CHAPTER III

MATERIALS AND METHODS

1. MATERIALS

The study consisted of lateral cephalograms from the Orthodontic Department, Faculty of Dentistry, Chiang Mai University and private clinics of the faculty members. The criteria for subjects inclusion were as follows,

1. At permanent dentition, regardless of the third molars
2. No restoration involving the incisal edges of central incisors or the cusp tips of first molars
3. Adult samples without history of orthodontic treatment
4. At least 15 and 17 years of age for females and males respectively
5. The deepbite was defined when the incisal edges of the lower incisors imprinted on the palate gingiva of upper incisors.

Table 1 Age distribution of Class I deepbite, Class II div. 1 deepbite and normal groups

Group	Number of	Age(years)			SD	SE mean
	subjects	Min	Max	Mean		
Class I deepbite						
Male	35	17.0	34.0	20.4	4.60	0.78
Female	35	15.0	34.0	19.8	4.02	0.48
Class II div 1 deepbite						
Male	35	17.0	38.0	20.9	4.67	0.79
Female	35	15.0	38.0	20.0	4.38	0.52
Normal						
Male	35	16.3	25.7	20.97	1.83	0.31
Female	35	15.8	28.8	19.17	2.48	0.42

The sample size in this study was calculated from the pilot study.The study was comprised of the centric occluded lateral cephalograms of 210 Northern Thai adults, 105 females and 105 males. The samples were equally divided into three groups: Control or normal occlusion, the Class I deepbite and Class II div. 1 deepbite. Data of the normal group were collected from lateral cephalograms available at the Orthodontic Department of the Faculty of Dentistry, Chiang Mai University. Each subject had a good interdigitation, normal overjet and overbite and a pleasing profile.

The anterior deepbite samples were divided into the Class I and the Class II div. 1 groups. A pilot study was undertaken in 10 samples of each group to obtain a reasonable estimate of sample size (Appendix A). The required number of samples should be 69 in each group for 95% confidence, 75% power desired. The sample size for this study was 70 for each group.

2 METHODS

2.1 Tracing of Cephalograms

The lateral cephalometric tracings were performed by a single investigator on 8 by 10 inch acetate paper using a 0.3 millimeter 2B pencil. When bilateral images were not coincident, the midline between both images was traced. The angular and linear measurements were done by using a standard cephalometric protractor (ORMCO) which could measure differences as small as 0.5 millimeter and 0.5 degree. Each measurement was checked only to ascertain that the observer did not misread. The 20 cephalometric landmarks of hard and soft tissues, the 12 planes/lines, 15 angular measurements and 19 linear measurements are identified in figure 1 to figure 6. The cephalometric analyses in this investigation were adopted from Steiner (1953), Burstone (1967), Jarabak and Fizzell (1972) and Karlsen (1994).

2.2 Statistical Methods

1. Descriptive analyses provided the mean, standard deviation and estimation of means for each craniofacial values to enable characterization of the different sample groups of the Class I deepbite, the Class II div. 1 deepbite and normal occlusion samples.
2. Intergroup mean differences for each measurement were assessed, with one way analysis of variance (ANOVA) in the three groups of deepbite and normal occlusion. The ANOVA was followed by Scheffe test comparisons among the means.
3. Intergroup mean differences for each measurement was assessed, with two way analysis of variance (ANOVA) in three occlusion groups (gender combined). The ANOVA was followed Scheffe test comparisons between the means.

The propability of significance was donated as * for $p<0.05$, as ** for $p < 0.01$ and as *** for $p<0.001$.

2.3 Evaluation of Method Errors

Ten lateral cephalograms were randomly selected, retraced and remeasured by the same investigator and an experienced orthodontist to check for intra-examiner and inter-examiner systematic errrors respectively (Freudenthaier *et al.* 2000). The repeated measurements were tested with *t*-test to assess the errors in the measurements(Appendix B).

2.4 Descriptions of Cephalometric Landmarks

2.4.1 Skeletal, dentofacial and soft tissue landmarks (Figure 1)

1. Nasion (N):

   The junction of frontal, maxillary and nasal bones.

2. Anterior nasal spine (ANS):

   The tip of the projection on the maxilla for support of the nose .

3. Upper incisor apex (UIA):

   The root tip of the maxillary incisor.

