

CHAPTER III

MATERIALS AND METHODS

III.1 Materials

This study was composed of lateral cephalograms which were taken in centric occlusion and impression models of 60 northern Thai adults (30 males, 30 females). The age of subjects were shown in Table 3. The subjects were selected on the basis of :

1. good facial profile,
2. class I molar and canine relationships,
3. normal overjet and overbite,
4. good dental alignment or slight incisor crowding and no proximal dental caries or filling,
5. no previous orthodontic treatment or maxillofacial surgery and
6. no history of facial trauma.

Table 3 Age distribution of male, female and sex combined samples

Sex	No.	Min.(yrs.)	Max. (yrs.)	\bar{X} (yrs.)	SD (yrs.)
Male	30	19.30	25.90	21.38	1.55
Female	30	15.60	28.80	19.29	2.53
Combined	60	15.60	28.80	20.33	2.34

The subjects were collected by Chatkupt et al. (1987) who are presently staff members of the Orthodontic Department , Faculty of Dentistry, Chiang Mai University, Thailand. Arrangements were made for preliminary clinical examination of 6,817 subjects from the institute of Commerce, the institute of Fine Art, the military camp and some colleges in Chiang Mai. All subjects were

born and had stayed in the northern part of Thailand up to the time of the investigation.

More than 300 sets of study model were made of qualified good occlusion. Seven orthodontists examined the study models. More than one hundred subjects participated in the detailed examination at the Faculty of Dentistry. Further profile and intraoral slides were taken.

All the models and slides were evaluated in the final examination by seven orthodontists to exclude subjects with unacceptable facial profile and with unacceptable occlusion.

The cephalometric protractor (ORMCO) which could measure differences as small as 0.5 millimeter and 0.5 degrees was used for cephalometric measurement. The clinical crown height was measured by the caliper (MECANE) which could measure the nearest 0.05 millimeter (Figure 8). The crown inclination measuring instrument was modified from Dingtaweesub's (1997). It was composed of a surveyor (KEY GOLD, The J.M. Company) and a protractor (CCKL CREATOR, U.S.PAT. 4,766,675) (Figure 7a-c). It could measure the nearest 10 libdas.

To minimize the method error, all lateral cephalograms were traced twice. Each model and tracing were measured twice. The second measurement was performed approximately 4 weeks after the first one. The average values between the first and the second measurements were determined.

III.2 Methods

III.2.1 Cephalometric measurement

All of the lateral cephalograms were traced on 0.001 inches acetate paper over an illumination viewbox in dark room with a sharpe-edge black pencil (0.5 mm. 2B). The specific landmarks used in the investigation were illustrated in Figure 6a. The locations of each landmark were indicated by a single fine pencil dot. When bilateral images were not coincident, the midpoint between

both images were chosen. The angular measurements were done. All the reference points and lines were defined as follows.

Reference points (Figure 6a)

Sella (S) :

The center of the pituitary fossa of the sphenoid bone as seen in the lateral cephalometric radiograph

Nasion (N) :

The most anterior point of the frontonasal suture in the midsagittal plane

Subspinale (A) :

The deepest point on the anterior curvature of the maxillary alveolar process in midsagittal plane

Pogonion (Pog) :

The most anterior point of the bony chin in the midsagittal plane

Suprametale (Point B) :

The deepest point on the anterior curvature of the mandibular alveolar process in midsagittal plane

Menton (Me) :

The lowest point on the symphysis of the mandible in the midsagittal plane

Gnathion (Gn) :

A point located by taking the midpoint between the anterior (Pog) and inferior (Me) points of the bony chin

Gonion (Go) :

A point on the curvature of the angle of the mandible located by bisecting the angle formed by lines tangent to the posterior ramus and the inferior border of the mandible

Tangent - Gonion (tgo) :

A point where the lines tangent to the posterior ramus and the inferior border of the mandible intersect.

