

CHAPTER III

RESEARCH METHODOLOGY

1. Target Population and Sample Population

Dried adult human mandibles.

2. Sample Selection

Dried adult human mandibles were obtained from the Department of Anatomy, Faculty of Medicine, Chulalongkorn University. Gender and age were unknown.

3. Inclusion Criteria

- 3.1 Dried adult human mandible
- 3.2 No bony defect
- 3.3 Dentulous mandible

4. Exclusion Criteria

- 4.1 Defective mandible
- 4.2 Edentulous mandible
- 4.3 Partially dentulous mandible

5. Sample Size Determination

In pilot study, 10 mandibles were measured. The distance between the mandibular foramen and the third molar (= 6.22 mm) was used to calculate the sample size.

Continuous response variables and one-sample problem

$$n = Z_{\alpha/2}^2 \sigma^2 / d^2$$

$$Z_{\alpha/2} = Z_{0.05/2} = 1.96 \text{ (two tail) at 95\% CI}$$

$$\sigma^2 = \text{Variance} = (6.22)^2$$

$$d = \text{Acceptable error} = 1 \text{ mm.}$$

$$n = Z_{\alpha/2}^2 \sigma^2 / d^2$$

$$n = (1.96)^2 (6.22)^2 / (1)^2 = 148.62$$

∴ The sample size was at least 149 mandibles.

6. Materials

- 6.1 Ruler
- 6.2 Pencil
- 6.3 Alcohol
- 6.4 Plasticine
- 6.5 Goniometer
- 6.6 Permanent marker
- 6.7 Adult human mandible
- 6.8 Electronic Caliper (BAKER type EC-10)

7. Methods

One hundred eighty adult human dentulous mandibles, with a total of 360 mandibular rami from the Department of Anatomy, Faculty of Medicine, Chulalongkorn University, were measured. Nineteen reference points (A-S) were marked on the mandible (Figure 2.). The distances from the mandibular foramen and the mental foramen to surrounding anatomic landmarks and the mandibular dimensions were recorded. All measurements were performed by the same examiner and the value noted was the average of 2 measurements. (Figure 3-6.)

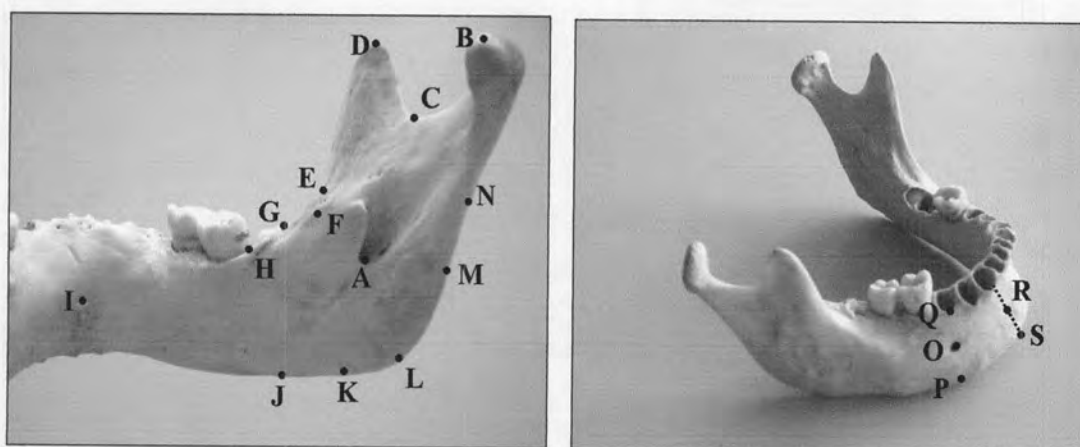


Figure 2. Reference points on the mandible

- A. Lowest point of the mandibular foramen
- B. Highest point of the condyloid process
- C. Lowest point on the concavity of the mandibular notch
- D. Highest point of the coronoid process

- E. The point on the anterior border of mandibular ramus where a horizontal line from point N crossed
- F. Nearest point to mandibular foramen on the internal oblique ridge
- G. The nearest point to mandibular foramen on the anterior border of the mandibular ramus
- H. Posterior border of the socket of third molar tooth
- I. Mid point on the symphysis menti
- J. Superior point of the pre-angular notch
- K. Lowest point of the mandibular inferior border
- L. Farthest point on the angle of the mandible
- M. The nearest point to the mandibular foramen on the posterior border of the mandibular ramus
- N. Midpoint on the posterior border of the mandibular ramus
- O. The mental foramen
- P. Inferior rim of the mandible
- Q. The alveolar crest
- R. Midpoint on the mandible symphysis
- S. The gnathion (the most inferior and ventral point of the mandible symphysis)