4. Subspinale (A):

   The deepest point on the maxilla between the anterior nasal spine and alveolar process.

5. Upper incisor (UI):

   The center of the tip of the upper incisal margin.

6. Lower incisor (LI):

   The center of the tip of the lower incisal margin.

7. Lower incisor apex (LIA):

   The root tip of the mandibular incisor.

8. Supramentale (B):

   The deepest point on recess of the alveolus outline on the mandible.

9. Pogonion (Pg):

   The most prominent point at the anterior curvature of the chin.

10. Gnathion (Gn):

    The anteroinferior margin of symphysis.

11. Menton (Me):

    The lowest point on the symphysis.

12. Gonion (Go):

    The postero–inferior point on the ramus. The cephalometric Go is at the intersection of the mandibular plane and the ramus plane.

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13. Articulare (Ar):

    The posterior outline of the condyle neck visible below the cranium. It may also be selected at crossing of the dorsal outline, the neck of the condyloid process, with the BaN plane.

14. Basion (Ba):

    The point at the center of the anterior border of foramen magnum at the base of the occipital bone.

15. Sella (S):

    The arbitrary point selected by inspection at the center of sella tursica.

16. Posterior nasal spine(PNS):

    The midpoint of the base of the palatine bones at the posterior margin of hard palate.

17. Upper molar cusp tip (UMT):

    The mesiobuccal cusp tip of the maxiilary first molar.

18. Lower molar cusp tip (LMT):

    The mesiobuccal cusp tip of the mandibular first molar.

19. Subnasale (Sn):

    The point at which the nasal septum merges with the upper cutaneous lip in the midsagittal plane.

20. Stomion superious (Stm_s):

    The lowermost point of the ermillion borderof the upper lip.

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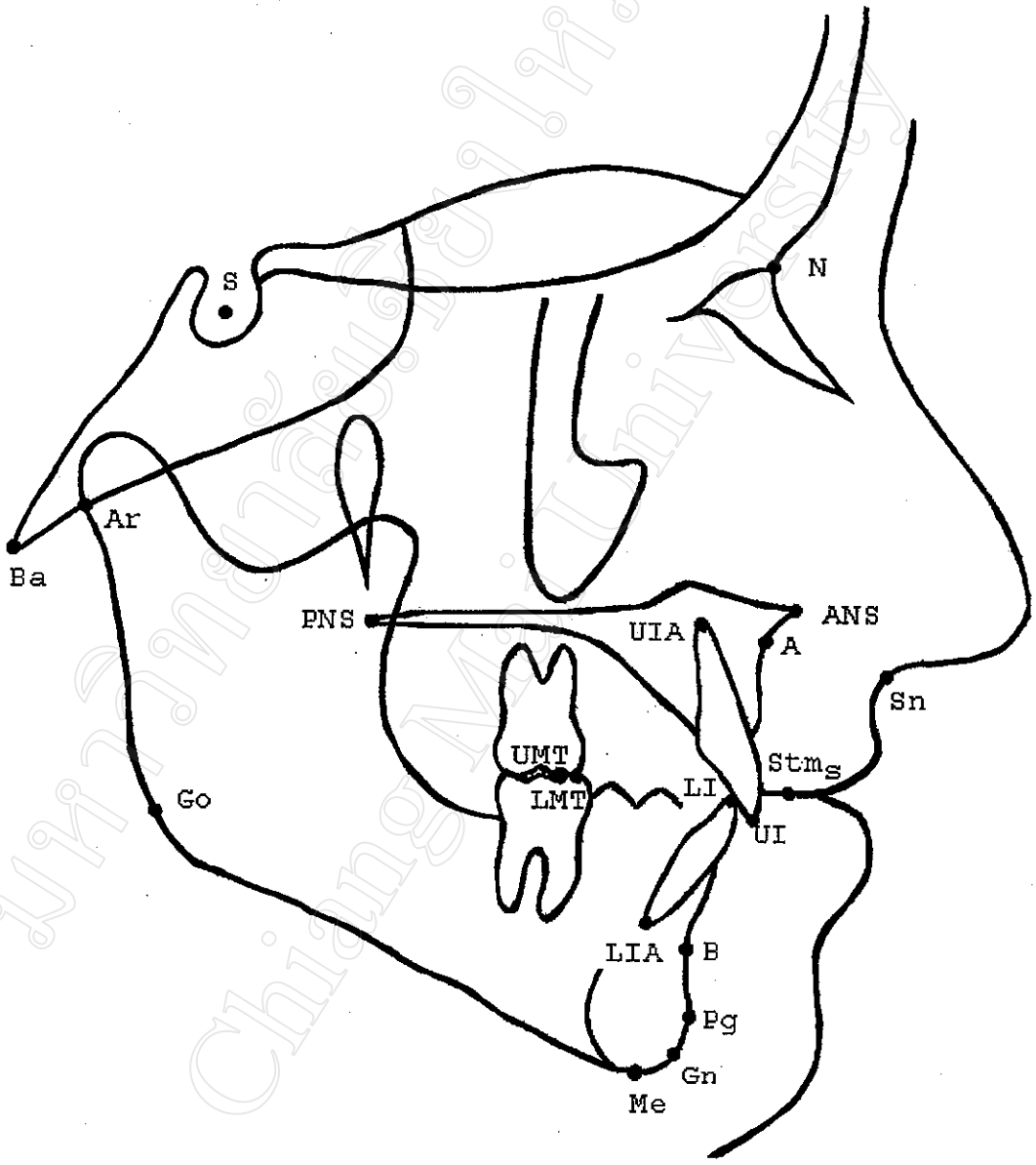

