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To Evaluate Morphology Using Various Parameters in Human Mandibles

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Abstract:

Background: Non-metric methods are used to differentiate sex, age, and race with the help of the mandible in cases of aircraft crashes, warfare, and earthquakes. The earliest approach in forensic cases of sex determination is the examination of bone morphology. **Aim:** To evaluate the mandibular morphology using various parameters. **Materials and methods:** The present study was approved by the Institutional Ethics Committee. This study was an observational study. This study was conducted in the Department of Anatomy, Index Medical College, Malwanchal University. **Results:** The most common lingula was triangular (48%). Males were more likely to have this condition (36%). The Truncated type (10%) was the least common. Triangular ligulae were discovered bilaterally in 132 mandibles, unilaterally in 29 bones on the right side, and in 27 bones on the left side. Only 14 mandibles on both sides and 15 bones on the right and left sides were truncated. The most common type of genial tubercle was Type II (49%), whereas the least common type was Type IV (3%). **Conclusion:** This study examined several qualitative and non-metrical features of the mandible. Mandible sexing makes effective use of the lingula, a sexually dimorphic feature of the mandible. The form of the male mandible is typically triangular. The triangular process accounts for the vast majority of coronoid processes. In order to accurately identify racial differences, a large number of bones should have their genial tubercle patterns carefully analyzed.

Key words: Mandible; Lingual, Menti, Mylohyoid line, Sex determination, Mandibular foramen.

Introduction:

In genetic, anthropological, odonatological, and forensic studies on live and deceased humans, the skeleton is an extremely important component because of its involvement in these fields [1]. In forensic cases, the identification of human remains is an essential first step because it lays the groundwork for further investigation [2].

The mandible is the largest, strongest bone in the face. It has a horizontally curved body that is convex forwards, and two broad rami that ascend posteriorly. The rami bear the coronoid and condyloid processes [3]. The development of mandible is completed by two halves right half and left half and the joint formed is called symphysis menti [4] The 2 sides unite and formed a single bone [5]. Mandible is a U-shaped bone or can say horse shoe shaped shaped bone that

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consist of 3 parts a horizontal body and 2 vertical oriented rami [6]. It is the only movable bone present in the skull, mandible provide sockets for the teeth, that are present horizontally on both halves of the mandible [7,8]. Mandibular foramen is present on the inner aspect of the mandible that continues into a canal that is called mandibular canal and opens externally into a canal i.e. mental foramen through which passes the inferior alveolar nerve and vessels. Lingual is present on the inner aspect on the anterior margin of mandibular foramen mylohyoid groove begins just below mandibular foramen and run downward and forward to reach the body of mandible below the posterior part of mylohyoid line [4].

Non-metric methods are used to differentiate sex, age, and race with the help of the mandible in the case of aircraft crashes, warfare, and earthquake disasters [9]. The earliest approach in forensic cases of sex determination is the examination of bone morphology. Sex determination is reflected by the shape and size of the mandible, and male bones are generally larger and more robust than those of females. Using qualitative methods, researchers have found that the shape of the chin can be used to distinguish between males and females [10]. Therefore, the present study aimed to evaluate the mandibular morphology using various parameters.

Materials & methods:

The present study was approved by the Institutional Ethics Committee. This study was an observational study. This study was conducted in the Department of Anatomy, Index Medical College, Malwanchal University. The sample size was calculated using the following formula,

$$n= Z^2 \times p \times q / e^2$$

where n= sample size, p= prevalence, 75%, q= 1-p, Z= 1.96, Confidence Interval of 95%, and e= margin of error, 5%. So, $n=(1.96)^2 x (0.75) (1-0.75)/ (0.05)^2$, n= 288.12, Therefore, the present study was conducted on 289 mandibles in the Department of Anatomy, Index Medical College, Malwanchal University. **Inclusion criteria:** All adults (mandible with bilateral molar teeth, prominent alveolar sockets, intact condylar and coronoid processes, and well-developed bone) with intact and well-formed mandibles were included. **The exclusion criteria were** broken, deformed, or pathological. The following parameters were observed in the mandible: Ther morphologic parameters to observe are,

i. Variations in shapes of lingual: Different shapes of lingula were observed such as
   A. Triangular: It is with wide base and narrow rounded or pointed apex and apex being directed postero-superiorly i.e., towards condyle or towards posterior border.
   B. Truncated: somewhat quadrangular with superior, inferior, and posterior borders.
   C. Nodular: the entire lingula, except for its apex, merged into the ramus.
   D. Assimilated: in this type, the lingula is completely incorporated into the ramus.
ii. The different shapes of the studied coronoid process were triangular, hook-shaped, and rounded.
iii. The distribution of genial tubercles depends upon their number and configuration, and they are classified as follows: Various Patterns of genial tubercles