Reference lines (Figure 6b)

S - N line :

The line extending from Sella to Nasion

Mandibular plane (MP) :

The line extending from Gonion to Gnathion

tgo - Me line :

The line extending from tangent- Gonion to Menton

Occlusal plane (OP) :

The plane bisecting the overbite of molars and first premolars (Functional occlusal plane)

N - A line :

The line extending from Nasion to Subspinale

N - B line :

The line extending from Nasion to Supramentale

N - Pog line :

The line extending from Nasion to Pogonion

S - Gn line :

The line extending from Sella to Gnathion

B - Pog line :

The line extending from Supramentale to Pogonion

Skeletal variables (Figure 6b)

ANB :

The angle between the NA line and the NB line

SNB :

The angle between the SN line and the NB line

SNPog :

The angle between the SN line and the NPog line

N angle :

The angle between the tgo-Me line and the BPog line

SN - MP :

The angle between the SN line and the mandibular plane

SN - OP :

The angle between the SN line and the occlusal plane

NSGn :

The angle between the SN line and the SGn line

III.2.2 Crown inclination measurement

Crown inclination values were derived from the angle formed by the intersection of a line perpendicular to the occlusal plane and a line tangent to the middle of the labial or buccal long axis of the clinical crown (Figure 1).

The measuring procedures were described step by step as follows.

1. The long axis of the clinical crown was drawn in the upper and lower impression models on the labial surface of each tooth except third molars.
2. The bisecting point was identified at the long axis line after the clinical crown height with adding a 1 millimeter gingival sulcus depth was determined. This point was called " LA point" (Figure 9a-c).
3. The protractor was set parallel to the surveying platform (Figure 9d). This process would adjust the line passing zero degree perpendicular to the surveying platform.
4. The impression model was fixed on the surveying table. Then the horizontal occlusal line was constructed by connecting the LA points of the left and the right first molars and average LA points of the left and the right central incisors (Figure 9e-g). The three points of each model were set parallel to the surveying platform by adjustment of the surveying table until the three points were at the same level as the end of the horizontal arm of the protractor.
5. The crown inclination was measured by setting the vertical protractor arm until the scribe line touching the LA point. Then, the crown inclination value was recorded by reading the protractor scale (Figure 9h-i).

