CHAPTER III

METHODOLOGY

3.1 STUDY POPULATION AND SAMPLE

The study sample included ninety-three subjects living in Nai Soi village, Huay Puu Kaeng village and Huay Suea Tao village in Mueang District, Mae Hong Son Province. They were divided into two groups according to the neck-coil wearing.

Group I : Subjects wearing brass neck-coils (61 subjects)

Group II: Subjects not wearing brass neck-coils (32 subjects)

The required criteria for the subjects selection were as follows;

Group I :-Padaung women wearing brass neck-coils

- No history of facial trauma occurred
- They have worn the brss neck-coils since 5 years old.

Group II:-Red Karen women not wearing brass neck-coils

- No history of facial trauma occurred

Since most of Padaung women wore brass neck-coils, the other group of the Red Karen women who did not wear brass neck-coils were selected as group II to compare to group I.

Because of the morphological change according to age, each group was classified into two subgroups.

Subgroup I (age group 1) : 5-15 years

Subgroup II (age group 2) : Over 15 years

Normally, Padaung women have to wear brass neck-coils since 5 years old and the sample will pass the adolescent growth spurt which had growth changes less than 0.2% per year after 15 years old (Nabangxang *et al.*,1978).

3.2 METHODS

Facial and dental variables of the study were measured base on photographic analysis, direct facial measurement, and model analysis in order to compare the facial and dental characteristics of the subjects wearing brass neck-coils with the subjects not wearing brass neck-coils.

3.2.1 Facial measurements

The facial measurements consisted of photographic analysis and direct measurement. These measurements were performed on all subjects (ninety-three subjects). The sample size by neck-coil wearing and age group for the facial measurements are showed in Table 1.

Table 1 Number of the subjects, by neck-coil wearing and age group for the facial measurements

Neck-coil wearing	Age group		
	Age group 1	Age group 2	Total
	n	n	n
Wearing	21	40	61
Not wearing	10	22	32
Total	31	62	93

3.2.1.1 Photographic analysis

Two facial photographs, frontal and right views, were taken for each subject. Subjects were in centric occlusion with the lips in rest position. Soft tissue Orbitale point was located by careful palpation and marked on the face of each subject with a black pen.

All photographs were taken using a precise standardized technique proposed by Claman *et al.*,(1990) (Figure 5). The photographic frame should encompass the crown of the head and the clavicle. The distance between the camera and subjects was

controlled to be constant by frequently adjusting and fixing its distance, in order to assure the consistent perspective for all subjects and similar reproduction ratios. To achieve the best picture for analysis, they suggested to establish a constant distance at one-eight magnification. In our study, all photographs were taken using one-eight magnification, although some photographs of subjects wearing brass neck-coils had not encompassed the clavicle. In addition, the reference object was used to calculate the image magnification.

In frontal view, the interpupillary line had to be paralleled to the horizontal plane. The distance from the outer canthus of the eye to the lateral side of hairline should be equal on each side.

For lateral view, Frankfort horizontal plane (FH) was used as horizontal reference line. This line connects the uppermost point of the tragus of ear to the soft tissue Orbitale. The Frankfort line should be parallelled to the horizontal plane. For a true lateral profile, this relationship was established by making certain the inner and outer aspects of one eye visible, the structure of the other side was hidden.

All photographs were recorded by digital camera (Nikon D-100 with 105-mm. macro lens). The digital imaging software (VixWin ™ 2000,Dentsply) was used to calibrate the magnification and to measure the facial photographs variables.

Figure 5 The position for frontal and lateral facial photographs

A. Frontal facial analysis

The 14 frontal facial landmarks and 8 frontal facial measurements were identified in Figure 6 and 7.

Descriptions of frontal facial landmarks (Figure 6)

a. Exocanthion (Ex)

: the outer end of fissure between eyelids

b. Endocanthion (En)

: the inner end of fissure between eyelids

c. Alare (Al)

: the lateral side of alar of nose

d. Cheilion (Ch)

: the corner of the mouth

e. Zygion (Zy)

: the bowlike prominence created at the side of the head by the temporal process of the zygoma

f. Gonion (Go)

: the outline angle of mandible at the lateral side of face

g. Midsagittal hairline (H)

: the end of hair at forehead in the midsagittal plane

h. Soft tissue Menton (Me')

: the most inferior point of the soft tissue chin in the midsagittal plane

Frontal facial measurements

a. Right eye width (REW)

: the distance between the right Endocanthion (En^{rt}) to the right Exocanthion (Ex^{rt})

b. Left eye width (LEW)

: the distance between the left Endocanthion (En^{lt}) to the left Exocanthion (Ex^{lt})

c. Nose width (NW)

: the distance between the right Alare (Al^{rt}) to the left Alare (Al^{lt})

d. Mouth width (MW)

: the distance between the right Cheilion (Ch^{rt}) to the left Cheilion (Ch^{lt})

e. Upper face width (UFW)

: the horizontal distance between the right Zygion (Zy^{rt}) to the left Zygion (Zy^{lt}) (Figure 7)

f. Lower face width (LFW)

: the horizontal distance between the right Gonion (Go^{rt}) to the left Gonion (Go^{lt}) (Figure 7)

g. Total face height (TFH)

: the vertical distance between midsagittal Hairline (H) to the soft tissue Menton (Me') (Figure 7)

h. Facial index (FI)

: The facial index is calculated by the formula: "Total face height x 100/ Upper face width" (Figure 7).