Figure 1 Skeletal, dentofacial and soft tissue landmarks

2.4.2 **Lines and Planes** (Figure 2)

1. Sella-Nasion plane (SN):

   The line between Sella and Nasion.

2. Sella-Nasion prime plane (SN'):

   The sagittal axis constructed through Sella at an angle of 8 degrees to the SN.

3. SNP' plane:

   The vertical axis perpendicular to SN' through Nasion.

4. NA line:

   The line between Nasion and point A.

5. NB line:

   The line between Nasion and point B.

6. SBa:

   The line between Sella and Basion.

7. SAr:

   The line between Sella and Articulare.

8. ArGo:

   The line between Articulare and Gonion.

9. GoGn:

   The line between Gonion and Gnathion.

10. Palatal plane (ANS-PNS):

    The line between ANS and PNS.

11. Mandibular plane (MP):

    The tangent to the lower border of the mandible through Menton.

12. Functional occlusal plane (FOP):

    The line between the cusp tip of the mandibular first molars to the first premolars.

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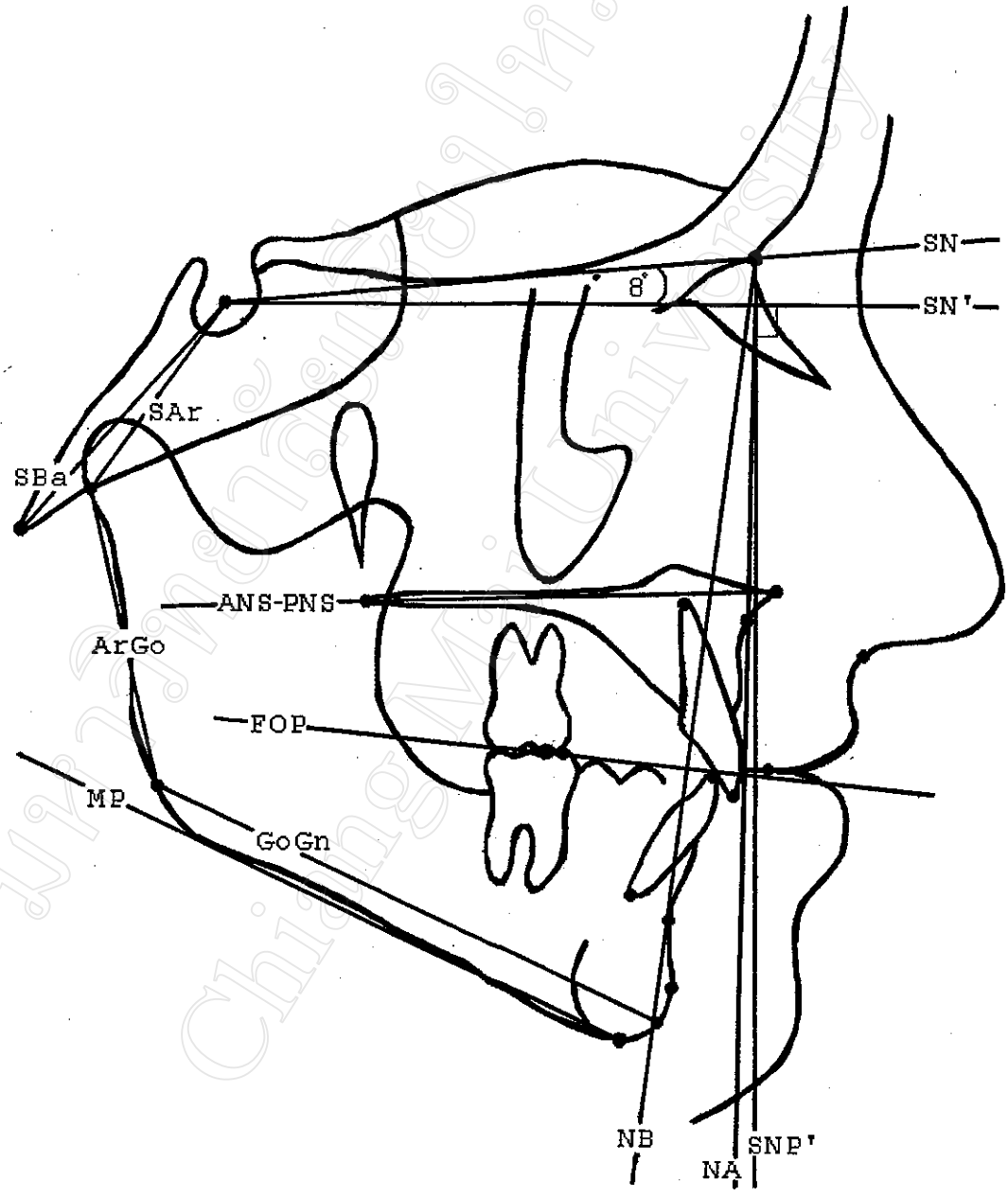

Figure 2 Lines and planes

2.4.3 Angular Measurements (Figure 3)

Skeletal variables.

1. SNA:

   The angle between SN plane and NA line, to evaluate anteroposterior position of maxilla to the cranium.

2. SNB:

   The angle between SN plane and NB line, to evaluate anteroposterior position of mandible to the cranium.

3. ANB:

   The angle between NA line and NB line, to evaluate the anteroposterior relationship between maxilla and mandible.

4. NSBa:

   The angle between SN plane and SBa line, to evaluate configuration of cranial base.