Mandibular foramen measurements

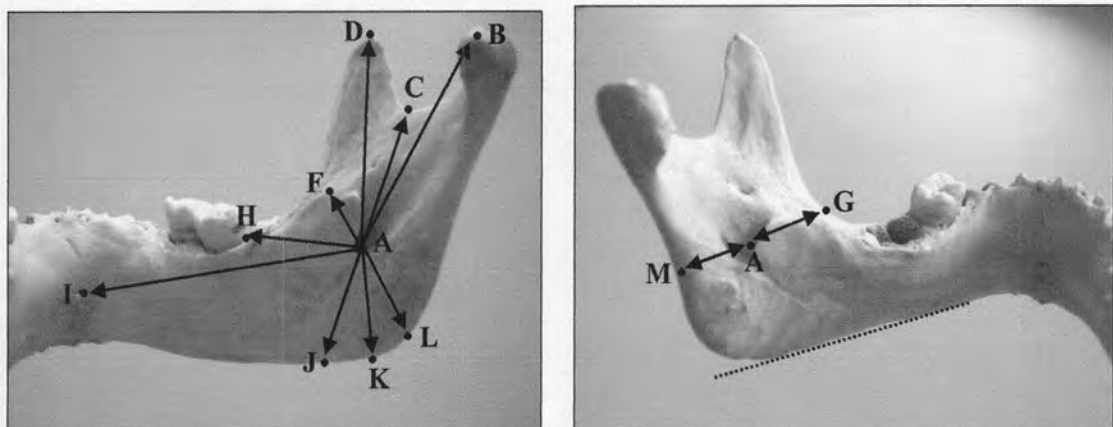


Figure 3. Inner surface of adult mandibles showing the labels of all measurements from the mandibular foramen (A) to reference points.

1. The distances were measured between the following pairs of landmark:
 - 1.1 (A-B); Lowest point of the mandibular foramen - Highest point of the condyloid process [23, 24]
 - 1.2 (A-C); Lowest point of the mandibular foramen - Lowest point on the concavity of the mandibular notch [17, 20, 21, 23, 24]
 - 1.3 (A-D); Lowest point of the mandibular foramen - Highest point of the coronoid process [17]
 - 1.4 (A-F); Lowest point of the mandibular foramen - Nearest point on the internal oblique ridge [16, 17]
 - 1.5 (A-H); Lowest point of the mandibular foramen - Posterior socket of third molar tooth [17, 23]
 - 1.6 (A-I); Lowest point of the mandibular foramen - Mid point on the symphysis menti [23, 24]
 - 1.7 (A-J); Lowest point of the mandibular foramen - Superior point of the pre-angular notch [24]
 - 1.8 (A-K); Lowest point of the mandibular foramen - Lowest point of the mandibular inferior border [20]
 - 1.9 (A-L); Lowest point of the mandibular foramen - Farthest point on the angle of the mandible [17, 23]
 - 1.10 (A-G); Lowest point of the mandibular foramen - The nearest point to mandibular foramen on the anterior border of the mandibular ramus (parallel to the mandibular inferior border) [12, 17, 21, 23]
 - 1.11 (A-M); Lowest point of the mandibular foramen - The nearest point to mandibular foramen on the posterior border of the mandibular ramus (parallel to the mandibular inferior border) [17, 20]
2. Mandibular foramen width (anterior border to posterior border of the mandibular foramen at the same level) [12]
3. The incidence of accessory mandibular foramen [22]