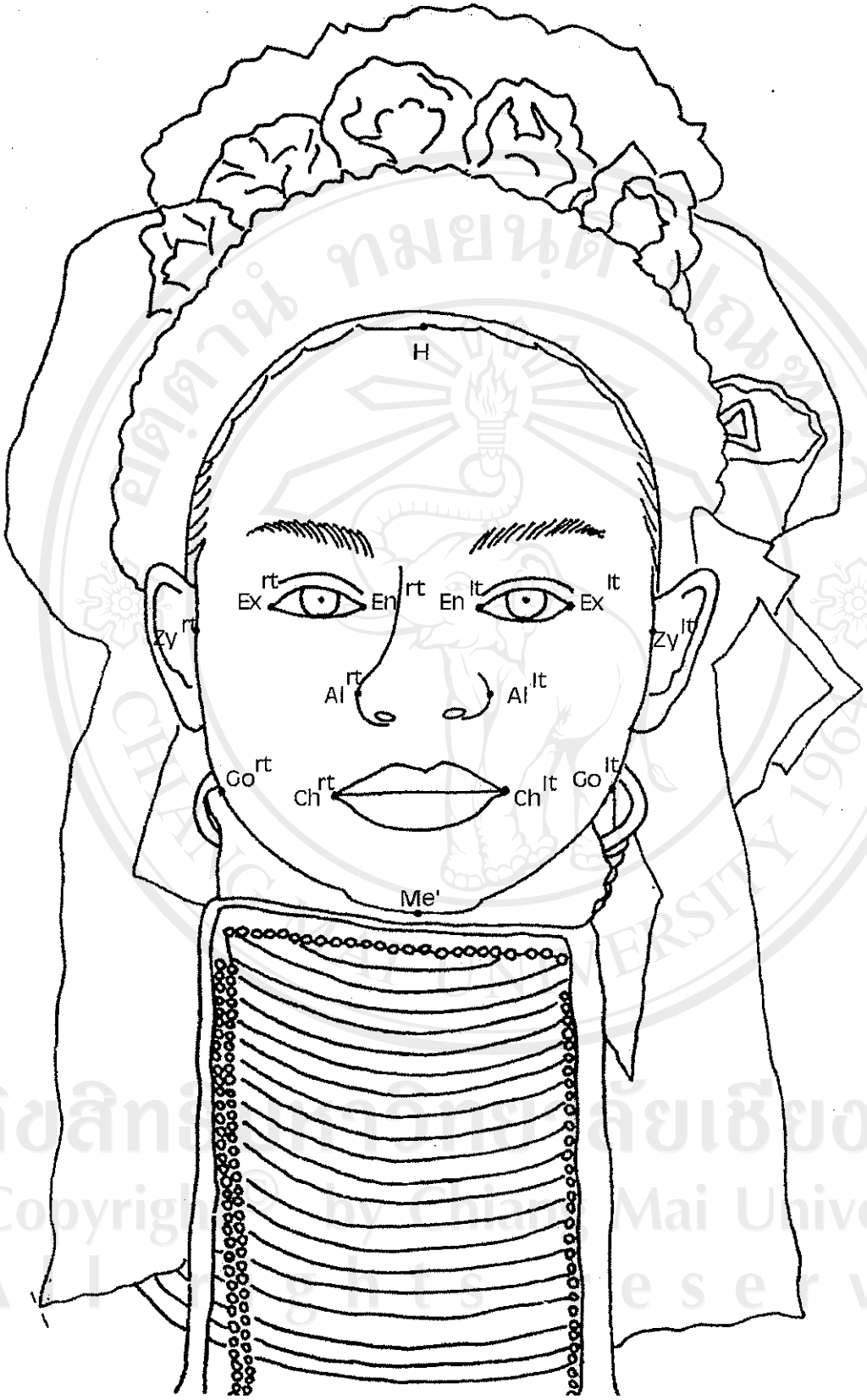


Figure 6 Frontal facial landmarks

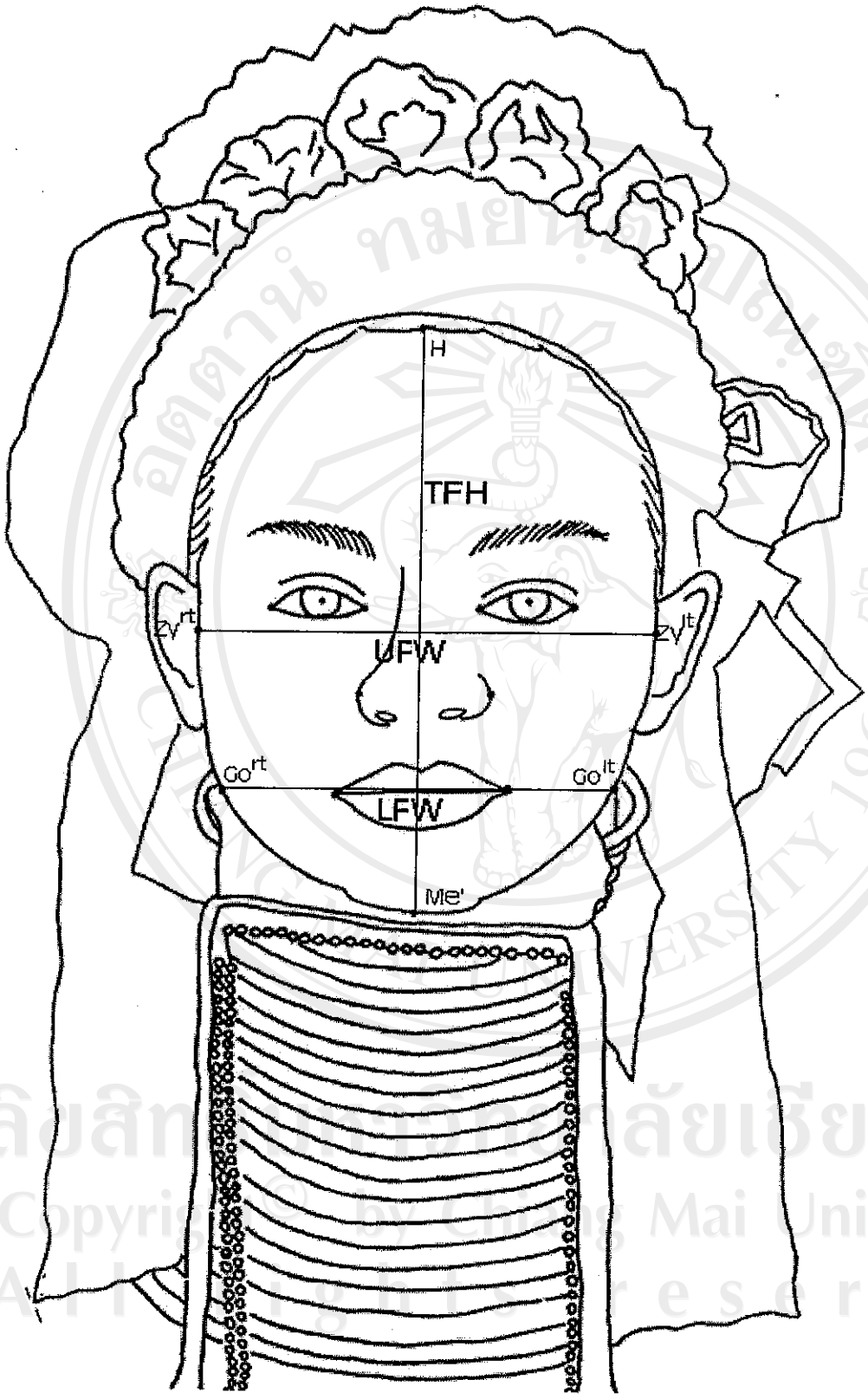


Figure 7 Measurement of total face height and face widths

B. Lateral facial analysis

The 7 lateral facial landmarks, 1 line and 14 lateral facial measurements were identified in Figure 8, 9, 10 and 11.

Descriptions of lateral facial landmarks and a line (Figure 8)

a. Midsagittal hairline (H)

: the end of hair at forehead in the midsagittal plane

b. Midbrow (Mb)

: the midpoint between eyebrows in the midsagittal plane

c. Subnasale (Sn)

: the point in the midsagittal plane where the base of the columella of the nose meet the upper lip

d. Stomion (Sto)

: the most anterior point of contact between the upper and lower lip in the midsagittal plane

e. Soft tissue Menton (Me')

: the most inferior point of the soft tissue chin in the midsagittal plane

f. Gabella (G')

: the most anterior point of the middle line of forehead in the midsagittal plane

g. Soft tissue Pogonion (Pg')

: the most prominent point on the soft tissue contour of the chin in the midsagittal plane

h. Esthetic line (E-line)

: the line between tip of nose and soft tissue Pogonion

Lateral facial measurements

a. Upper face height (UFH)

: The vertical distance between midsagittal Hairline (H) to Midbrow (Mb) (Figure 9)

b. Middle face height (MFH)

: The vertical distance between Midbrow (Mb) to Subnasale (Sn) (Figure 9)

c. Lower face height (LFH)

: The vertical distance between Subnasale (Sn) to soft tissue Menton (Figure 9)

