RESEARCH PAPER

Variations in Genial Tubercles, Coronoid Process, and Lingula of Adult Human Dry Mandible

Rutuja N Tilekar[1], Dr. Sheela D Kadam[2], Dr. Muthuchitra R Pandian[3], Anjum S Shaikh[4*]

[1]Department of Anatomy, MGM Medical College Panvel, MGM Institute of Health Sciences, Kamothe, Navi Mumbai, Maharashtra, India.

[2]Department of Anatomy, Krishna Vishwa Vidyapeeth (Deemed to be University), Karad, Maharashtra, India.

[3]Department of Anatomy, MGM Medical College Panvel, MGM Institute of Health Sciences, Kamothe, Navi Mumbai, Maharashtra, India.

[4]Department of Anatomy, MGM Medical College Panvel, MGM Institute of Health Sciences, Kamothe, Navi Mumbai, Maharashtra, India. Email: anjumshaikh2328@gmail.com

***Corresponding Author: Anjum S Shaikh**

Department of Anatomy, MGM Medical College, Panvel, MGM Institute of Health Sciences, Kamothe, Navi Mumbai, Maharashtra, India

Email: anjumshaikh2328@gmail.com

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ABSTRACT

Introduction: The mandible exhibits considerable anatomical variations in structures such as the lingula, coronoid process, and genial tubercles. Knowledge of these variations is important for dental anesthesia, maxillofacial surgery, and anthropological studies.

Materials and Methods: The present study was conducted on 140 dry human mandibles to evaluate the morphological variations of the lingula, coronoid process, and genial tubercles. The observed patterns were classified according to their morphological characteristics and analysed.

Results: In the present study, the nodular type was the most commonly observed morphology of the lingula, followed by the truncated, assimilated, and triangular types. The rounded shape was the predominant form of the coronoid process, while the hook-shaped variety was not observed. Among the genial tubercle patterns, Type II was the most frequent, followed by Type I and Type IV, whereas Type III was absent.

Conclusion: The study demonstrated significant morphological variations in the lingula, coronoid process, and genial tubercles of the mandible. These findings may provide useful anatomical information for clinical procedures involving the mandible and contribute to improved surgical and anaesthetic outcomes.

Keywords: Mandible, Lingula, Coronoid Process, Genial Tubercles, Inferior Alveolar Nerve Block, Maxillofacial Surgery, Dental Anatomy, Anthropological Study.

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Introduction

The mandible is the largest and strongest bone of the face. The mandible come from the Latin word “jaw bone” [(1)] Meckel's cartilage, the first pharyngeal arch cartilage, develops the mandible [(2)]. The largest and strongest bone in the face is the mandible. It has two wide rami that rise posteriorly and a convex, horizontally curved body. The coronoid and condyloid processes are found on the rami [(3)]. Except the ear ossicles, the mandible is only moveable bone in the skull. The temporomandibular joint is formed by the condyloid process articulating with the mandibular fossa of the temporal bone. The round head of the condyloid process connects with the temporal bone. Beneath the head is the neck, which is a narrow, lower region. Fractures of the head and neck commonly occur in facial injuries [(1)]. The lingula of the mandible is a tongue-shaped bony protrusion located near the posterior edge of the mandibular foramen on the medial surface of the ramus. The connection of the lingula to the inferior alveolar nerve is clinically significant for dental surgeons, as this nerve enters the mandibular foramen to supply structures in the lower jaw. Understanding the morphology of the lingula is essential to protect critical structures during procedures involving the mandible in this region [(4)]. Earlier studies described lingual characteristics depending on its location [(5)], its shape and different races [(6)]. Triangular shaped lingulae have been described as the most prevalent type by various leading authors [(7)]. Different textbooks illustrate truncated [(8)], nodular [(9)] and assimilated [(10)] type. The coronoid process can vary in size, appearing round, hook-shaped, or triangular. Each bone exhibits a distinct pattern of genial tubercles. When

interpreting an oral radiograph, the varying patterns may obscure the lingual foramina [3]. The present study was undertaken mainly to establish the frequency of various morphological types of lingula and coronoid process in adult human mandibles of Western Indian Population

Material and Methods

The present study was conducted in Department of Anatomy, MGM Medical College, Panvel, Navi Mumbai on 140 dry human mandibles belonging to unknown age and gender.

The following parameters were studied.

1. **Variations in shapes of lingula**
   In the present study 70 mandibles were observed on both sides (140 sides) to study any variations in shapes of lingula. Different shapes of lingula were observed such as 1. Triangular 2. Truncated 3. Nodular and 4. assimilated.

   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: It is somewhat quadrangular with superior, inferior and posterior borders.
   C. Nodular: Entire lingula except for its apex merged into the ramus.
   D. Assimilated: In this type lingula completely incorporated into ramus.

Table 1: - Variation in the shapes of lingual in 70 mandibles (140 Sides)

Triangular			Truncated			Nodular			Assimilated		
R	L	T	R	L	T	R	L	T	R	L	T
10	14	24 (17.1%)	20	18	38 (27.1%)	16	34	50 (35.7%)	20	8	28 (20.0%)

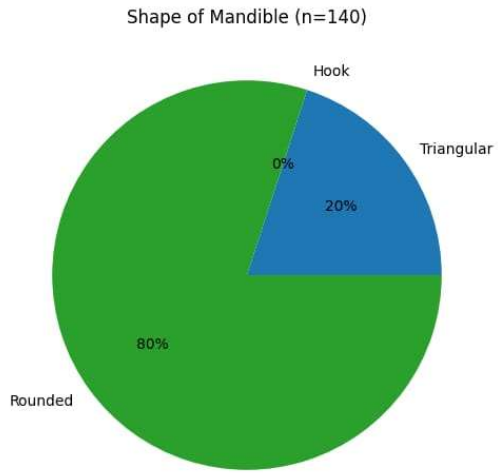
Fig1: Showing Triangular Shaped Lingula
Fig2: Showing Assimilated Shaped Lingula

Fig3: Truncated Shaped Lingula
Fig 4: Nodular Shaped Lingula

2. Variations in shape of coronoid process

Different shapes of coronoid process studied are triangular, hook shaped and rounded.