Mental foramen measurements

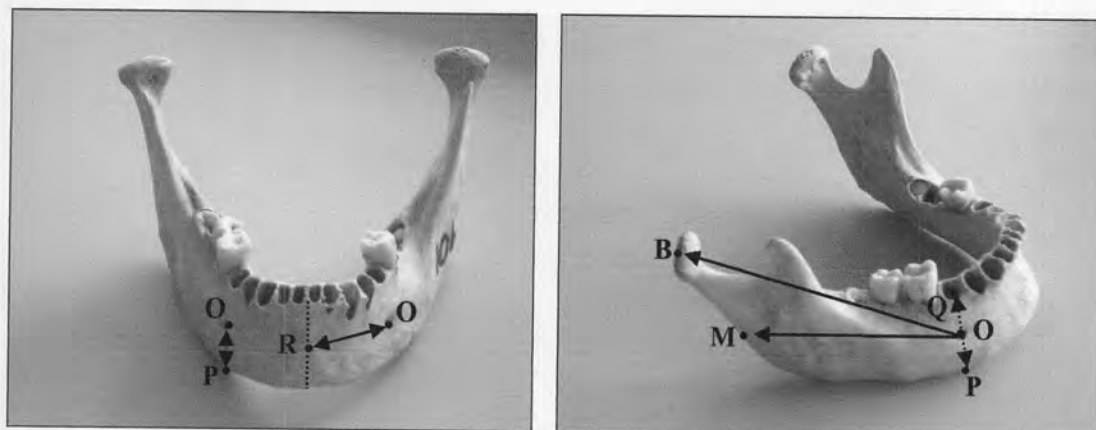


Figure 4. Outer surface of adult mandibles showing the labels of all measurements from the mental foramen to reference points.

1. The distances were measured between the following pairs of landmark:
 - 1.1 (O-P); Mental foramen - Inferior rim of the mandible [20, 24, 28]
 - 1.2 (O-R); Mental foramen - Midpoint on the mandible symphysis [24, 25, 27, 28]
 - 1.3 (O-M); Mental foramen - The nearest point to mandibular foramen on the posterior border of the mandibular ramus (parallel to the mandibular inferior border) [24, 25]
 - 1.4 (O-B); Mental foramen - Highest point on the condyloid process [24]
 - 1.5 (Q-P); The distance across the mental foramen between the alveolar crest - inferior rim of the mandible (vertical direction) [25, 35]
2. The mental foramen width (horizontal dimensions and vertical dimensions) [20]
3. The incidence of accessory mental foramen [26]

The positions of the mental foramen in relation to the roots of the mandibular teeth, were classified as follows [15, 20, 25, 27]:

1. below the first premolar
2. between the premolars
3. below the second premolar
4. between the second premolar and the first molar
5. below the mesial root of the first molar