5. SArGo:

   The angle between SAr line and ArGo line to evaluate the anteroposterior relation of the mandible to the posterior cranial base.

6. ArGoGn:

   The angle between Ar-Go line and Go-Gn line (Gonial angle), to evaluate morphology of mandible.

7. NSGn:

   The angle between SN plane and S-Gn line shows growth direction of mandible.

8. SN-GoGn:

   The angle between SN plane and GoGn line, to evaluate the vertical relationship between anterior cranial base and mandible.

9. SN-PP:

   The angle between SN plane and palatal plane, to evaluate the vertical relationship between anterior cranial base and maxilla.

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10. PP-GoGn:

    The angle between palatal plane and GoGn line, to evaluate the vertical relationship between maxilla and mandible.

Dentofacial Variables (Figure 3)

11. UI-NA:

    The angle between long axis of maxillary incisor and N-A line, to evaluate inclination of maxillary incisor in relation to N-A line.

12. UI-SN:

    The angle between long axis of maxillary incisor and SN plane, to evaluate inclination of maxillary incisor in relation to anterior cranial base.

13. LI-NB:

    The angle between long axis of mandibular incisor and N-B line, to evaluate inclination of mandibular incisor in relation to N-B line.

14. LI-GoGn:

    The angle between long axis of mandibular incisor and Go-Gn line, to evaluate inclination of mandibular incisor in relation to Go-Gn line.

15. UI-LI:

    The angle between long axis of maxillary incisor and long axis of mandibular incisor represents the interincisal angle.