d. Upper face proportion (UFP)

: the proportion between distance from Hairline (H) to Midbrow (Mb) and total face height (Figure 9)

e. Middle face proportion (MFP)

: the proportion between distance from Midbrow (Mb) to Subnasale (Sn) and total face height (Figure 9)

f. Lower face proportion (LFP)

: the proportion between distance from Subnasale (Sn) to soft tissue Menton (Me') and total face height (Figure 9)

g. Upper lip length (ULL)

: the vertical distance between Subnasale (Sn) to Stomion (Sto) (Figure 9)

h. Lower lip length (LLL)

: the vertical distance between Stomion (Sto) to soft tissue Menton (Me') (Figure 9)

i. Upper lip proportion (ULP)

: the proportion between distance from Subnasale (Sn) to Stomion (Sto) and total lip length (Figure 9)

j. Lower lip proportion (LLP)

: the proportion between distance from Stomion (Sto) to soft tissue Menton (Me') and total lip length (Figure 9)

k. Sn-Pg'

: the horizontal distance between Subnasale (Sn) to soft tisse Pogonion (Pg') (Figure 10)

l. Upper lip to Esthetic line (UL-E-line)

: the distance from the most prominence of upper lip perpendicular to Esthetic line (Figure 10)

m. Lower lip to Esthetic line (LL-E-line)

: the distance from the most prominence of lower lip perpendicular to Esthetic line (Figure 10)

n. Profile angle (G'-Sn-Pg')

: the angle formed by connecting soft tissue Glabella (G'), Subnasale (Sn), and soft tissue Pogonion (Pg') (Burstone, 1958; Legan and Burstone, 1980) (Figure 11)

