CHAPTER V

DISCUSSION

The discussion were presented under two major headings.

V.1 Discussion of the results of the study

V.1.1 Skeletofacial cephalometric variables

V.1.2 Crown inclination

V.1.3 Correlations between the crown inclination and the skeletofacial cephalometric variables and predictable equations of the crown inclination

V.2 Discussion of the factors affecting data

V.2.1 The factors affecting the cephalometric variables

V.2.2 The factors affecting the crown inclination

V.1 Discussion of the results of the study

V.1.1 Skeletofacial cephalometric variables

The seven common cephalometric parameters were evaluated in this study. The measurement was expressed for each variable in term of angulation. In Table 4, the comparisons were made between male and female groups. The basal sagittal relationship (ANB) was greater in females. This finding corresponded with Sorathesn's study (1988) but differed from that of Scheideman et al. (1980), Suchato and Chaiwat (1984), Chatkupt et al. (1987), Jotikasthira (1988) and Dechkunakorn et al. (1994).

There were no significant sex differences for the anteroposterior development of the mandible (SNB), the prognathism of the chin (SNPog, N angle), the inclination of the mandibular plane (SN-MP) and the inclination of the occlusal plane (SN-OP).

The only seven parameters were taken in this study. Therefore, it could not be concluded exactly that the skeletofacial morphology of males and females were similar or different. There is however, sufficient published data to support " sex influences on skeletofacial morphology ", Dechkunakorn et al. (1994), Bishara and Fermandez (1985), Connor and Moshiri (1985), Chatkupt et al.(1987), Jotikasthira (1988) and Sorathesn (1988).

In Table 5, the ANB angle ranged from -2.75 to 8.00 degrees. It should be noted that, even though the cephalometric values were derived from subjects with normal occlusion and good facial profile, the ANB angle might not be 0-4 degrees. This finding indicated that nature was able to achieve a normal occlusion even in cases exhibiting a sagittal basal relationship discrepancy.

The N angle and SNPog presented the chin prominence. The SNPog and N angle revealed a well pronounced bony chin. The chin position depended upon the growth pattern. Patients with vertical growth pattern demonstrated retrognathic chin, while the patients with horizontal growth demonstrated prognathic chin.

Table 16 summed up the cephalometric variables of northern Thai adult samples as compared with previous published White and Black adults (Fonseca and Klein, 1978).

Table 16 Comparisons of means and standard deviations of cephalometric variables (degree) in three different ethnic groups

Variables	Thai (n=60)	White (n=20)	Black (n=40)
ANB	1.70 ± 1.83	3.00 ± 2.24	4.30 ± 2.53
SNB	81.11 ± 2.75	79.60 ± 4.47	83.90 ± 4.43
SNPog	81.68 ± 2.79	-	-
N-angle	65.43 ± 5.50	-	-
SN-MP	28.60 ± 4.20	32.10 ± 5.81	32.90 ± 6.32
SN-OP	16.48 ± 3.65	-	-
NSGn	67.59 ± 2.70	67.30 ± 4.02	65.50 ± 4.43

– Non-published data

Thais versus Caucasians

In skeletal pattern, the relation of the mandible to the cranial base (SNB) was not different in two ethnic groups. But the sagittal relation of the maxilla and mandible (ANB) was greater in the Caucasian. The cause of difference might be the more anteriorly maxillary position in Thai group, Suchato and Chaiwat (1984), Sorathesn (1988) and Swasdiampairaks (1997).

The Y-growth axis to SN plane was not different. But the inclination of the mandible was less steep in the Thai samples. The lesser gonial angle in Thais (Swasdiampairaks, 1997) might contribute mainly to the flattening of the mandibular plane.

Thais versus Black

A comparison between Thai and Black samples showed highly differences. The mandible was more prognathic (SNB) and the relationship between the maxilla and mandible was greater in the Black samples. It implied that the maxilla of the Black might be more prognathic too. This finding corresponded with Suchato and Chaiwat's study (1984).

The Y growth axis to SN plane showed that the mandible of the Black was more posterior rotation. Moreover, the mandibular inclination was steeper than those of the Thais.

From Table 16 indicated that the racial influences on skeletofacial morphologies. Therefore, this warns the readers that we should not use one racial norms for the others.

