

SOME MANDIBULAR GEOMETRY OF EASTERN NIGERIANS

By

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SUMMARY

Objective: To determine mean values of the mandibular angle, mandibular length and mandibular ramus height in Nigerians of Eastern origin.

Methods: A prospective study of 34 prepared mandibular bones of Eastern Nigerians was conducted. The measurements were done using the mandibulometer according to accepted definitions of the different parameters.

Results: For the right mandible, the mean mandibular angle was found to be $120.41^\circ \pm 6.29$, mean mandibular length $9.27\text{cm} \pm 0.650$ and mean mandibular ramus height $5.58\text{cm} \pm 0.555$. For the left mandible, the corresponding mean values were $120.03^\circ \pm 5.800$ for the mandibular angle, $8.83\text{cm} \pm 0.830$ for the mandibular length and $5.81\text{cm} \pm 0.451$ for the mandibular ramus height. The Angle/Height ratio and Angle/Length ratio for the right mandible was found to be 21.58 and 13.01 respectively, while the corresponding values for the left mandible were found to be 20.66 and 13.50 respectively. These differences were found not to be statistically significant ($p < 0.05$).

Our results suggest that the mandibular angle of Eastern Nigerians compares favorably with those of other black populations in having a smaller mandibular angle compared to Caucasians whose mandibular angles may reach 128° . However, the mandibular Angle/Height ratio is lower than values in other black populations.

Conclusion: Our findings suggest that Nigerians of Eastern origin apparently exhibit a short ramus and a narrow mandibular angle. The implication of this in the ease of laryngoscopy and intubation for the Eastern Nigerian will need further investigation.

Key words: Mandible; Nigerians; Mandibular height; Mandibular angle; Mandibular length.

INTRODUCTION

The mandible is the largest and strongest bone of the face. It forms the skeleton of the lower jaw and articulates with the base of the cranium at the temporo-mandibular joint. It has a curved (horse shoe-like) horizontal body that is convex forwards and two rami. The lower border of the body is its base (also termed the mandibular length) which extends posterior-laterally from the symphysis menti

and becomes continuous with the lower border of the ramus behind the third molar teeth forming the angle of the mandible^{1,2}. From the angle the ramus extends posterior-superiorly to end at the head of the mandible. The posterior border of the ramus marks the height of the mandible (Fig.1).

The mandible functions in mastication, airway support, deglutition and adds an aesthetic value to the face. Fractures of the

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positions of the ramus and angle of the mandible are important to the anesthetist. Above all, the mandible is important in forensic studies, especially in the determination of race and age.

Morant et al² made angular and linear measurements on two series of ancient Egyptian mandibles to explore the usefulness of new methods to calculate coefficient of variation and correlations and concluded that only mandibular height was variable between the sexes. Harrower³ studied mandibles from four Asian groups and observed that despite differences in cranial morphology in these groups, the mandible showed a much more constant structure, with near identical mean values of the measurements made in each group. Similarly, Cleaver⁴ worked on the differences of 26 (17 male and 9 female) mandibles and concluded that the mandible was less useful for describing population differences than the cranium. According to him, mandibles tended to be more variable relative to size than the cranium.

In 1940, Hrdlicka⁵ studied 4,541 male and 24 female mandibles from 24 different human populations. He measured the angles and provided additional data on linear measurement and ratios of the mandibles. In the end, he averred that mandibles are 'the neglected step child of anthropometry'. He also concluded that mandibular variation in linear measurements could safely be accepted as mainly ontogenetic and of functional causation connected with masticatory function and bears little relation to stature or head shape and shows no marks of phylogenetic or evolutionary phenomena.

Mbajorgu et al⁶ studied 32 adult black Zimbabwean mandibles and found significant sex differences in the angles of the mandibles. They concluded that the black Zimbabwean mandible appears to possess important unfavorable anatomic factors that may predispose the male black Zimbabwean to difficult laryngoscopy and/or intubation. A similar conclusion was made after studies on

mandibles from the north eastern part of Nigeria by Mbajorgu and Ekanem⁷.

Chou and Wu⁸ after studies on 11 patients in whom laryngoscopy proved difficult and in 100 control subjects found that a relatively short mandibular ramus is an important unfavorable anatomic factor for difficult intubation.

Despite the abundance of published data on measurements of mandibular values, only the study of Mbajorgu and Ekanem⁷ reports values on the mandibles of Nigerians from the north eastern arid zone. The objective of the present study was therefore to determine values of the anthropometric parameters of the mandible in Nigerians of eastern origin. This would help establish baseline values which could be of use to maxillo-facial surgeons, anesthetists and dentists and of course, in comparative anatomy.

MATERIALS AND METHODS

We collected a total of 34 intact mandibles from the Anatomy Laboratory of the College of Health Sciences, University of Port Harcourt, Nigeria. The 34 bones were those of Nigerian who were from and lived in the southeastern part of Nigeria.