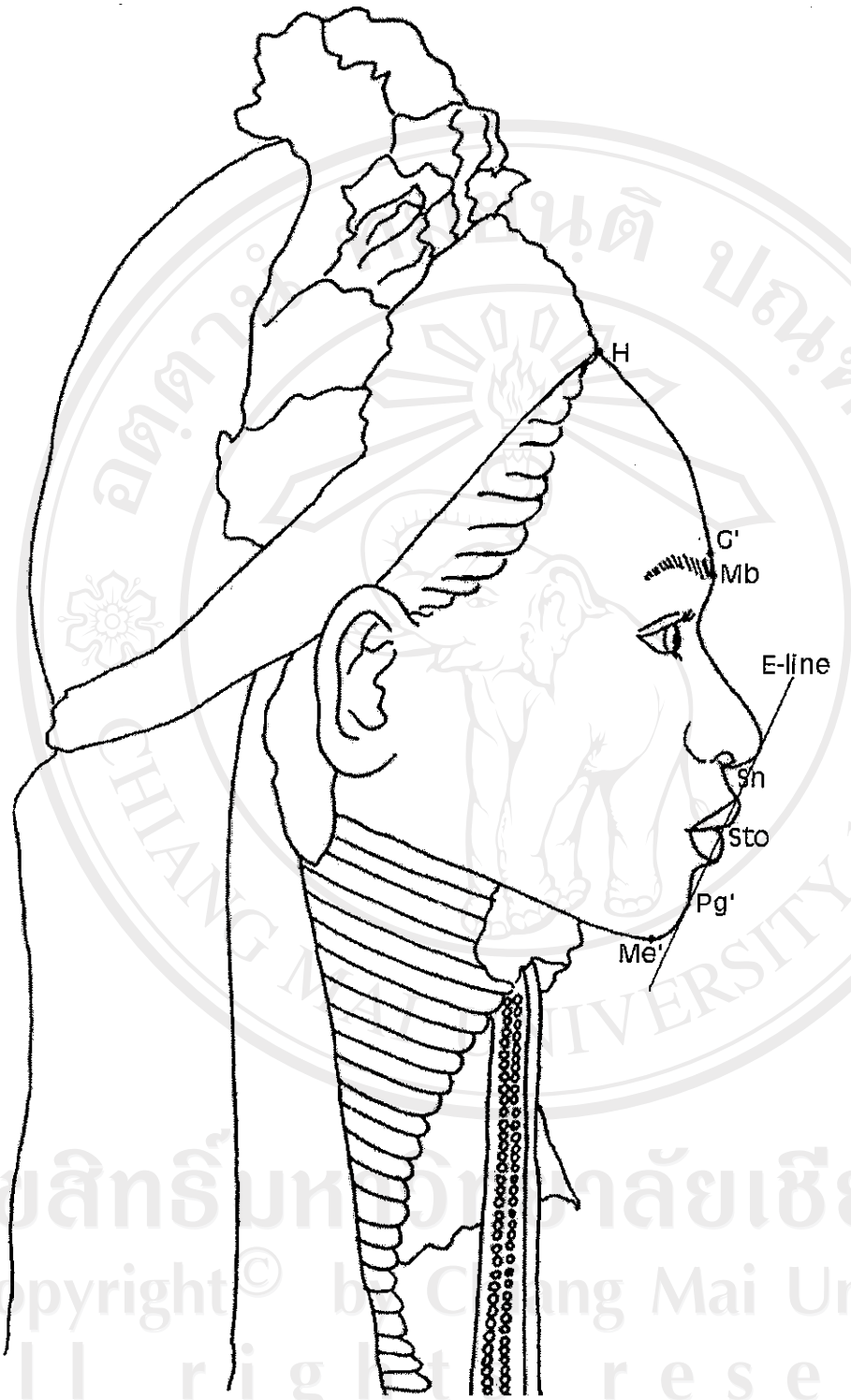


Figure 8 Lateral facial landmarks and a line

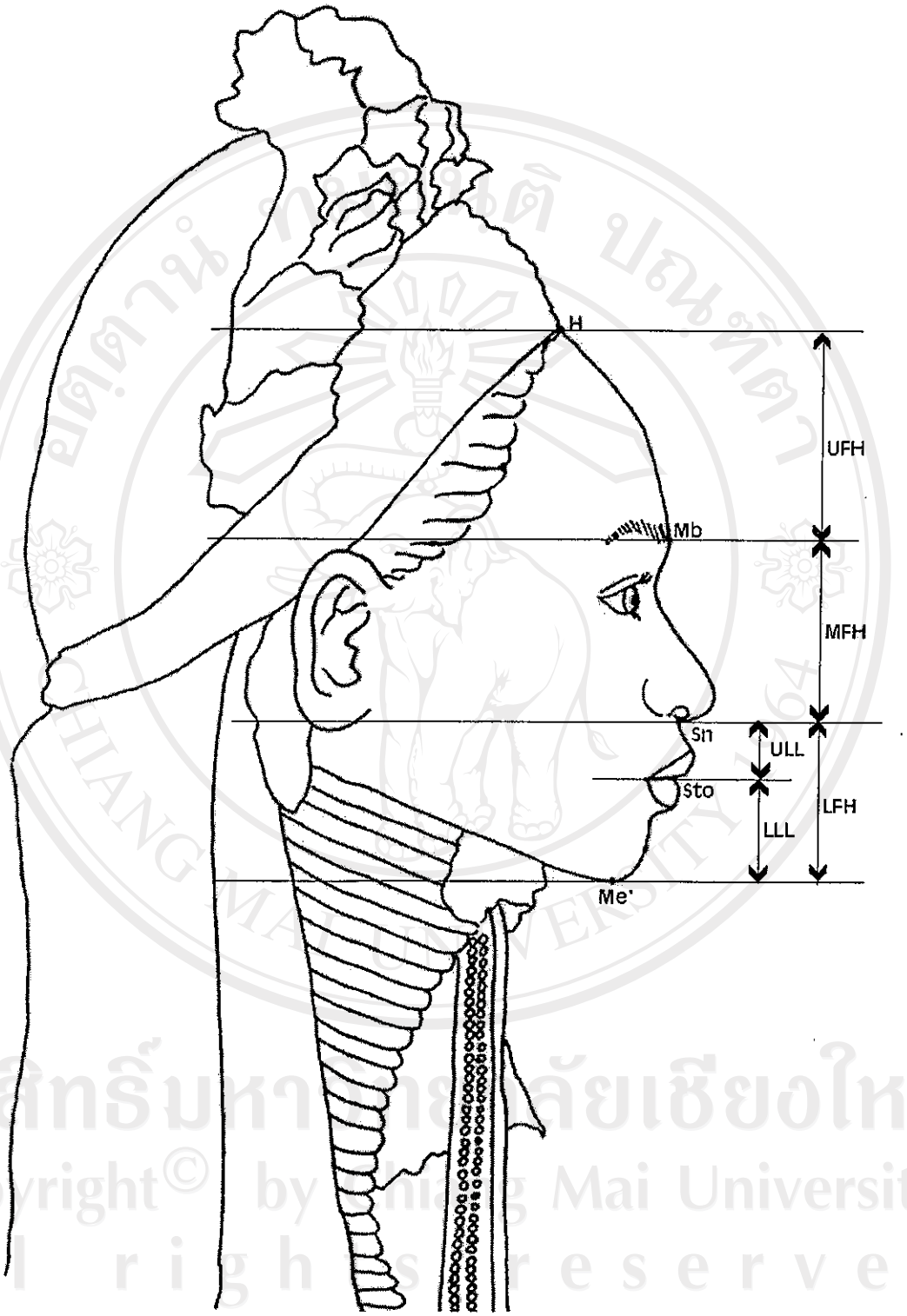


Figure 9 Measurement of vertical facial proportions in the lateral facial view

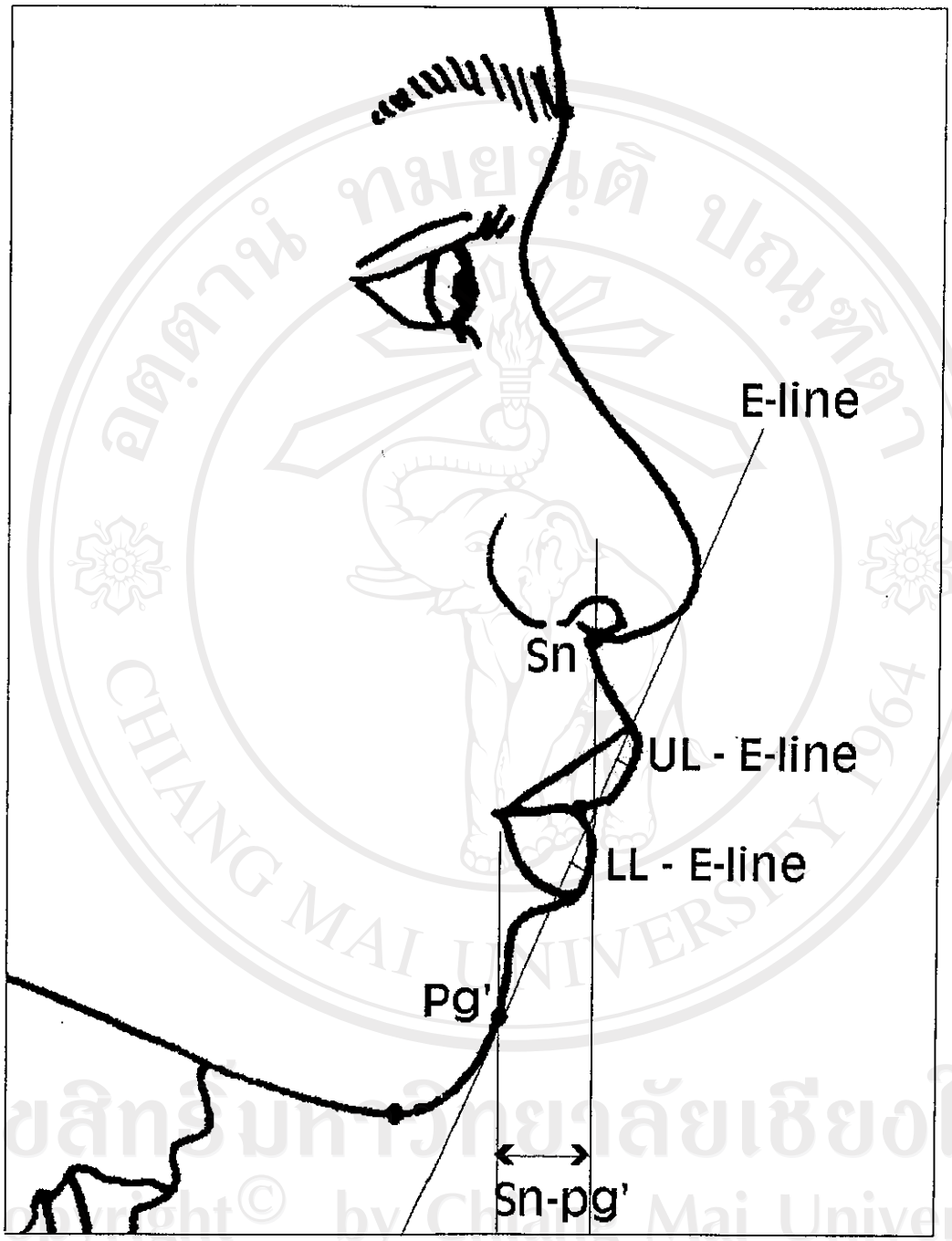


Figure 10 Measurement of upper and lower lips to Esthetic line and Sn-Pg' distance

Figure 11 Measurement of profile angle

3.2.1.2 Direct measurement

a. Maximum mouth opening (MMO)

: the distance between the incisal edges of the upper and lower central incisors on maximum jaw opening

The amount of overbite is added to obtained this value. This measurement was made with Electronic digital straight caliper (KEIBA) with fine tip measuring within 0.01 mm.

3.2.2 Dental measurements

All dental measurements were performed by model analysis (model examinations and model measurements). Each subject was seated on the chair with her back supported, so that an accurate dental impression could be made. The impression material used was alginate. All of the impression were rinsed and immediately poured with orthodontic stone. In addition, bite registrations with dental pink wax were made.

The criteria of dental models for subjects inclusion were as follows

- Each model had to have fully erupted permanent first molars.
- Each model had not loss more than two teeth in each arch that broke arch continuity and influenced the vertical dimension (Bishara *et al.*, 1996).

As a results, sixty-three subjects were accepted for the dental measurements. The sample sizes by neck-coil wearing and age group for the dental measurements are showed in Table 2.

