Morphological and morphometric study of mandibular Lingula in a dry mandible.

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Abstract

Introduction; Lingula is a small tongue shaped, sharp bony projection located on the medial aspect of mandibular ramus close to the posterior margin of the mandibular foramen. The lingula becomes an important landmark for identifying the site for injection of local anaesthetics and to correct dento facial deformities.

Methodology; This study was conducted on 140 dry adult human mandibles collected from the Department of Anatomy, JSS Medical College Mysore and Mysore Medical College and Research Institute, Mysore to determine the different shapes of lingula through direct observation. The position of the lingula was determined by measuring distance between the lingula and the anterior border of the ramus of the mandible and also distance between the lingula and the posterior border of the ramus.

Results; The most common type of lingula with respect to shape was triangular (64.3 %) and least type was assimilated on both sides. Mean distance distance between the lingula and the anterior border of the ramus of the mandible right side – 16.38 mm, left side 16.72 mm. Mean distance between the lingula and the posterior border of the ramus right side – 15.41mm, left side – 15.53 mm.

Conclusion; Comprehensive knowledge regarding its shapes and location is essential to understand Inferior Alveolar Nerve (IAN) block and ramus surgery like in Sagittal split ramus osteotomy (SSRO). The nerve blocks are effective and successful by precisely identifying the positions of lingula along with mandibular foramen.

Key words; Mandibular foramen, Ramus of the mandible, Tongue shaped bony projection.

INTRODUCTION

The lingula is a small sharp tongue-shaped bony prominence present on the medial side of the mandible, that partially overlaps the mandibular foramen. The shape of the lingula varies among different populations and becomes an important bony landmark in maxillofacial and oral surgeries [1, 2].

In the year 2000, Tuli et al. documented the shape of the lingula according to four different types, viz. nodular, triangular, truncated and assimilated [3]. Later Varma and Sameer described an additional shape of the lingula, i.e. M-shaped type [4]. The different shapes were described i.e. in the triangular type, the lingula has a narrow rounded, or pointed apex and a broad base (type 1), while the truncated type has a quadrangular top (type 2), the nodular type has the lingula fully merged into the mandibular foramen except for its apex (type 3), while the assimilated type has the lingula completely incorporated into the ramus of the mandible (type 4) [3]. The M-shaped type was defined as the lingula having two apices [4]. In the majority of population, triangular-shaped lingula was the most common type with 68.50%, the least common type was assimilated type with 1.2–17.70% [5,6].

The lingula is in close relation with the mandibular foramen. The inferior alveolar nerve which supplies the lower lip, mandibular teeth, and gum enters through the mandibular foramen and hence it becomes a significant bony landmark used in maxillofacial and oral surgical procedures. It is also used in locating the injection site for anesthetics and nerve excision in facial neuralgia [7,8,9,10, 11,12].

Therefore, adequate knowledge of the structural variations of the lingula and location may help in precisely locating the mandibular foramen and damage to the neurovascular structures entering the mandibular foramen can be prevented.

This study was aimed to explore the morphological and morphometric characteristics of the mandibular lingula in dry human adult mandibles, to provide more knowledge on its structural variations, and location for surgeons involved with maxillofacial and oral surgeries.

Methodology

This study was conducted on 140 dry adult human mandibles collected from the Department of Anatomy, JSS Medical College Mysore and Mysore Medical College and Research Institute, Mysore firstly to determine the different shapes of lingula through direct observation. The shapes of the lingulae were classified as triangular, truncated, nodular, and assimilated as per Tuli et al. classification [3].

a. Triangular - Broad base with a narrow rounded, or pointed apex.

b. Truncated - top of this bony projection appeared quadrangular.

c. Nodular- Entire lingula except for its apex merged into the ramus.

d. Assimilated - Lingula completely incorporated into ramus.

The position/location of the lingula was determined by measuring the following distances using vernier calipers;

1. Distance between the tip of lingula and the anterior border of the ramus of the mandible

2. Distance between the tip of lingula and the posterior border of the ramus of the mandible.

Results

The present study was conducted on 140 dry adult human mandibles.

