaacson, 1972; Jacobson *et al.*, 1974; Battagel, 1993 and Toms, 1999). Jacobson *et al.* (1974) found that normal occlusion samples had thicker of the symphysial width than that in class III malocclusion group which it was in agreement with this present study. Furthermore, the symphysial height had statistically less in class III malocclusion group that it was similar to Jacobson' s study. The increased of gonial angle and palatomandibular angle were in agreement with the findings of Jacobson *et al.* (1974), Guyer *et al.* (1986) and Battagel (1993) but contradicted to the mandibular length and effective mandibular length. These authors found increased mandibular length and effective mandibular length.

For the facial height measurements, this present study found that class III malocclusion group had reduced upper anterior facial height, reduced total anterior facial height, reduced lower posterior height and reduced total posterior facial height. These findings were in consistent with many studies (Droel and Isaacson, 1972; Jacobson *et al.*, 1974; Guyer *et al.*, 1986 and Battagel, 1993).

The present data indicated that the increased value in the gonial angle, palatomandibular angle seemed to be mainly due to a downward and backward tipping of the mandibular plane and a shortened ascending ramus. With the downward and backward rotation of mandible, consequently, the result of such growth pattern would increased a lower anterior facial height and/or decreased a ramus height (Isaacson *et al.*, 1971) but it contrasted from this present data that also decreased a ramus height only. This study showed reduced upper anterior facial height but normal lower anterior facial height, they seemed to be the natural compensatory mechanism of the acute cranial base angle combined with the obtuse gonial angle and reduced ramus height.

1.1.2 Dental pattern

In keeping with the usual description of class III malocclusion, this study showed that the maxillary incisors were more proclined than the control normal group and the mandibular incisors were more retroclined. These results were in agreement with many studies of Isaacson *et al.* (1971), Droel and Isaacson (1972), Jacobson *et al.* (1974), Ellis and Mcnamara (1984), Guyer *et al.* (1986), Battagel (1993) and Toms (1999). Exception with the interincisal angle, this study, it was not affected in class III malocclusion group.

There were highly significantly less of the lower anterior and posterior dentoalveolar heights in class III malocclusion group than that in normal occlusion group which were similar to the investigations of Jacobson *et al.* (1974), Kerr and TenHave (1988). Furthermore, there was significantly greater UPDH/UADH ratio and there was highly significantly less LPDH/LADH ratio in class III malocclusion group. These results implied that the upper posterior dentoalveolar height and the lower anterior dentoalveolar height had greater values than the upper anterior dentoalveolar height and the lower posterior dentoalveolar height respectively.

The differences in the dental measurements appeared to be compensatory responded to the anteroposterior dysplasias of the apical bases in class III malocclusion

(Jacobson *et al.*, 1974). The general tendency in the class III malocclusion samples had trend toward an openbite or hyperdivergent skeletal pattern.

1.1.3 Facial soft tissue pattern

This present study showed the facial soft tissue differences between Thai adults with class III malocclusion and normal occlusion groups. Almost of the facial soft tissue measurements were significantly differences between two groups, except in the nose prominence and the soft tissue chin thickness .

The soft tissue facial angle was highly significantly greater in class III malocclusion group than that in normal occlusion group which in agreement with the investigation of United Kingdom adult samples (Battagel, 1993). By contrast, there were significantly less nasolabial angle and greater mentolabial angle in this present finding which they were not in agreement with Battagel's study. Her was not found the differences of nasolabial angle and mentolabial angle between two types of occlusion. Furthermore, the reduced H angle was found in class III malocclusion group, which it implied that the mandible had more protrusive position than that in normal occlusion group.

There were significantly greater superior sulcus depth and less inferior sulcus depth in class III malocclusion group that they correspond to the less nasolabial angle and greater mentolabial angle. Furthermore, the upper lip thickness was thicker and the lower lip thickness was thinner in class III malocclusion group. These results were consistence with the finding of Battagel (1993).

Class III Thai adults had more retrusive position of the upper lip but they had more protrusive position of the lower lip when compared with the normal Thai adults. Battagel (1993) stated that class III adult samples had more protrusive position of the lower lip, which was in agreement with this present finding, but her was not found the difference of the upper lip position between class III malocclusion and normal occlusion samples.

1.2 The model measurements

For the dental arch characteristics, there was highly significantly less of the upper canine depth in class III malocclusion group than that in normal occlusion group. These results indicated that the less upper canine depth in class III malocclusion group might be affected from the anterior crossbite of the dentition (means overjet = -1.97 mm.). Furthermore, there was significantly narrower of the lower interpremolar width in class III malocclusion group which it was not in agreement with the investigation in Caucasian and Japanese mandibular arch forms by Nojima *et al.* (2001). Nojima and coworkers stated that there was no single arch form specific to any of the Angle classifications or ethnic groups.