Table 2 Number of the subjects, by neck-coil wearing and age group for the dental measurements

Neck-coil wearing	Age group		
	Age group 1	Age group 2	Total
	n	n	n
Wear	13	30	43
Not wearing	6	14	20
Total	19	44	63

Model examination

a.Type of occlusion

: the type of occlusion is divided into 3 types according to Angle's classification

- Class I malocclusion : a malocclusion in which the buccal groove of the mandibular first permanent molar occludes with the mesiobuccal cusp of the maxillary first permanent molar
- Class II malocclusion : a malocclusion in which the buccal groove of the mandibular first permanent molar occludes posteriorly (distal) to the mesiobuccal cusp of the maxillary first permanent molar
- Class III malocclusion : a malocclusion in which the buccal groove of the mandibular first permanent molar occludes anteriorly (mesial) to the mesiobuccal cusp of the maxillary first permanent molar

b. Arch form

: the shape of an individual dental arch

- Upper arch form (UAF) : the upper arch forms were divided into parabolic, V-shaped and U-shaped
- Lower arch form (LAF) : the lower arch forms were divided into parabolic, V-shaped and U-shaped

Model measurements

a. Overjet (OJ)

: the horizontal distance between the labial incisal edge of the upper incisor and the labial surface of the lower incisor

b. Overbite (OB)

: the vertical distance between the incisal edge of the upper incisor and the lower incisor

c. Curve of Spee (CS)