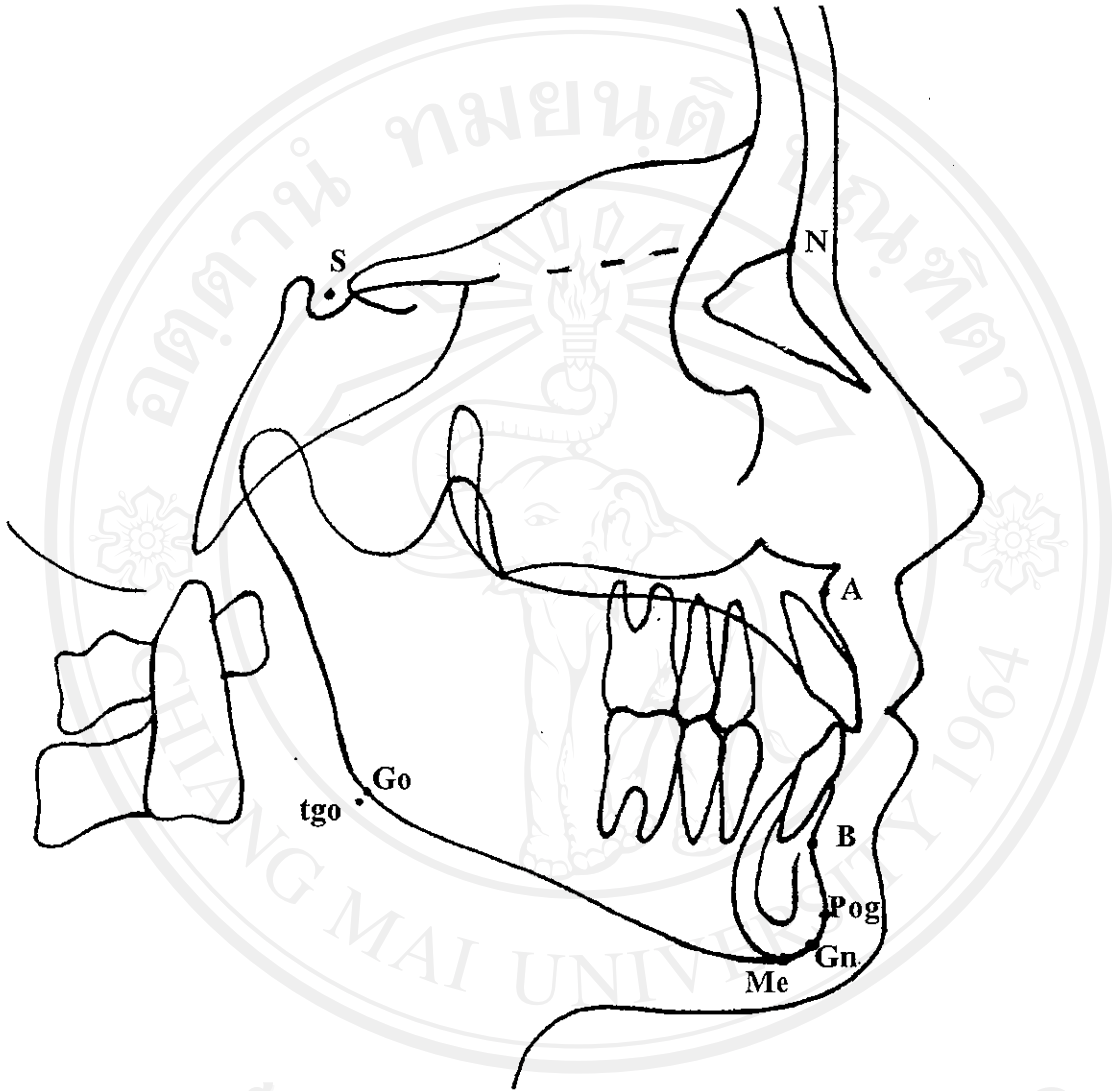


Figure 6a The reference points used in this study.