Mandibular dimension measurements

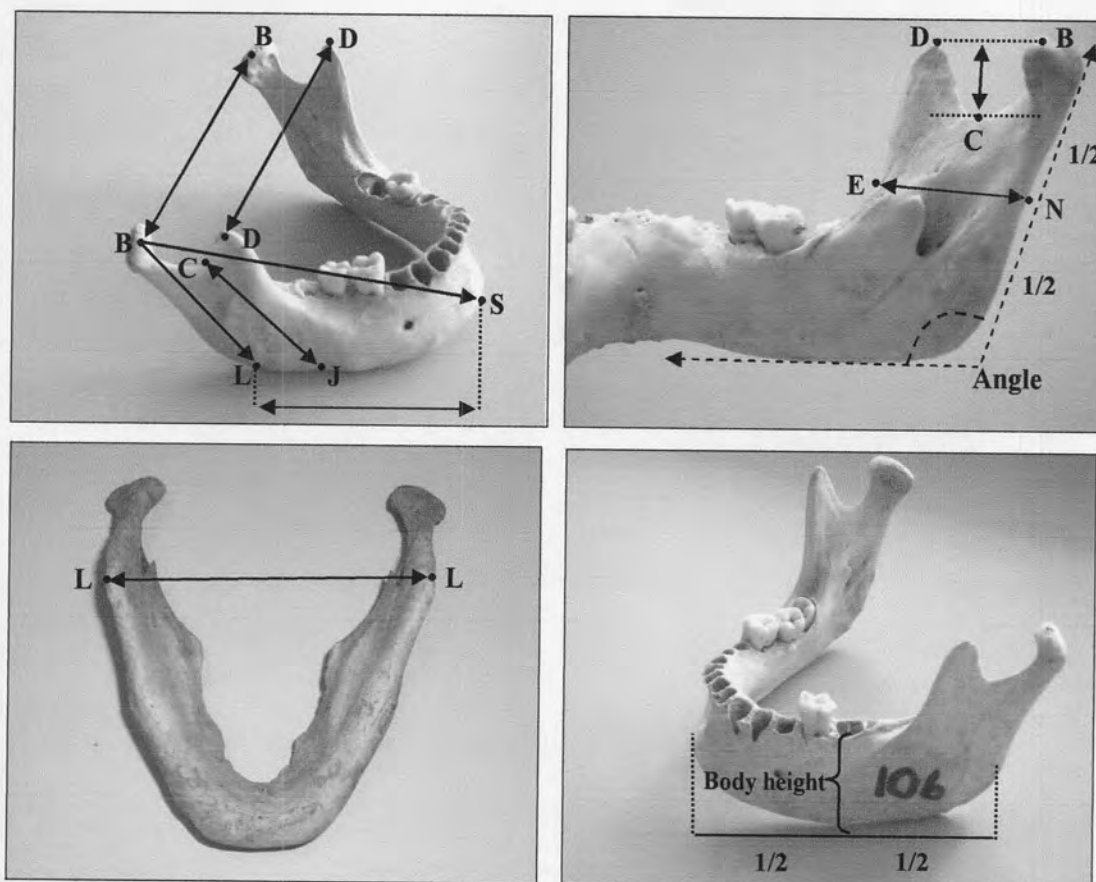


Figure 5. Measurement of the mandibular dimensions

The distances were measured between the following pairs of landmark:

1. The total length of the mandible (B-S); Highest point of the condyloid process - The gnathion (the most inferior and ventral point of the mandible symphysis) [24]
2. The total length of the ramus (B-L); Highest point of the condyloid process - Farthest point on the angle of the mandible [24, 29]
3. The height of the ramus (C-J); Lowest point on the concavity of mandibular notch - Superior point of the pre-angular notch (parallel to the mandibular posterior border) [19, 24]
4. Intercondyloid distance (B-B); The distance between left and right condyloid processes [36]

5. Intercoronoid distance (D-D); The distance between left and right coronoid processes [38]
6. Menton - gonian distance (S-L); The gnathion - The farthest point on the angle of the mandible [24]
7. Width of mandibular notch (B-D; Highest point of the condyloid process - Highest point of the coronoid process [21, 24]
8. Depth of mandibular notch; The vertical distance from the lowest point on the concavity of the mandibular notch to the line connecting the condyloid process and the coronoid process. [18, 24]
9. Minimal width of mandibular ramus (E-N); A line was drawn between anterior (point E) - posterior of the mandibular ramus (point N) which parallel to the mandibular inferior border) [17, 24]
10. Mandibular angle; Angle formed by inferior border of body and posterior border of ramus [17, 29, 35]
11. Intergonial distance (L-L); The distance between left and right mandibular angles [35]
12. Height of the mandibular body; The height of mandibular body was measured at mid-distance between menton and gonion [37]

The frequency and anatomical features of torus mandibularis

The mandibles with torus mandibularis were observed for shape, side location and relation to teeth. The shape and length were respectively categorized as follows: round when the torus mandibularis had only one nodule and multiple when there were two or more nodules; solitary when the location was related to one or two teeth and elongated when the torus mandibularis was larger than the end points of two adjacent teeth. The border was defined as the area of the teeth including half of the space between adjacent teeth [43]. (Figure 6.)

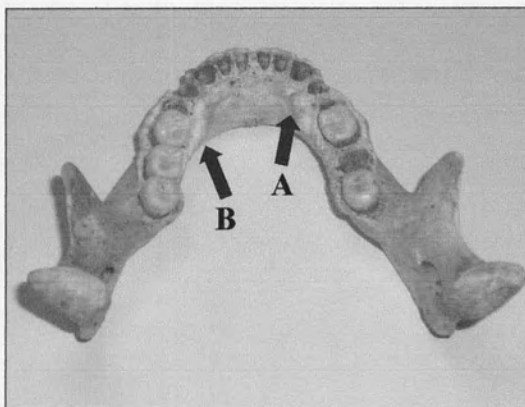


Figure 6. The torus mandibularis of mandible in (A) rounded shape and (B) elongated shape.

8. Statistical analysis

Statistic analysis was undertaken with SPSS version 14. The data of measurements were analyzed by descriptive statistics as means and standard deviations. The comparison between sides for each measurement was done by paired student's t test. The p-value of less than 0.05 was set for the significant difference.