A summary listing of the craniofacial morphologies of Thai adult class III individuals who exhibited highly significant differences from normal occlusion samples in this study included: more acute cranial base angle, shorter anterior cranial base length, more protrusive of mandible, shorter ramus height, more obtuse gonial angle, less symphysial width and height, reduced upper anterior facial height, reduced lower posterior facial height, reduced total posterior facial height, more proclined maxillary incisors, more retroclined mandibular incisors, reduced lower anterior and posterior dentoalveolar height, more obtuse soft tissue facial angle, more acute nasolabial angle, more acute H angle, less inferior sulcus depth, thinner lower lip thickness and less upper canine depth.

The present investigation reinforced the view that class III malocclusion could be present with various combinations of skeletal, dental and facial soft tissue components.

2. DIFFERENCES BETWEEN MALE AND FEMALE THAI ADULTS WITH CLASS III MALOCCLUSION AND NORMAL OCCLUSION

The differences between the means of the Thai adult male and female class III malocclusion and normal occlusion groups were shown in Table 4.3 and 4.4. The male linear measurements are generally greater than the corresponding measurements in females.

There were not significantly different of the SNA, SNB, ANB, NSBa, SArGo, ArGoGn, NSGn, SN-GoGn, SN-PP, SN-OP, PP-GoGn angles between genders of both class III malocclusion and normal occlusion groups, which were in agreement with the observation of Jacobson *et al.* (1974). However, the gender indifferences of the SN-PP and SN-GoGn of normal occlusion group were not in agreement with the other studies in Central Thai adults (Suchato and Chaiwat, 1984) and in the Caucasian adults (Scheideman *et al.*, 1980).

The anterior cranial base length, the ramus height and the effective mandibular length were significantly different between genders of both two types of occlusion groups, which were in agreement with the observation in Caucasian adults (Jacobson *et al.*, 1974). Furthermore, the gender difference for the posterior cranial base length was found only in normal occlusion group.

The present study in Thai adults was in agreement with the other study in Central Thai (Dechkunakorn *et al.*, 1994), Chinese (Chang *et al.*, 1993), and Caucasian (Scheideman *et al.*, 1980) adults that the normal males had larger the facial heights and the dentoalveolar heights than the normal females. These results corresponded with the class III malocclusion group, which were in agreement with the observation of Caucasian class III adults (Jacobson *et al.*, 1974). Although the absolute linear measurements were significantly greater in the male, the facial and the dentoalveolar height ratios showed a much lower degree of significant sexual dimorphism.

The symphysial heights were highly significantly higher in the normal males and class III males, but there was little difference between class III males and females mean symphysial widths.

For the facial soft tissue measurements, this study showed that in spite of the differences in the mean values of the upper and lower lip thickness between the males and females of both class III malocclusion and normal occlusion groups.

With regard to the model measurements, the present data showed that the class III malocclusion subjects had similar results of the highly significantly gender differences for the upper and lower interpremolar width and intermolar width. However, no such

gender differences for these measurements were found in the normal occlusion group, which were in agreement with the study of Raberin and Brunner (1993). These results suggested that the dental arch morphologic differences in the normal occlusion group might have overpowered the sexual dimorphism.

3. DIFFERENCES AMONG THREE VERTICAL SKELETAL PATTERNS IN THAI ADULTS WITH CLASS III MALOCCLUSION

There were highly significant differences for the SNA, SNB, NSGn, ArGoGn, SN-OP, PP-GoGn, UPFH/LPFH, TPFH/TAFH and soft tissue facial angle among the skeletal class III normal overbite, deepbite and openbite subgroups (Table 4.5 and 4.6). The class III malocclusion, almost of the facial height, the dentoalveolar height, the facial soft tissue measurements and the model measurements were not significantly different among three vertical skeletal patterns.

Nevertheless, some characteristics of class III malocclusion were different among three vertical skeletal patterns. Skeletal class III deepbite group presented more prognathic mandible, more acute angle of the gonial angle, Y axis angle, mandibular plane angle and palatomandibular plane angle, greater ramus height and soft tissue facial angle than in skeletal class III normal overbite and openbite groups. Skeletal class III openbite group exhibited less upper intercanine width and lower canine depth than in skeletal class III normal overbite and deepbite groups. It was notable that most of severities of class III malocclusion were presented in skeletal class III deepbite.