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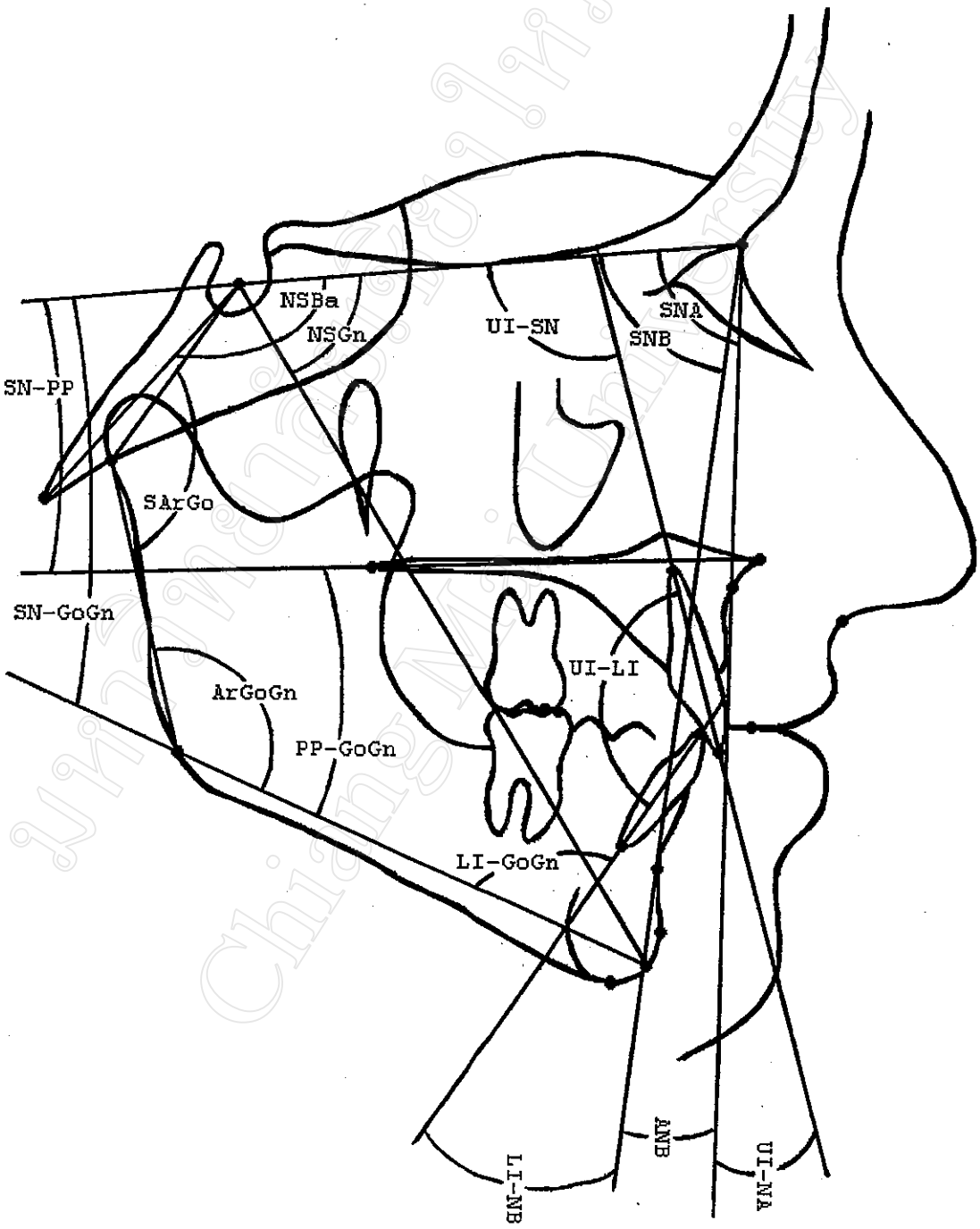

Figure 3 Skeletal and dentofacial angular measurements

2.4.4 Vertical linear measurements (Figure 4.)

Skeletal variables

1. Total anterior facial height (TAFH):

   The distance between N and Me was be measured along the vertical axis SNP'.

2. Upper anterior facial height (UAFH):

   The distance between N and ANS was measured along the vertical axis SNP'.

3. Lower anterior facial height (LAFH):

   The distance between ANS and Me was measured along the vertical axis SNP'.

4. Total posterior facial height (TPFH):

   The distance between S and Go was measured along the vertical axis SNP'.