Shape of Mandible	Count (Out of 140)	Percentage
Triangular	28	20%
Hook	0	0%
Rounded	112	80%
Total	**140**	**100%**



Graph No.1 Types of coronoid process

Fig 5: Triangular Coronoid Process
Fig 6: Rounded coronoid Process

3. **Distribution of genial tubercles**

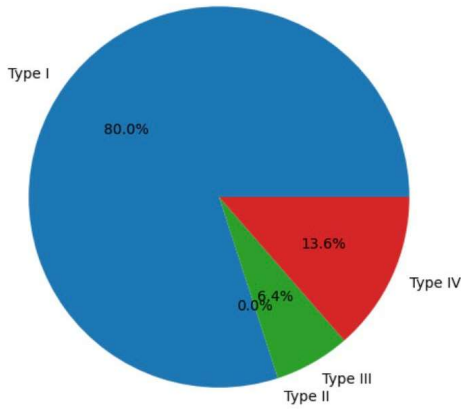
Depending upon their number and configuration, they are classified as follows.

Table 3: - Various Patterns of genial tubercles

Type-I	Four separate genial tubercles upper pair as superior, lower pair as inferior genial tubercles.	● ● ●
Type-II	Superior genial tubercles of both sides separate while inferior tubercles of both the sides fused to form single crest or tubercle.	▪ ▮
Type-III	Superior and inferior genial tubercles of either side fused to form single crest on either side.	▯ ▯
Type-IV	All four genial tubercles fused to form single crest or tubercle.	▮

Table 4: - Distribution of Patterns of Genial Tubercles

Pattern of Genial Tubercles	Number of Mandibles (n)	Percentage (%)
Type-I	19	13.5
Type-II	112	80
Type-III	0	0
Type-IV	09	6.4
Total	**140**	**100**



Graph No.2: - Distribution of Patterns of Genial Tubercles

Observation

Among the patterns of genial tubercles, the Type II variety was found to be the most predominant, occurring in 80% of the mandibles, followed by Type I in 13.5%, while Type IV was seen in only 6.4% and Type III was completely absent. With respect to the shape of the coronoid process, the rounded type was overwhelmingly dominant, accounting for 80% of the specimens, whereas the triangular type constituted 20%, and no hook-shaped processes were identified. Lingula also showed distinct variability: the nodular type was the most frequent (35.7%), followed by the truncated (27.1%), assimilated (20%), and triangular (17.1%) types.

Discussion

The findings of the present study were compared with those reported in previous studies on the morphology of the lingula and coronoid process of the mandible. In the present study, the nodular type of lingula was the most common, accounting for (35.7%) of cases, followed by the truncated type (27.1%), assimilated type (20.0%), and triangular type (17.1%). These findings differ from those of Lopez et al [(11)]. (2010), A. Tuli et al [(12)]. (2000), Kositbowornchai et al [(13)]. (2007), and Jansisyanont et al [(14)]. (2009), who reported either the triangular or truncated type as the predominant form. The higher incidence of the nodular type observed in the present study may be attributed to ethnic and population-based variations.

With regard to the coronoid process, the rounded type was the most prevalent morphology in the present study, observed in 80% of cases, followed by the triangular type in 20% of cases. No hook-shaped coronoid process was observed. These findings are in contrast to previous studies by Tanveer A [(15)]. (2011), Issac B [(16)]. (2001), and Vipul et al [(17)]. (2011), which reported the triangular type as the most common morphology. The predominance of the rounded type and the absence of the hook-shaped variety in the present study may be due to genetic, racial, environmental, and functional factors affecting mandibular development. Overall, the present study demonstrates considerable variation in the morphology of the lingula and coronoid process when compared with earlier studies, highlighting the influence of population-specific anatomical characteristics.

In the present study, the distribution of genial tubercle patterns was assessed in 140 dry human mandibles. Among the four identified patterns, Type II was the most frequently observed, being present in 112 mandibles (80%), indicating its clear predominance in the study population. Type I was found in 19 mandibles (13.5%), making it the second most common pattern. Type IV was comparatively rare and was observed in only 9 mandibles (6.4%). Notably, Type III genial tubercles were not identified in any of the examined specimens. The findings demonstrate a marked predominance of Type II genial tubercles, while the absence of Type III and the low occurrence of Type IV reflect considerable morphological variation in the genial tubercle region.

Conclusion

The present study revealed considerable morphological variations in the lingula, coronoid process, and genial tubercles of the mandible. Among the lingula types, the nodular form emerged as the most commonly encountered morphology, whereas the triangular form was the least frequent. The coronoid process predominantly exhibited a rounded shape, while the hook-shaped variety was not observed in the studied specimens. Examination of the genial tubercles demonstrated a clear predominance of the Type II pattern, whereas the Type III pattern was absent.

These findings indicate that mandibular anatomical structures exhibit substantial variation in their morphology. Such variations are of great clinical importance during dental and maxillofacial procedures, particularly in the administration of inferior alveolar nerve blocks, mandibular osteotomies, implant placement, and other surgical interventions. Awareness of these anatomical differences can assist clinicians in achieving greater procedural accuracy and minimizing complications.

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