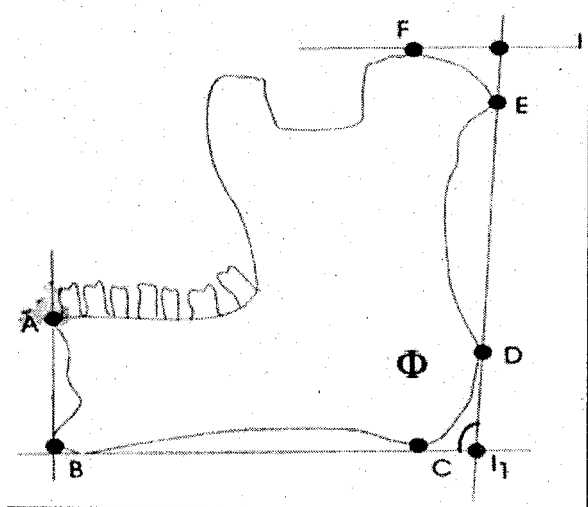
On collection, the bones were first soaked in tap water at 60–65°C for 12 hours for simmering and then in tap water at 37°C for 2 weeks to ensure proper maceration of tissues. Later, the bones were soaked in 2% caustic soda for 1-4 hours to help remove any remaining tissues. They were then brushed with a brush and rinsed in cold tap water. Finally, the bones were soaked in 10% hydrogen peroxide for 2 weeks and then thoroughly rinsed in tap water to remove traces of hydrogen peroxide. The bones were then allowed to dry in the sun for 1-2 days.

MEASUREMENTS

The parameters measured were the mandibular angle, mandibular length and mandibular height. This was done using the mandibulometer. These parameters are as

shown in Fig.1. The mandibular angle was measured according to the accepted definition that the angle of the mandible is the angle formed between the standard horizontal and standard ramal planes i.e. angle CI_1D (Φ); the mandibular length was measured as the distance between points B and I_1 ; while mandibular height was measured as the distance between points I_1 and I_2 .

Figure 1: Illustration of measurements of the Mandibular Angle, Height and Length



Key:

- Point A: Alveolar margin
 Point B: The anterior – inferior border of the body of the mandible
 Point C: The curved posterior part of the body of the mandible
 Point D: The posterior – inferior part of the mandibular ramus
 Point E: The posterior – superior part of the ramus
 Point F: Apex of the head of the mandible
 I_1 I_2 : Mandibular height
 Φ : Mandibular angle
 $B I_1$: Mandibular length

Values obtained for the mandibular parameters were recorded and analyzed separately for left and right sides of the mandible. The ratios of mandibular height to both mandibular angle and mandibular length were calculated. The students' T-test was used to test the observed differences between the left and right sides of the mandibles for statistical significance.

RESULTS

The parameters measured in this study were the right and left mandibular angle, mandibular length and mandibular ramus height as shown in Fig. 1. The mean mandibular angle, length and height were also calculated as shown in Table 1. For the right mandible, the mean angle is $120.41^\circ \pm 6.529$, mean length is $9.27\text{cm} \pm 0.560$ and mean height is $5.58\text{cm} \pm 0.557$, for the left mandible the mean angle is $120.03^\circ \pm 5.800$, mean length is $8.83\text{cm} \pm 0.532$ and mean height is $5.81\text{cm} \pm 8.451$. These difference between the left and right mandibular side were found not to be significant ($p > 0.05$). The standard errors and ranges for each parameter are as shown in Table 1. The Angle/Height ratio and Angle/Length ratio for both the left and right sides of the mandible were calculated and is as shown in Table 1.

In order to show how mandibular height is related to angle the mean mandibular angle and height are tabulated in Table 2 using the angle intervals of 3° and between the angle ranges of 104° and 137° . Fig. 2 is the graphical representation of this. It clearly shows that as mandibular angle decreases mandibular height increases. A critical observation on the graph shows that point A is the peak height with the least angle and as the height falls to point B the angle increases. The height is further reduced at point C and D with further increase in the mandibular angle.

The Table 3 compares the results obtained from present study with already published reports.