5. Upper posterior facial height (UPFH):

   The distance between S and PNS was measured along the vertical axis SNP'.

6. Lower posterior facial height (LPFH):

   The distance between PNS and Go was measured along the vertical axis SNP'.

7. Ramus height (RH):

   The distance between Ar and Go.

Skeletal linear ratios

8. UAFH/LAFH ratio:

   The ratio of upper anterior facial height to lower anterior facial height.

9. UPFH/LPFH ratio:

   The ratio of upper posterior facial height to lower posterior facial height.

10. TPFH/TAFH ratio (Jarabak quotient):

    The ratio of total posterior facial height to total anterior facial height.

Dentofacial variables

11. Upper anterior dentoalveolar height (UADH):

    The perpendicular length of a line dropped from the incisal edge of the maxillary central incisor to the palatal plane.

12. Upper posterior dentoalveolar height (UPDH):

    The perpendicular length of a line dropped from the mesiobuccal cusp tip of the maxillary first molar to the palatal plane.

13. Lower anterior dentoalveolar height (LADH):

    The perpendicular length of a line dropped from the inciasal edge of the mandibular central incisor to the mandibular plane.

14. Lower posterior dentoalveolar height (LPDH):

    The perpendicular length of a line droppen from the mesiobuccal cusp tip of the mandibular first molar to the mandibular plane.

Dentofacial linear ratios.

15. UPDH/UADH ratio:

    The ratio of upper posterior dentoalveolar height to upper anterior dentoalveolar height.

16. LPDH/LADH ratio:

    The ratio of lower posterior dentoalveolar height to lower anterior dentoalveolar height.

17. Overbite (Figure 5):

    The distance from incisal edge of maxillary incisor to incisal edge of mandibular incisor, measured perpendicular to functional occlusal plane.

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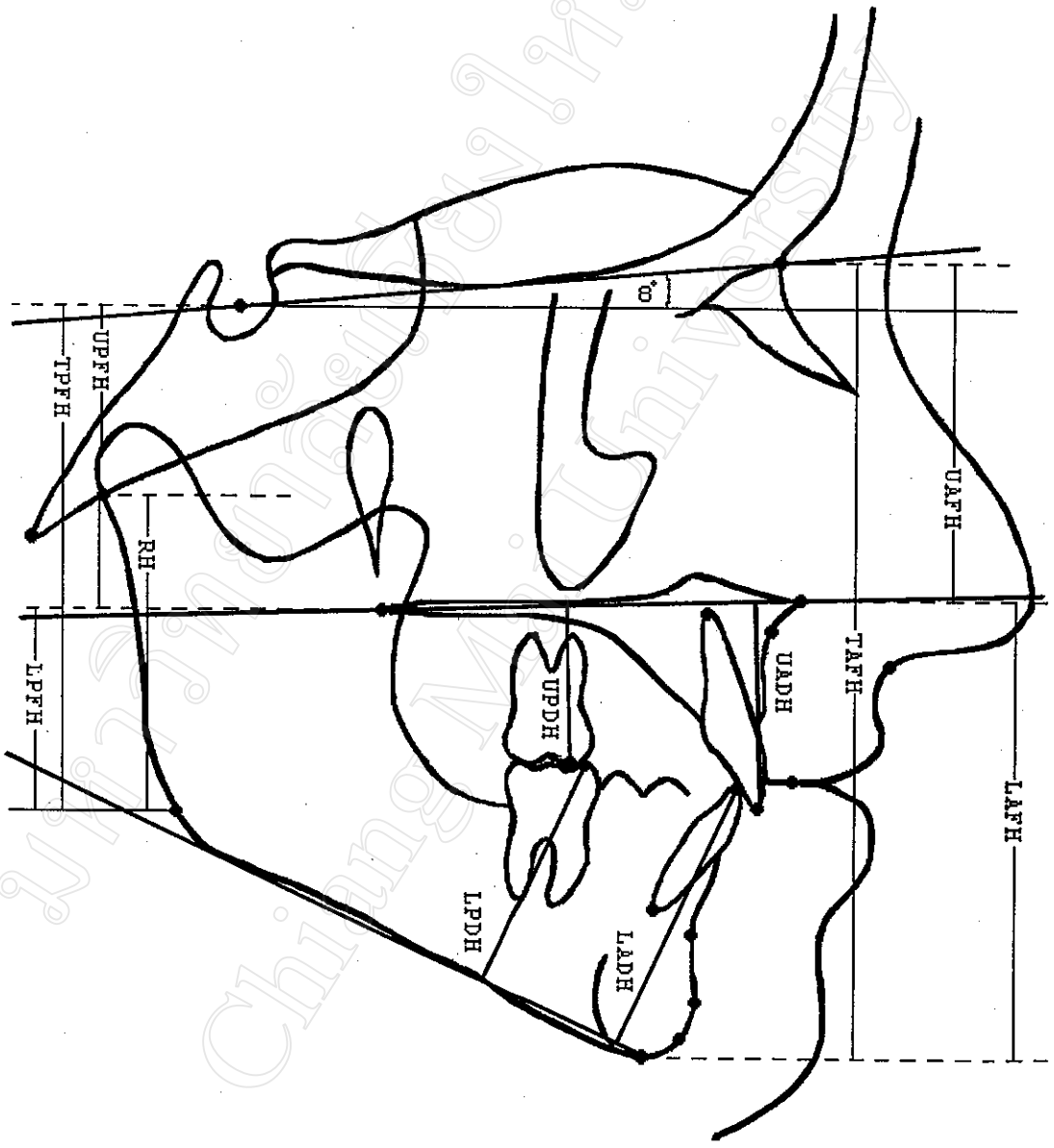