V.1.2 Crown inclination

Table 6 and 7 showed no significant differences between inclination of male and female groups except lower right second molar ($p < 0.05$). In addition, the inclination patterns of both males and females were the same. This implied that crown inclination had no sex influence. The crown inclination of central and lateral incisors in both arches had positive values (central incisors were greater than lateral incisors). This indicated that the central and lateral incisors had labial crown inclination. The crown inclination of upper teeth was nearly constant from canines through the second molars or continuous lingual crown inclination. Those of the lower posterior teeth showed progressively negatively increased or progressively lingual crown inclination.

It was seen from Table 8 that the upper second premolar, the lower lateral incisor and the lower second molar were significantly different between the right and the left. This study was allowed less than 1 millimeter crowding. As considering the impression models, it revealed that the variation in tooth position (rotation and crowding) was the cause of difference.

Table 9 summarized the crown inclination of each tooth when both sex combined. The inclination of all the crowns had a consistent scheme :

A. Anterior teeth : The upper and lower incisors were labial crown inclination (central incisors were greater than lateral incisors).

B. Upper posterior teeth (canines through molars) : The upper posterior teeth had continuously lingual crown inclination.

C. Lower posterior (canines through molars) : The lower posterior teeth had progressively lingual crown inclination.

Table 17 The comparisons of the crown inclination of Andrews (1976), Dellinger (1978), Duangtaweesub (1997) and present study

Tooth	Andrews	Dellinger	Duangtaweesub	Present study
IU1	7.00	2.27	8.20	7.90
IU2	3.00	0.06	6.27	6.56
IU3	-7.00	-8.40	-5.95	-5.74
IU4	-7.00	-5.77	-8.04	-8.26
IU5	-7.00	-10.02	-8.20	-8.71
IU6	-9.00	-16.15	-9.50	-10.64
IU7	-9.00	-24.60	-8.38	-10.23
IL1	-1.00	-0.80	5.36	4.99
IL2	-1.00	-2.82	2.26	3.29
IL3	-11.00	-12.70	-3.77	-3.93
IL4	-17.00	-18.60	-13.91	-13.38
IL5	-22.00	-22.48	-18.93	-18.27
IL6	-30.00	-29.60	-25.17	-23.91
IL7	-35.00	-30.46	-34.69	-32.69

Table 17 compared the crown inclination of this study with Andrews', Dellinger's and Duangtaweesub's studies. In both arches the means of the crown inclination of the present study was in close agreement with Duangtaweesub's. The torque values of the lower incisors were different from those of Andrews' and Dellinger's studies. The means of Andrews and Dellinger were negative while present study was positive but the others were similar. The difference was probably caused by a difference in the method of selecting the samples, selecting the point of tangency and ethnic. The present study and Duangtaweesub's study investigated in Northern Thai but Andrews' and

Dellinger's studies did in Caucasians. Dellinger measured data from setup models of orthodontically non-extracted and extracted cases, while the other studies determined the crown inclination values from non-orthodontic cases with normal occlusion. Means of model setup and orthodontic treatment could flatten the occlusal plane. The alternation of occlusal plane was one of the factors which affected the crown inclination value. In Dellinger's, Duangtaweesub's and the present studies identified the point of tangency on the midpoint of labial surface after adding a 1 millimeter gingival sulcus depth but the method of Andrews did not.

V.1.3 Correlations between the crown inclination and the skeletofacial cephalometric variables and predictable equations of the crown inclination

In Table 10 and 11 the coefficients showed a strong influence of the ANB angle on the inclination of the lower incisor in both sexes. The ANB angle was significantly positively correlated with the inclination of the lower incisors (both central and lateral incisors) corresponding with Steiner, 1960 ; Hasund and Ulstein, 1970 ; Bibby, 1980 ; Casko and Shepherd, 1984 ; Jotikasthira, 1988.

However, in previous studies (Steiner, 1960 ; Hasund and Ulstein, 1970 ; Bibby, 1980 ; Casko and Shepherd, 1984 ; Jotikasthira, 1988), the ANB angle was not only positively correlated with the inclination of the lower incisor but also negatively correlated with the inclination of the upper incisor. Those studies determined the inclination from cephalograms. It also meant axial inclination. The angle between the labial surface and the axial inclination was probably the reason of difference. According to Carlsson and Ronnerman (1973), the angle between the labial surface and the axial inclination of upper incisor, was 21.2 ± 3.1 degrees in slight abrasion of enamel group. As considering anatomy of each tooth, the labial surface of lower incisor was flat and seemed rather parallel with the axial inclination. Although N angle correlated with the crown inclination of lower central incisor and lower lateral incisor of male, it was not effective enough to predict the inclination. When the stepwise multiple linear regressions were used for calculating the predictable equations of the crown inclination of each tooth. The equations showed the crown inclination of lower central incisor and lower lateral incisor in both sexes could be predicted by the only ANB angle.