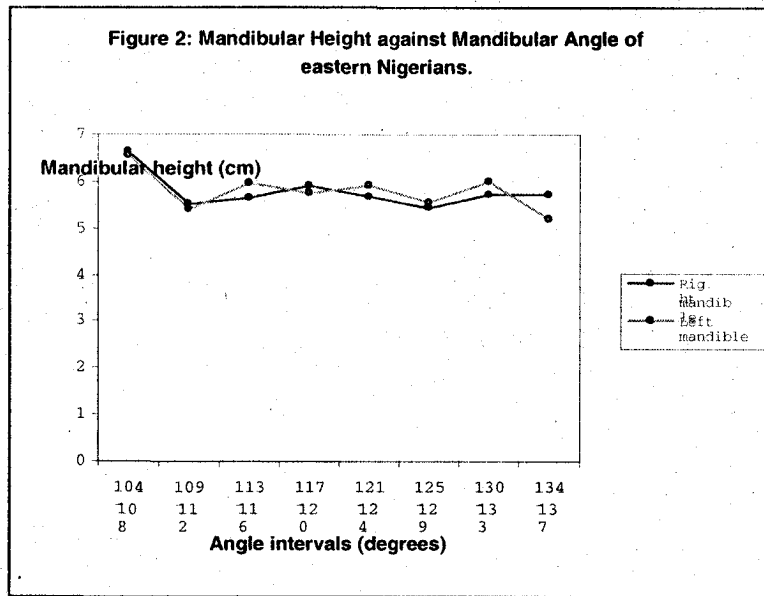


TABLE 1: VALUES OF MANDIBULAR ANGLE, HEIGHT AND LENGTH OF EASTERN NIGERIANS

Mandibular side	Mandibular Parameter	Mean value	SD	SE	Range	Angle/ Height ratio	Angle/ Length ratio
Right (n=34)	Angle (°)	120.40	6.529	0.897	106.5-137.0		
	Height (cm)	5.58	0.557	0.072	4.2-6.65	21.58	13.01
	Length (cm)	9.27	0.650	0.166	7.75-10.25		
Left (n=34)	Angle (°)	120.03	5.800	0.939	104.0-135		
	Height (cm)	5.81	0.451	0.056	4.7-6.55	20.66	13.50
	Length (cm)	8.83	0.532	0.137	8.2-9.1		

TABLE 2: MEAN VALUES OF MANDIBULAR ANGLE AND MANDIBULAR HEIGHT FOR DIFFERENT MANDIBULAR ANGLE RANGES FOR THE LEFT AND RIGHT MANDIBLE

Range of Mandibular Angle (°)	Right Mandible			Left Mandible		
	n	Mean Mandibular angle (°)	Mean Mandibular height (cm)	n	Mean Mandibular angle (°)	Mean Mandibular height (cm)
104-108	1	106.5	6.65	1	114.0	6.55
109-112	1	111.0	5.50	1	110.0	5.40
113-116	9	114.8	5.65	3	104.2	5.95
117-120	8	118.8	5.93	12	117.7	5.76
121-124	7	122.1	5.68	10	122.1	5.90
125-129	3	126.2	5.43	3	125.3	5.57
130-133	4	130.8	5.73	2	130.0	6.00
134-137	1	137.0	5.70	1	135.0	5.20

TABLE 3: COMPARISON OF RESULTS OF THE PRESENT STUDY WITH PREVIOUS STUDIES IN DIFFERENT POPULATION TYPES

Population type	N	Range of Mandibular Angle (°)	Mandibular Angle (°)	Mandibular Height (cm)	Mandibular Length (cm)	Author and year of publication
Negro	-	-	125	-	-	Martin (1928) ¹
East African (Bantu)	259	101-133(M) 106-142(F)	120.14±0.47(M) 127.96±1.05(F)	-	-	Zivanovic (1969) ⁹
European	-	-	128	-	-	Martin (1928) ¹
South Africa	392	103-135	120.60±0.31(M)	-	-	Martin (1928) ¹
Australians	-	-	124	-	-	Martin (1928) ¹
Aboriginal Black Zimbabweans	23 9	117-129 124-130	123.06±0.70(M) 128.00±0.67(F)	5.98±0.634 6.13±0.709	7.73±0.523 7.23±0.569	Mbajiorgu (1996) ⁶
Chinese and Peruvians	-	-	119	-	-	Mbajiorgu (1996) ⁶
North Eastern Nigerians	60	-	118.75±0.395	-	-	Mbajiorgu (2002) ⁷
Neanderthals	-	-	110	-	-	Martin (1928) ¹
Present Study	34	106.5-137	120.41±6.529(R) 120.03±6.800(L)	5.58±0.557 5.81±0.451	9.27±0.650 8.83±0.830	Didia and Dapper

DISCUSSIONS

The mean mandibular angle of 120.40° for the right mandible and 120.03° for the left mandible obtained in the present study compares favorably with the values reported for East African males (120.14°)⁹, South African males (120.60°)¹ and Black Zimbabweans (123.06°)⁶ as shown in Table 3. The results suggest that Nigerians as other Negro populations apparently have smaller mandibular angles compared to Caucasians whose mean mandibular angles can approach 128° (see Table 3). Differences between the left and right mandibular angles in Eastern Nigerians were found not to be statistically significant ($p > 0.05$).

The mandibular ramus height of Eastern Nigerian mandibles found in the present study is apparently slightly lower than values for Black Zimbabweans⁶. These differences could possibly account for the lower mandibular angle seen in Eastern Nigerians in the present study compared to reports from Zimbabweans⁶. Apparently, as the length of the mandible increases, the mandibular angle decreases. These differences can likely be explained in terms of variations in masticatory functions, muscle micro-structure and mandibular morphology¹⁰. These reasons were however not investigated in the present study.

The ratio of mandibular angle to mandibular height is 21.58 for the right side and 20.66 for the left side. These values are apparently lower than in other black races. Eastern Nigerians apparently exhibits significantly short ramus and narrow mandibular angles and since angle/height ratio is very important during laryngoscopy and intubations, the implication of these smaller values in Eastern Nigerians will need to be further investigated.

The ages of the mandibles we used were not known. It has however been reported that while mandibular angle decreases with age, mandibular height shows an increase⁸.

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