Figure 4 Skeletal and dentofacial linear measurements

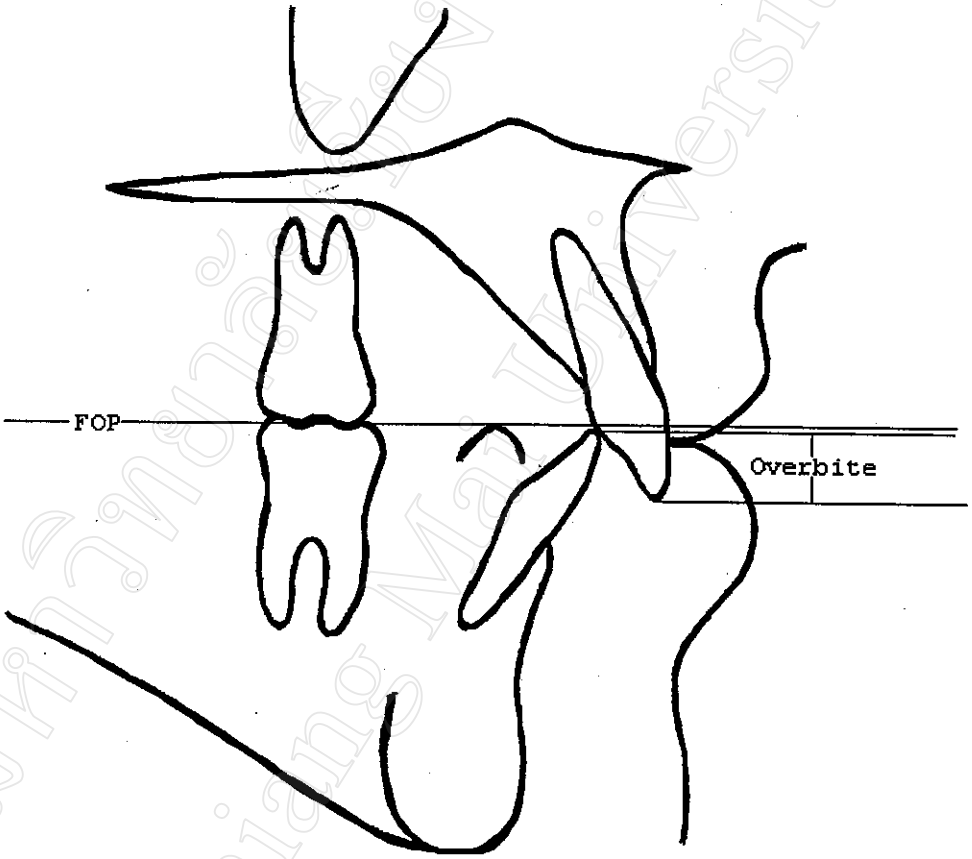

Figure 5 Overbite measurement

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2.4.5 **Soft tissue variables** (Figure 6)

Linear measurements

1. Upper lip length (Sn-Stms):

   The distance from subnasale to stomion superious perpendicular to the palatal plane.