The most common type of lingula with respect to shape was triangular and least type was assimilated on both sides (table 1)

Table 1; Showing variations in the shape of Lingula.

Type	Right side		Left side	
Triangular	92	65.7%	88	62.8%
Nodular	22	15.7%	22	15.7%
Truncated	18	12.8%	20	14.3%
Assimilated	08	5.7%	10	7.1%
Total	**140**		**140**	

Fig 1: Triangular Type

Fig 2: Nodular Type

Fig 3: Truncated

Fig 4: Assimilated Type

Discussion

In the year 1815, a German anatomist Johannes-Baptist Spix described Lingula as ‘mandibular tongue’ or ‘little tongue’ which is a bony elevation partially covering mandibular foramen, hence it was named as Spix’s ossicle or spine [14].

This small bony tongue like projection, in close vicinity to mandibular foramen is present on the medial surface of ramus of mandible. It gives attachment to sphenomandibular ligament, another end of which is attached to the spine of sphenoid [1].

The spine of sphenoid, the sphenomandibular ligament and the part of the mandible bearing the lingula have a common origin from the Meckels cartilage of first branchial arch [15].

Various studies have reported morphological differences in the shape and position of the lingula among different population.

Hollinshead (1962) described truncated type of lingula [16], Berkovitz et al (1978) [17], Sampson (1991) [18], Williams et al. (1995)[19] described nodular type of lingula and Morgan et al. (1982) [20] described assimilated types of lingula. Tuli et al. classified lingula into four different types based on its shape namely triangular, truncated, nodular and assimilated types [3].

The studies done describing different shapes and position of lingula among different populations are Tuli et al. on North Indian [3], Jansisyanont et al of Thai origin [21], Varma and Sameer [4], Padmavathi et al [6], Desai et al [22], ArunKumar et al.[7], Sophia et al. [13] on south Indian, Lopes et al.on Southern Brazilian [8], Ozalp et al. [23] on Turkish and Ibeachu et al.[24] on Nigerian populations.

Table 2; Showing different shapes of lingula in various populations

Authors	Year	Population	Number of specimens	Types (%)				
				Triangular	Nodular	Truncated	Assimilated	M shaped
Tuli et al [3]	2000	Indian	165	68.50	10.90	15.80	4.80	-
Kositbowornchai et al [25]	2007	Thai	72	16.66	22.92	47.22	13.19	-
Jansisyanont et.al [21]	2009	Thai	92	29.9	19.6	46.2	4.3	-
Murlimanju et al [26]	2012	Indian	67	29.9	29.9	27.6	12.6	-
Varma and Sameer et. al [4]	2013	South Indian	193	13	42	29	6	**4**
Padmavathi et.al [6]	2014	South Indian	65	29.23	19.23	33.84	17.70	-
Desai et.al [22]	2014	South Indian	100	51	24	13	12	-
Arunkumar et.al [7]	2016	South Indian	100	23.20	13	32.50	1.90	-
Alves et. al [5]	2016	Brazil	132	23.3	26.5	49	1.2	-
Lopes et.al [8]	2017	Southern Brazil	80	41.30	10.50	36.30	11.90	-
Asdullah et al [2]	2018	Indian	50	42	20	32	6	-
Ozalp et.al [23]	2020	Turkey	50	42.42	30.30	27.27	-	-
Stipo et al [27]	2022	Italy	453	10.8	26.3	38.6	4	
Ibeachu et.al [24]	2022	Nigeria	42	39.27	9.52	41.67	9.52	-
S. Nkabinde et al. [28]	2024	South Africa	45	25.56	24.44	40.00	7.78	**2.22**

Present study	**2024**	**South Indian**	**140**	**64.25**	**15.7**	**13.55**	**6.4**	**-**

In the present study, most prevalent type of lingular shape was triangular with 64.25% and least prevalent was assimilated type, in accordance with the studies done by Tuli et al, Murlimanju et al, Desai et al, Lopes et al, Nirmale et al, Samanta et al [3, 26,22, 8, 29, 30].