: the vertical distance from the vertex of the curvature to the side of plastic template placed over the lower arch. The template touches anteriorly the incisal edges and posteriorly the disto-buccal cusp of the distal most molars (excluding third molars) The measurement was carried out by average the values from the left and right sides.

d. Intercanine widths

- Upper intercanine width (UCW)

Mixed dentition : the distance between the cusp tips of the right and left maxillary deciduous canines (Figure 12)

Permanent dentition : the distance between the cusp tips of the right and left maxillary permanent canines (Figure 12)

- Lower intercanine width (LCW)

Mixed dentition : the distance between the cusp tips of the right and left mandibular deciduous canines (Figure 12)

Permanent dentition : the distance between the cusp tips of the right and left mandibular permanent canines (Figure 12)

e. Anterior arch widths

- Upper anterior arch width (UAAW)

Mixed dentition : the distance between the distal pits of the right and left maxillary first deciduous molars (Figure 12)

Permanent dentition : the distance between the lower-most points of the transverse fissure of the right and left maxillary first premolars (Figure 12)

- Lower anterior arch width (LAAW)

Mixed dentition : the distance between the disto-buccal cusp tips of the right and left mandibular first deciduous molars (Figure 12)

Permanent dentition : the distance between the buccal contact points between first and second mandibular premolars of the right and left sides (Figure 12)