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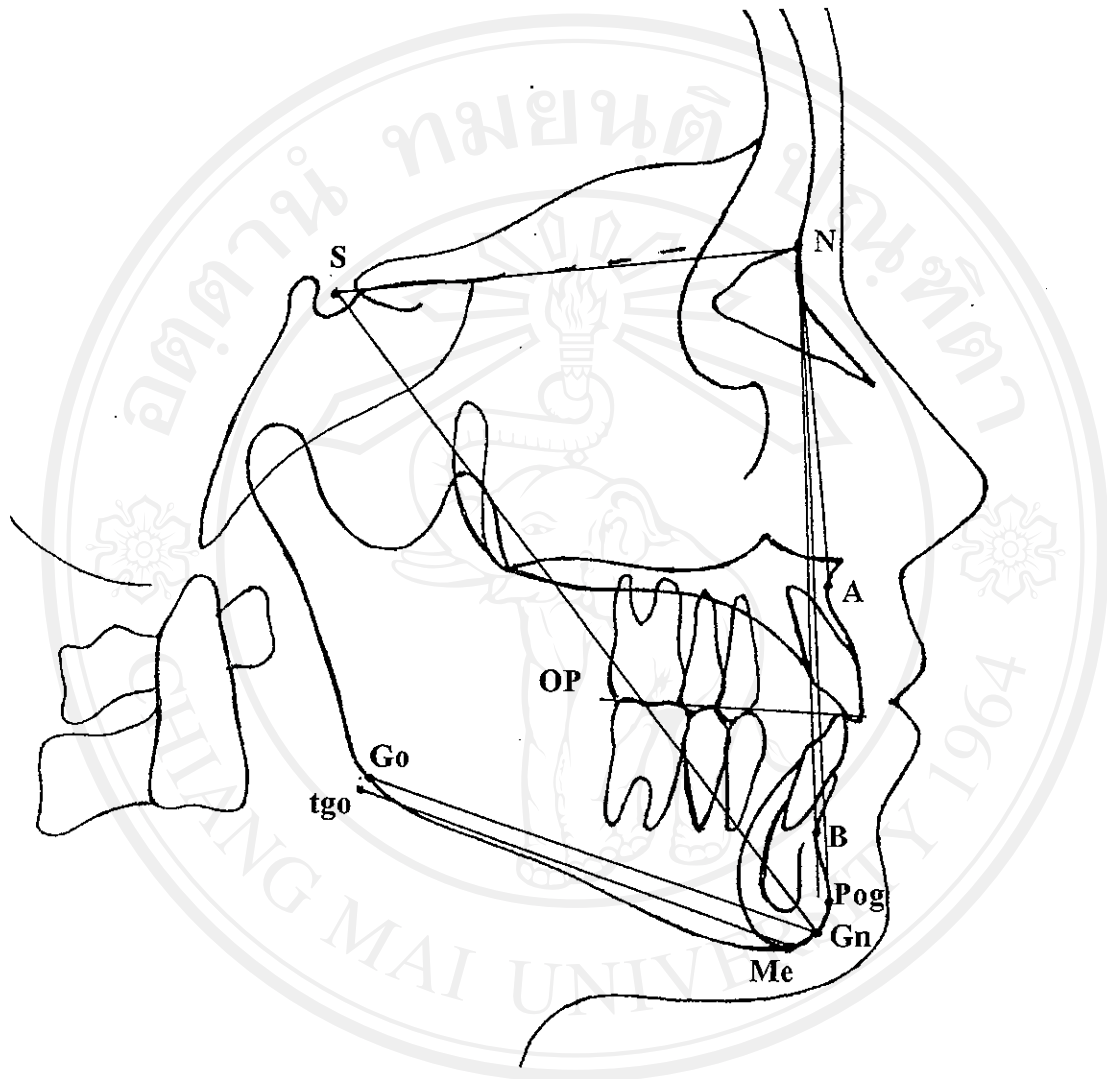


Figure 6b The reference lines used in this study.

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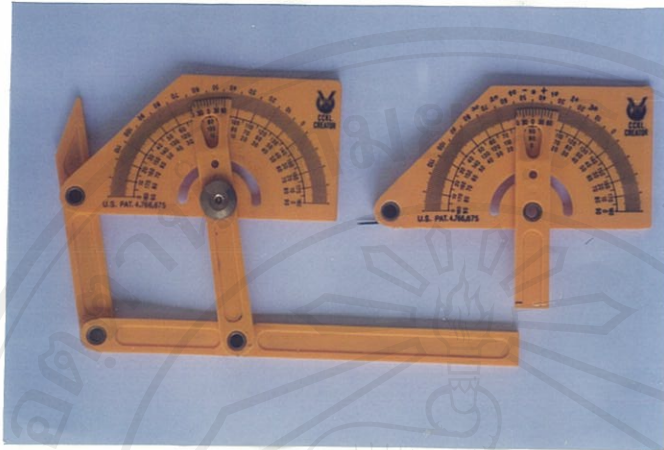


Figure 7a The original (CCKL CREATOR, U.S.PAT.4,766,675) and modified protractors



Figure 7b The crown inclination measuring instrument that was combined with surveyor and modified protractor.