Hossain et al. reported three types of lingule namely triangular, truncated, and assimilated types in Bangladeshi skulls [31]. Fabian classified lingula into five major types based on shape and size in the Tanzanian population [32]. Devi et al. described truncated and nodular types of lingula to be more frequently reported in South Indian population [33]. In Thai mandibles, the truncated type was most common followed by nodular, triangular, and assimilated types [25].

Stipo et.al reported the truncated shape was the most common (38.6%), followed by the nodular shape (26.3%). The assimilated and bridge shapes were the least frequent (4% and 5.1%, respectively), while the triangular shape (10.8%), as the mixed morphologies (15.2%) [27].

The knowledge regarding the position of lingula is important for osteotomy procedures, oro-facial surgeries and nerve blocks. To locate the lingula, various measurements are done i.e average distance of lingula tip to anterior and posterior border of ramus of mandible, and average distance of lingula from mandibular notch and base of mandible [34].

In the present study, distance of lingula tip to anterior and posterior border of ramus of mandible are done and compared with previous studies.

Table 3; Showing average distance of lingula tip to anterior and posterior border of ramus of mandible, and compared with previous studies.

Authors	Population	Average distance of lingular tip to anterior border of ramus of mandible	Average distance of lingular tip to posterior border of ramus of mandible
Samanta PP [11]	North indians	20.0 ±2.4	15.0±2.7
Jansisyanont [21]	Thai	20.6±3.5	18.0±2.6

Padmavathi G [6]	South Indians	21.32±4.12	19.61±3.3
Kositbowornchai [25]	Thai	20.70±2.27	18.88±3.03
Sophia MM [13]	South Indian	17.11±2.32	14.86±2.54
Umesh et al [34]	North Indian (Gujarat)	16.62±3.31	15.94±1.63
Senel et al [12]	Turkey	18.50±2.3	16.90±3.5
Arun kumar et al [7]	South Indian	16.70±2.7	13.00±2.3
Srimani P et al [9]	North Indian	18.21±1.50	16.33±1.21
Ozalp et al [23]	Turkey	16.86±2.73	14.70±1.6
S. Nkabinde et al [28]	South Africa	20.05 ± 3.26	16.59 ± 2.26
Present study	**South Indian**	**16.55**	**15.47**

The morphometric studies to locate the position of lingula are few and location of lingula also varied among ethnic and racial groups. In the study done by Suwadee et al on 72 adult dry human mandibles of Thai Population, the position of lingula was found 20.70 ± 2.27 mm from the anterior border of ramus, 18.88 ± 3.03 from the posterior border of ramus [35].

In the study done by Samanta et al on 124 dry mandibles of North Indian population, the position of lingula was observed 20.0 ± 2.4 mm from the anterior border of ramus, 15.0 ± 2.7 mm from the posterior border of ramus [30].

In yet another study of Padmavathi et al on 65 adult mandibles of South Indian Population, the lingula was located 21.32 ± 4.12 mm, 19.61 ± 3.30 mm from the anterior border of ramus, posterior border of ramus respectively [6].

In the present study, the position of lingula was found 16.55 mm and 15.47 mm from the anterior and posterior border of ramus similar to the study done by Umesh et al [34].

The knowledge of shape, position of lingula is important to oral and maxilla-facial surgeons, anthropologists, anatomists, radiologists and also for forensic studies.

CONCLUSION

The anatomical types of the lingula are essential to understand Inferior Alveolar Nerve (IAN) block, forms an important landmark for oral and maxillofacial surgical procedures, such as

the Sagittal split ramus osteotomy (SSRO), intraoral vertico-sagittal ramus osteotomy done to correct dento facial deformities. Identifying the precise positions of the lingula and mandibular foramen can help to maximize the chances of success and effectiveness of an Inferior Alveolar Nerve block and Intra-operative complications can be prevented.

In the field of Forensic medicine and anthropology, lingula serves as valuable anatomical landmark, facilitating the acquisition of many mandibular measures, tool for race identification.

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