2. Maxillary incisor exposure (Stms-UI):

   The distance from stomion superious to the maxillary incisor cusp tip perpendicular to the palatal plane.

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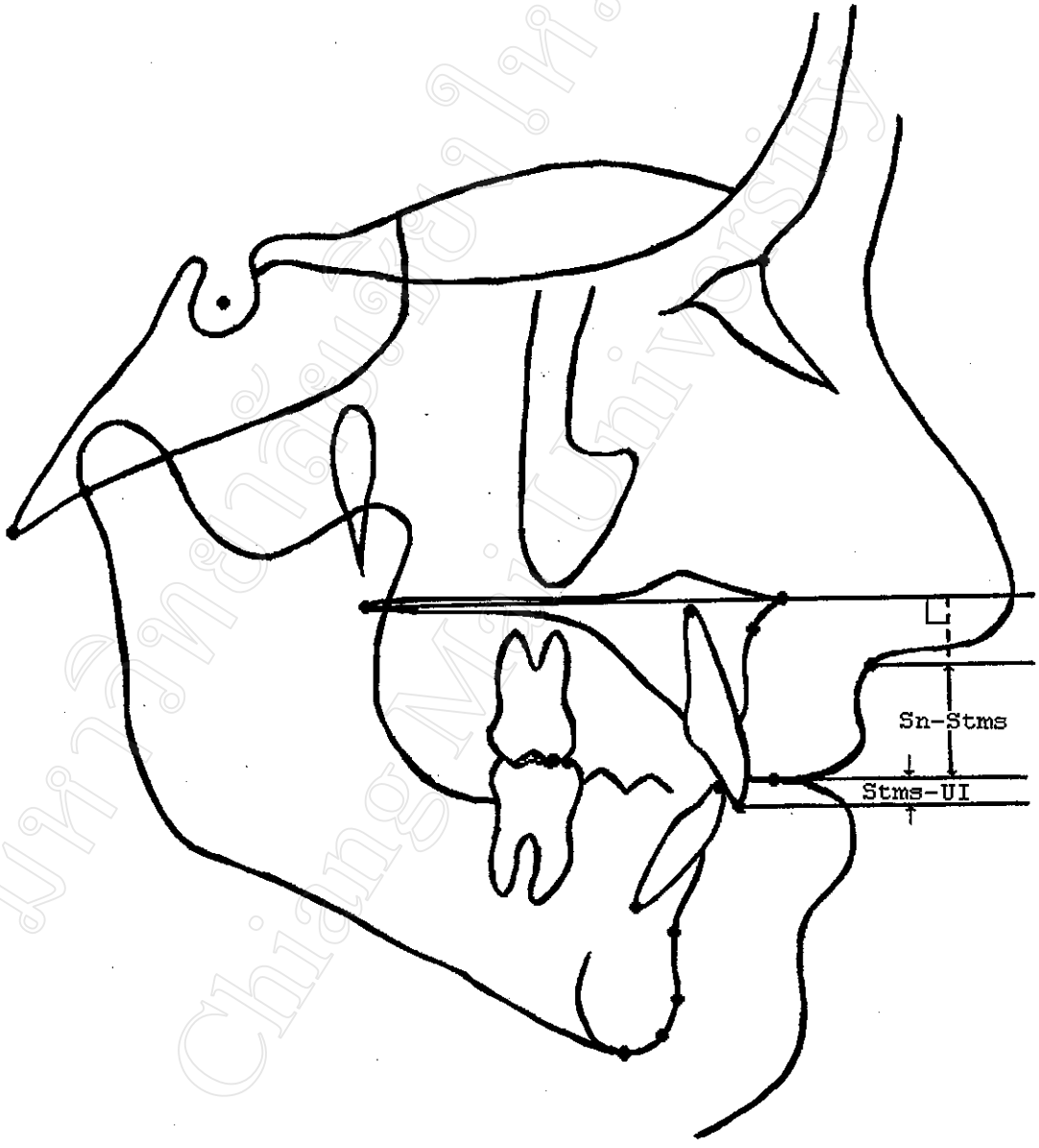

Figure 6 Soft tissue linear measurements