4. CLINICAL IMPLICATION

The observations reported in this study on the class III malocclusion have disclosed the disparate morphologic characteristics between the normal occlusion and class III malocclusion subjects. Knowledge of the differences in skeletal, dental and facial soft tissue morphologies is also helpful in diagnosis and treatment planning for the class III malocclusion patients. The differences between class III malocclusion and normal occlusion groups pointed that they need the individual diagnosis and difference treatment approaches. The developing class III malocclusion is one of the most

challenging problems confronting the practicing orthodontists. If left untreated, the malocclusion tends to worsen (Little *et al.*, 1981; 1988). Frost *et al.* (1980) stated that orthodontists should design and modify the treatment to correct the deformity at its origin. Identification of the site of origin of the deformity is the key to planning treatment for patient with dentofacial deformity. In particular, it is important to distinguish between class III malocclusion those are due to skeletal dysplasia and those resulting from dentoalveolar causes or combination. However, the difficulty arises in the numerous intermediate cases where the distinction among them is not clear. The problem of class III malocclusion in many patients may be multifactorial, and subsequent problems with similar appearance may have different causes (Battagel, 1993).

In class III malocclusion treatment, there were some characteristics of those patients that should be aware. A trend toward less total anterior facial height was observed in class III malocclusion subjects, especially it was restricted to the upper anterior face region. In addition, class III malocclusion subjects had shorter total posterior facial height and occurred primarily in the lower posterior face region, correspond to the facial proportion values which were decreased UAFH/LAFH, TPFH/TAFH ratios and increased UPFH/LPFH ratio. Thus the mechanics, which tend to increase the lower anterior facial height, may be inappropriate treatment for Thai adult patients with class III malocclusion, with the exception of some cases of skeletal class III deepbite who had increased UAFH/LAFH ratio. Class III malocclusion subjects had the lower anterior and lower posterior dentoalveolar hypoplasia but the any mechanics that tend to extrude lower posterior teeth should avoid, to rotate the mandible downward and backward, to increased lower anterior facial height and to decreased UAFH/LAFH ratio.

Interestingly, the symphysial width and the symphysial height were less in class III malocclusion subjects than that in normal occlusion subjects. So, the orthodontists should be very carefully and considered the treatment planning which moved the lower anterior teeth backward and/or adjusted the inclination of the teeth too much.

Most orthodontists therefore have much less experience treating patients with class III malocclusion than treating patients with class I or class II malocclusions. The severe class III malocclusion must be considered from the standpoint of facial esthetics, function, dental occlusion and reasonable long term stability. Orthodontic treatment alone may be limited in obtaining ideal facial and dental corrections in severe skeletal class III pattern problem, and certainly surgical correction alone may be less than ideal for obtaining a total resolution of the patient's existing problems. For many cases of class III malocclusion, surgical correction is the best alternative treatment depend on the amount and the specific characteristic of skeletal discrepancy. In severe skeletal class II or class III with or without a large discrepancy, surgery must be considered, if correction and not camouflage is the desired end. However, there is no one method of treating all skeletal discrepancies by one surgical or orthodontic method. Each case must be evaluated and resolved individually (Bilodeau, 1995).

5. ERRORS AND LIMITATIONS

1) The lateral cephalograms and the study models in this study were from the patient files and taken without the randomization. This limits the population explanation with the data from these samples.

2) Most of orthodontic patients were treated at rather young ages so this caused the difficulty of the adult samples collection. The sample size in this study was not enough for the gender separated of each vertical skeletal pattern of class III malocclusion group and for the forward stepwise multiple logistic regression analysis, caused may be not discovered if such differences exist.

3) Tracing and measurement errors could be occurred in each lateral cephalogram and study model.

6. SUGGESTIONS

1) Further study should be increased sample size, and balanced of gender in each group especially in the subgroups for the reliable interpretations and useful to indicate any differences between groups or subgroups.

2) It must be kept in mind that the findings from this study were obtained from the adult class III malocclusion subjects. Thus, these results can not be completely applied in class III malocclusion in children. In the future, a comparative study should be initiated class III malocclusion and normal occlusion between children and adults by dividing them into subgroups to investigate the differences of craniofacial patterns of which the result can be applied in the timing of orthodontic treatment and the treatment planning.

3) The longitudinal and prospective study will be a valuable clinical guide if one can predict or detect whether growth changes of class III malocclusion.

4) The possibility in the future for an early identification or detection of class III malocclusion and realization of their subsequent proportionate growth can lead to an effective early intervention.