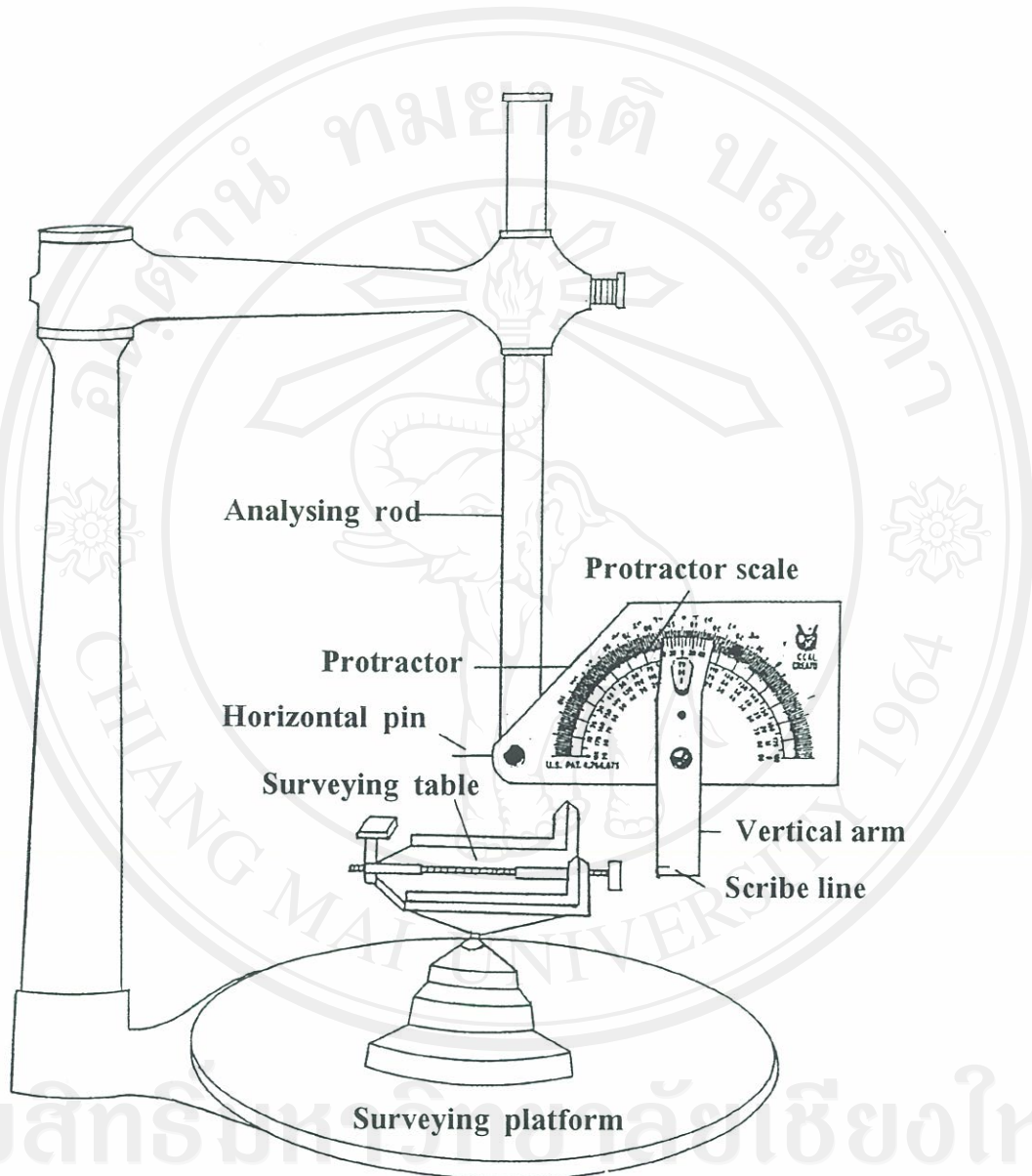


Figure 7C Diagram of the composition of the crown inclination measuring instrument