1. Type-I Four separate genial tubercles upper pair as superior, lower pair as inferior genial tubercles

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2. Type II Superior genial tubercles on both sides separate, while inferior tubercles on both sides fuse to form a single crest or tubercle.
3. Type III Superior and inferior genial tubercles on either side.
4. Type IV: All four genial tubercles are fused to form a single crest or tubercle.

Statistical analysis:

After every measurement, the data were statistically analyzed using IBM SPSS Statistics 21. We used a t-test that did not include the matching pairs. For both sexes, we determined the ranges of the parameters and calculated means and standard deviations. The "calculated range" was reached by applying the formula "mean 3 standard deviations" to these values. The limiting point can be determined, which is an absolute value anywhere in the two ranges. Most male mandibles had values higher than the chosen limiting point, whereas most female mandibles had values lower. This was done to ensure accurate classification. As a result, the restricting point allowed many more mandibles to be recognized than the demarking point did.

Results:

Table 1: Variations in the shapes of lingula of 289 mandibles (578 sides)

Gender	Triangular			Truncated			Nodular			Assimilated		
	Right	Left	Total	Right	Left	Total	Right	Left	Total	Right	Left	Total
Male	98	116	214	28	30	58	66	26	92	22	24	46
Female	38	26	64	10	6	16	28	36	64	8	16	24

Table 2: Variations in the shapes of coronoid process of 289 mandibles (578 sides)

Variable	Male	Female	Total
Triangular	223	152	375
Hook Shaped	101	61	162
Rounded	27	14	41

Figure 1: Variations in the shapes of coronoid process of 289 mandibles (578 sides)