V.2 Discussion of the factors affecting data

V.2.1 The factors affecting the cephalometric variables

Anatomical details on radiographs were obscured by overlapping images of individual bones and by differences in their thickness and density, which makes the interpretation of skull radiographs difficult. There were many possible sources of error that could affect the cephalometric variables. These included (1) quality of film, (2) radiographic technique and machine, (3) the density of the structure in particular, the surrounding and overlapping structures, (4) the experience of the diagnostician and (5) measuring instrument and measuring technique. To prevent the error that might be happened in this study, the processes were :

1. Standardization of film, technique, machine and measuring instrument (cephalometric protractor of ORMCO company) were used.

2. The investigators had studied radiographic anatomy and relationship of soft tissue, skeletal and dental structures.

3. Radiographic viewings were conducted in a quiet darkened room or dimly illuminated area of a room.

4. All tracing and measurements were performed twice.

In this study, cephalometric variables were expressed in term of angulation so the difference in magnification of the migsagittal structures of the cephalograms had not influenced on the comparison errors.

V.2.2 The factors affecting the crown inclination

The causes of the scattered distribution of crown inclination were related to many factors.

- Variation in facial contour and clinical crown height
- Tooth posture
- Occlusal plane
- Error from the measuring instrument and the measuring method
- Error from the operator

Variation in facial contour and clinical crown height

Attrition or gingival recession influence on clinical crown height variation. It was important in selecting the LA point. Meyer and Nelson (1978) stated that change in 3 millimeters vertical position on a premolar could result in 15 degrees inclination alternation. Andrew (1976) and Germane et al. (1989) showed that the different vertical position on the curvature of the labial surface affecting the crown inclination. Germane et al. (1989) found faciolingual contour varies from occlusal or incisal to gingival area was another factor that affected crown inclination. The study of Bryant et al. (1984) indicated that there was a wide variation in the shapes and forms of maxillary central incisors within the general population. In this study, there were some samples having beading and porous on the labial surface.

Tooth posture

It appeared that the operator had difficulty in setting the measuring arm to a malposed tooth. In this study the inclination of the upper second premolar, the lower lateral incisor and the lower second molar were significantly different (Table 8). The reason was that the upper second premolars and the lower lateral incisors were rotated and the distobuccal surface of the lower second molars were also interfered with external oblique ridge.

Occlusal plane

In this study the occlusal plane was an imaginary line connecting the LA points of the right and the left first molars and central incisors. The inclination angle was formed by the intersection of a line perpendicular to the occlusal and a line tangent to the LA point. Therefore, the occlusal plane alternation resulted in crown inclination variations.

Error from the measuring instrument and the measuring method

The measuring instrument in this study was modified from standard instrument. The horizontal arm was made of pin so as to touch the LA points of the first molars and central incisors in a single point contact (Figure 7a-c). The vertical protractor arm had only one piece to line up vertically without varying (Figure 7a). Inclination angle was measured by setting the lateral side of vertical protractor arm touching the LA point. It was hard to define a single contact point in flat surface. To solve this problem, scribe line was established at the end of vertical protractor arm (Figure 7a). It was easy to recognize when the end of scribe line contacting the LA point (Figure 9h).

The thickness of the vertical protractor arm was another factor that might be the cause of error. It made operator be unable to see clearly at LA point. In addition, the thickness of measuring arm caused difficulty in measuring the irregularity teeth and the lower second molars.

Error from the operator

The error from operator could occur in :

Stage of establishing long axis of clinical crown and LA point. In this study, the long axises of crowns were judged to be the mid-developmental ridge, which was the most prominent and centermost vertical position of the labial or buccal surface of the crown. The long axises of molar crowns were identified by the dominant vertical groove on the buccal surface of each molar crown.

Stage of establishing the horizontal occlusal line. The error on this stage might come from constructing the LA point.

Stage of being fixed the model on the surveying table. If the model was not fixed on the surveying table tightly, the HOL would be changed.

Stage of inclination value recording. The investigator had practiced how to use the measuring instrument and all of measurements were performed twice.

In conclusion the error could be occured in all stages. Therefore, the investigators had to have an knowledge and experience.