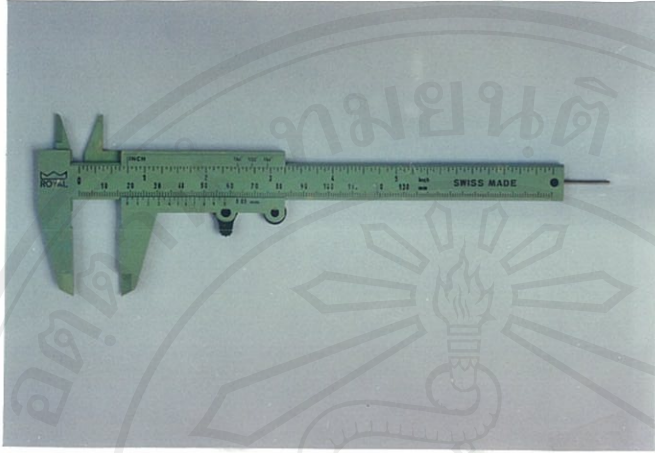


Figure 8 The caliper (MECANE) that was used for measuring the clinical crown height.

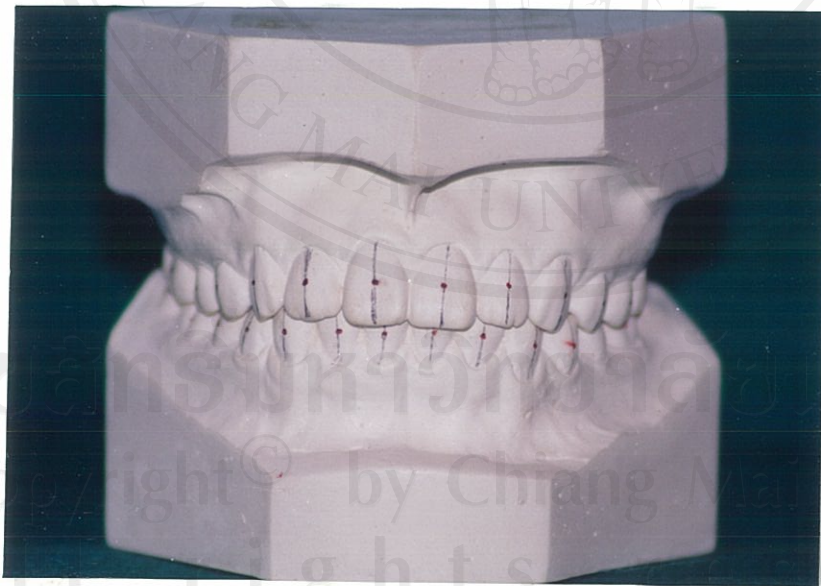


Figure 9a The impression models which were used to define the long axes of the clinical crowns and the LA points (frontal view).

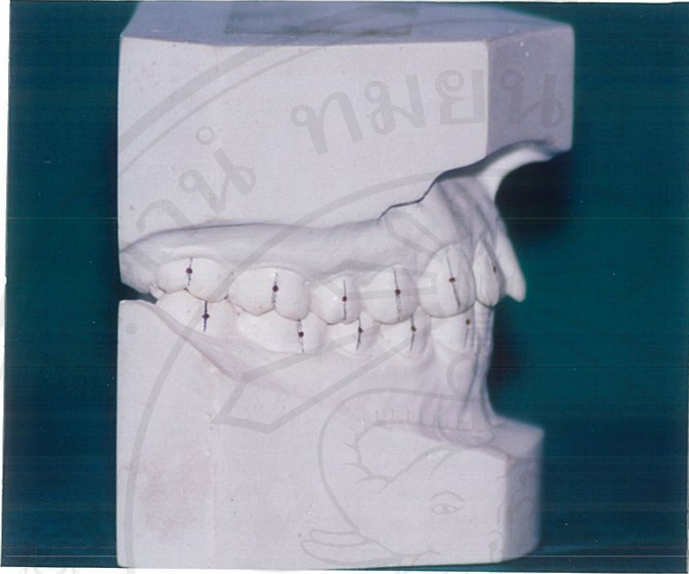


Figure 9b The impression models which were used to define the long axes of the clinical crowns and the LA points (right lateral view).