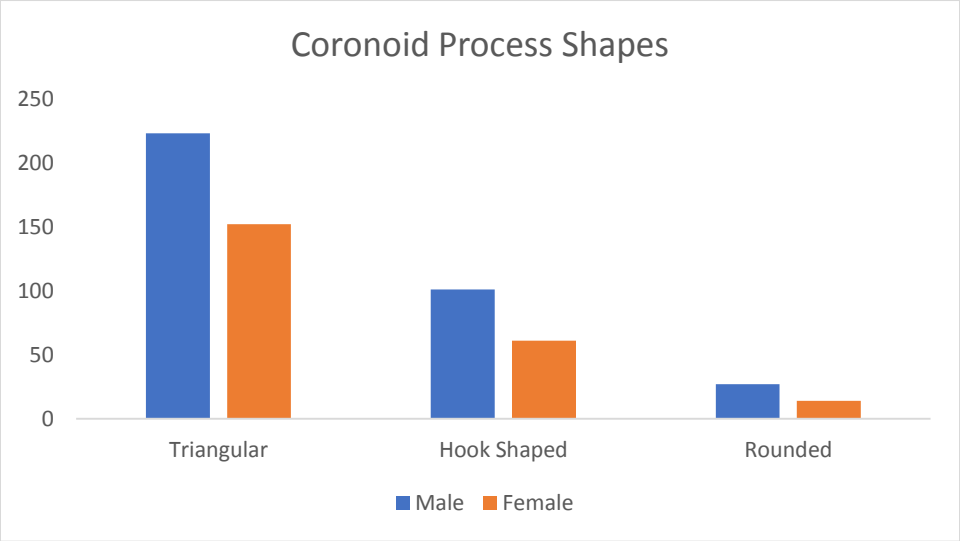

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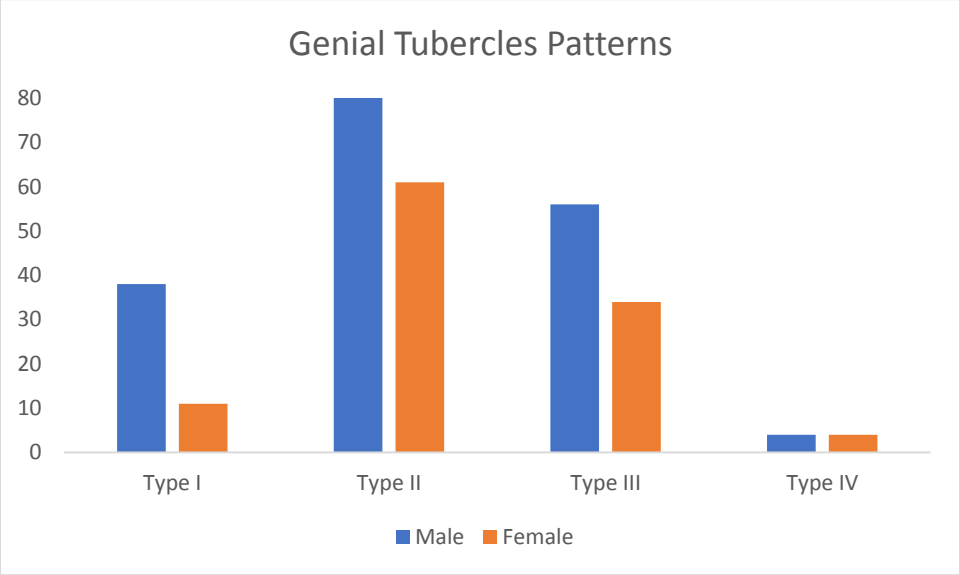
Table 3: Distribution of patterns of genial tubercles

Gender	Type I	Type II	Type III	Type IV
Male	38	81	56	4
Female	11	61	34	4
Total	49	142	90	8

Figure 2: Patterns of Genial Tubercles in the study population Mandibles



The most common lingula was triangular in shape (48%). Males were more likely to have this condition (36%). Truncated type (10%) was the least common. Triangular ligulae were discovered bilaterally in 132 mandibles, unilaterally in 29 bones on the right side, and in 27 bones on the left side. Only 14 mandibles on both sides and 15 bones on the right and left sides were truncated. The most common type of genial tubercle was Type II (49%), whereas the least common type was Type IV (3%).

Discussion:

The Index Medical College and Hospital in Indore, Madhya Pradesh, India, are home to the Department of Anatomy. bones from male and female human jaws, dried, and unidentified. We retained 289 mandibles for additional analysis after removing those that were not fit for reasons other than size.

Among the various morphological characteristics, specific lingulae exhibit sexual dimorphism [11]. The triangular shape was found in a greater number of bones, specifically 278 (132 bilateral and 29 unilateral). The results presented in the table above indicate that our findings surpass those of previous studies [12]. The prevalence of truncated lingula was the highest among the Thai populace [13], followed by nodular, triangular, and assimilated lingula.

Practical knowledge of the morphological configurations of the coronoid process is advantageous for maxillofacial surgeons. The coronoid process is an ideal donor graft site for reconstruction of orbital floor deformities is the coronoid process [14]. Four elevations on the

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interior surface of the mandible, known as the genial tubercles, are responsible for supplying the genioglossi and stylohyoid muscles on either side with their origin. They exhibited a discernible pattern of variation in both form and size. The current study identified four distinct genial tubercle patterns. Genial tubercle pattern type II was detected in 142 (49 percent) mandibles. There were 49 Type I (17%) and 90 Type III (33 %) cases. Type IV was the least frequent, comprising only eight bones (3 percent). These distinctions may have some ethnic significance, which requires further research.

Only the triangular lingulae have been discussed in numerous standard textbooks. However, while a study [15] documented the existence of diverse shapes, it failed to offer specific information regarding the categories and frequencies of these phenomena. An additional category of lingulae, known as the truncated 7 type, was delineated in one study[15], while another study [16] identified assimilated and nodular types [15,16].

Regarding triangular, hook-shaped, and rounded coronoid process shapes, our research revealed that 65% of the processes were triangular, 28% were hook-shaped, and 7% were rounded. The triangular shape is, on average, more commonly observed in males.

Conclusion:

This study examined several qualitative and non-metrical features of the mandible. Mandible sexing makes effective use of the lingula, a sexually dimorphic feature of the mandible. The form of the male mandible is typically triangular. The triangular process accounts for the vast majority of coronoid processes. In order to accurately identify racial differences, a large number of bones should have their genial tubercle patterns carefully analyzed.

Conflict of interest:

The authors declare that they have no conflict of interest.

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