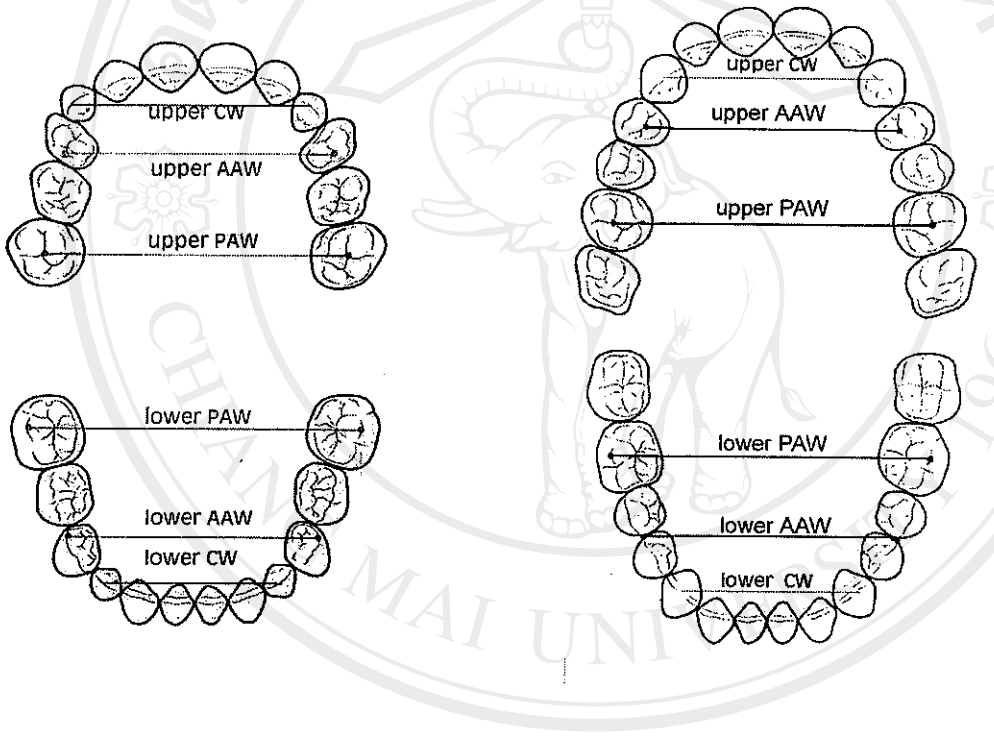
f. Posterior arch widths

- Upper posterior arch width (UPAW)

: the distance between the central pits of the right and left maxillary first molars (Figure 12)

- Lower posterior arch width (LPAW)

: the distance between the disto-buccal cusps of the right and left mandibular first molars (Figure 12)



Mixed dentition Permanent dentition

Figure 12 Measurement of dental arch width

g. Anterior arch lengths

- Upper anterior arch length (UAAL)

: the distance from the midline of the labial surfaces of the maxillary central incisors perpendicular to the upper anterior arch width (Figure 13)

- Lower anterior arch length (LAAL)

: the distance from the midline of the labial surfaces of the mandibular central incisors perpendicular to the lower anterior arch width (Figure 13)

h. Posterior arch lengths

- Upper posterior arch length (UPAL)

: the distance from the midline of the labial surfaces of the maxillary central incisors perpendicular to the upper posterior arch width (Figure 13)

- Lower posterior arch length (LPAL)

: the distance from the midline of the labial surfaces of the mandibular central incisors perpendicular to the lower posterior arch width (Figure 13)

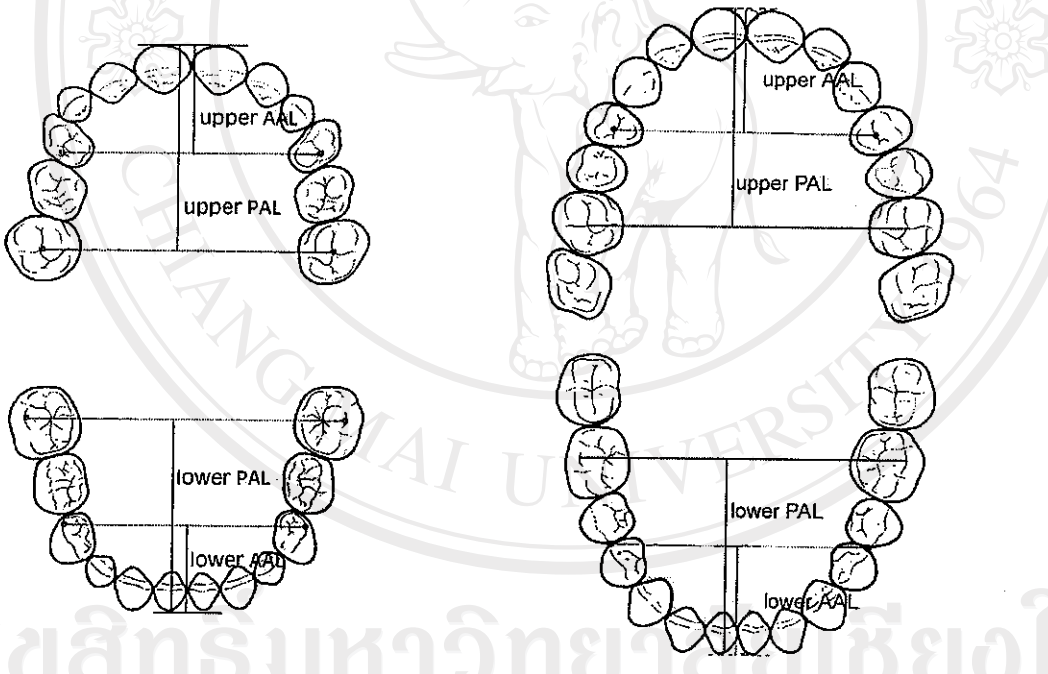


Figure 13 Measurement of dental arch length

The overjet, overbite, curve of Spee, intercanine width, anterior arch width, posterior arch width, anterior arch length and posterior arch length were measured by using the electronic digital straight caliper (KEIBA) with fine tip measuring within 0.01 mm.

i. Incisor inclination

The incisor inclination in this study was measured from the clinical crown inclination of the central incisors by using the surveyor and a protractor which was described by Duangtaweesub (1997) (Figure 14).