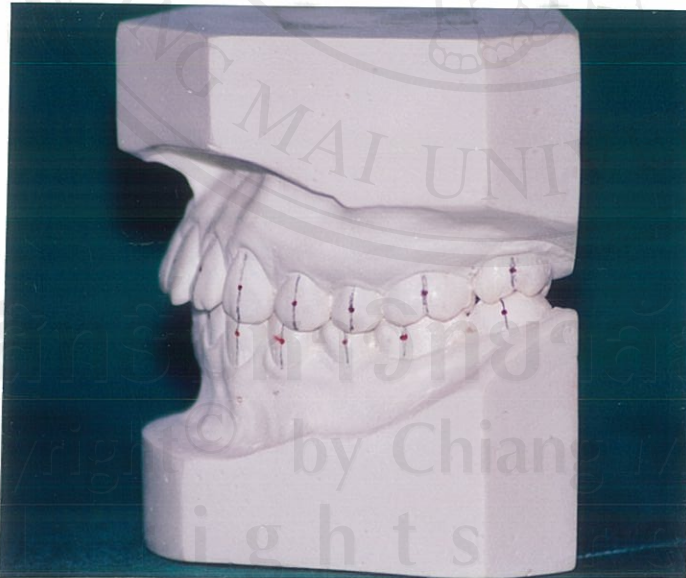


Figure 9c The impression models which were used to define the long axes of the clinical crowns and the LA points (left lateral view).



Figure 9d The protractor was set parallel to the surveying platform before measuring.

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Figure 9e The HOL was set parallel to the surveying platform by adjustment of the surveying table until the average of the LA points of the left and the right central incisors was at the same level as the tip of the horizontal arm.



Figure 9f At the same level of Figure 9e, the LA point of the right first molar was at the same level as tip of the horizontal arm.



Figure 9g At the same level of Figure 9e, the LA point of the left first molar was at the same level as the tip of the horizontal arm.

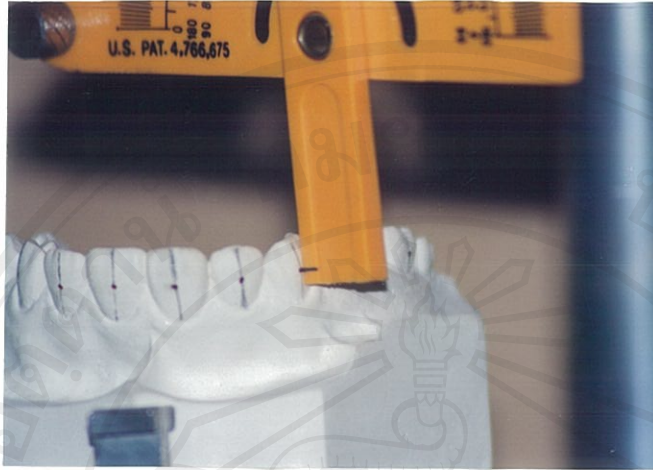


Figure 9h Setting the vertical protractor arm until the scribe line touching the LA point



Figure 9i The crown inclination value was recorded by reading the protractor scale.

III.3 Statistical analysis

All lateral cephalograms were traced twice. Each model and tracing were measured twice. The average values between the first and the second measurements were determined. The SPSS for Window Release 7.5.1 was used for calculating.

The statistical analysis in this study was presented as follows :

1. The mean values of crown inclination of each tooth of male and female were compared by t-test group.
2. The mean values of each skeletofacial cephalometric variable of males and females were compared by t-test group.
3. The average values of crown inclination of each right and left teeth were compared by paired t-test.
4. The correlations between crown inclination of each tooth and each skeletofacial cephalometric variable were analyzed by multiple correlation analysis.
5. If the variables were significantly correlated, the stepwise multiple linear regression would be calculated for predictable equations of crown inclination of each tooth that are proper for a particular skeletofacial pattern.

The probability of significance was denoted as $p < 0.05$, $p < 0.01$ and $p < 0.001$.