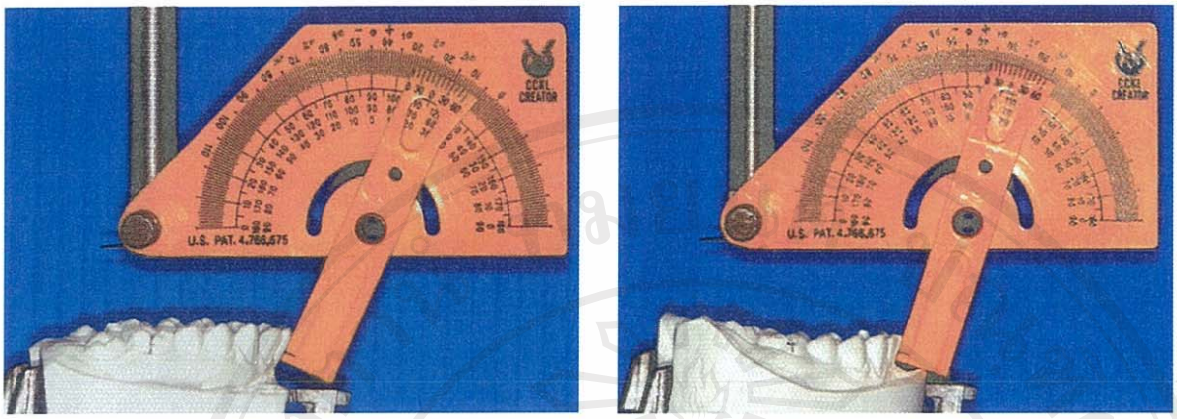
- Upper incisor inclination (UI)

  : the means inclination of upper right central incisor and upper left central incisor (Figure 15a)

- Lower incisor inclination (LI)

  :the means inclination of lower right central incisor and lower left central incisor (Figure 15b)

Figure 14 The measuring instrument of the incisor inclination



a. The Measurement of upper incisor inclination

b. The Measurement of lower incisor inclination

Figure 15 Measurement of incisor inclination

j. Palatal height (PH)

: the depth of the palate measured from the upper occlusal plane at the central pits of the maxillary first molars in the vertical axis to the palatal vault using the Korkhaus three-dimensional orthodontic divider (Figure 16)

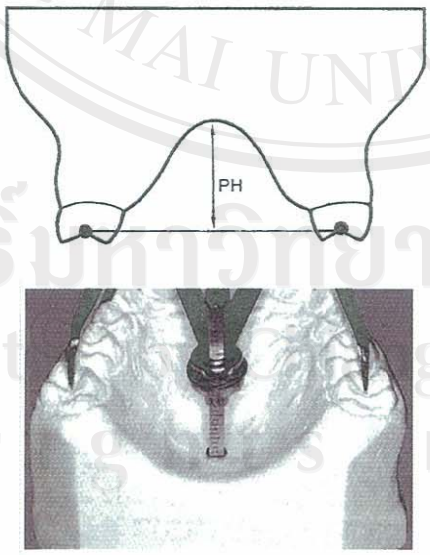


Figure 16 Measurement of palatal height

The measurement of the incisor inclination and the palatal height were measured only in models that have permanent dentition with fully eruption of all permanent canines. As a resulted, forty-seven subjects were accepted (Table 3).

Table 3 Number of the subjects, by neck-coil wearing and age group for measuring the incisor inclinations and palatal height

Neck-coil wearing	Age group		
	Age group 1	Age group 2	Total
	n	n	n
Wearing	6	28	34
Not wearing	0	13	13
Total	6	41	47

3.3 Statistical methods

The SPSS for Windows Release 10.0.1 program (SPSS., Chicago, USA, 1989-1999) was used for data analysis as follow.

3.3.1 Descriptive analysis

3.3.1.1 Means and standard deviations were used to describe for continuous variables.

3.3.1.2 Frequencies and percentages were used to describe for categorical variables.

3.3.2 Comparisons among groups

Ninety five percent confidence interval was used to consider for statistically significant results.

3.3.2.1 Two way analysis of variance (two-way ANOVA) was used to compare continuous variables among groups (neck-coil wearing variable) accounting for age group variable. Then, the Scheffe test was used for multiple comparisons between the means.

3.3.2.2 Chi-square test was used to test the associations between neck-coil wearing and categorical variables.

The probability of significance were denoted as * for $P<0.05$, as ** for $P<0.01$ and as *** for $P<0.001$.

3.4 Reliability of the measurements

To perform intra-investigator calibrations (in the same investigators) during the data measurements, 16.1% (15 subjects) of the sample were randomly selected. The second investigations were conducted after the first investigations for two weeks as suggested by Houston (1983). These intra-investigator calibrations were done in all facial and dental variables except the maximum mouth opening.

The categorical data were analyzed for intra-examiner reproducibility using Cohen's Kappa test. All categorical variables in this study (3 variables) showed perfect agreement (Kappa value = 1.00, $P<0.001$)(Appendix A). The intra-examiner calibration

for all continuous data were analyzed by using Pearson's product moment correlation, the correlation coefficients ranging from 0.92 to 0.99 ($P<0.001$) (Appendix B). This indicated that the measurements of the investigator were satisfied with a high reproducibility.