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Anatomy

MORPHOMETRY OF MANDIBULAR FORAMEN WITH LINGULA AND ANTILINGULA IN DRY ADULT HUMAN MANDIBLES IN WEST BENGAL REGION

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ABSTRACT

Aim: The present study was aimed to position the mandibular foramen from different anatomical landmarks in horizontal and vertical orientations. Also to statistically correlate mandibular foramen with lingula and antilingula and to evaluate usefulness of lingula and antilingula landmarks for maxillofacial-oral surgeons, mandibular ramus osteotomies and the inferior alveolar nerve block, a very common local anesthetic technique for lower jaw anesthesia examples - for tooth extraction, skeletal malocclusion correction, reduction of fractures etc.

Methods & Materials: Randomly selected 45 (90 sides) adult human mandibles were procured from Anatomy department of IQ City Medical College, West Bengal as the study material. Four measurements (MX, MY, MW & MZ) were done for mandibular foramen lingula and antilingula landmarks in two horizontal and two vertical orientations by Digital Vernier Calliper. The measurements were tabulated and statistically analyzed.

Results: Only 46 sides had prominent palpable antilingula, hence the comparison with respect to antilingula and mandibular foramen were done only for 46 sides. The mean values were significantly higher for MY & MW and significantly lower for MX & MZ of lingula landmark in comparison to mandibular foramen. Antilingula also showed similar trend when compared to mandibular foramen.

Conclusion: Lingula can be used as bony landmark to identify the mandibular foramen for various maxillofacial oral operations and anesthesia. Antilingula (if palpable) can be used as supplementary landmark. In relation to both lingula and antilingula, mandibular foramen is located posteroinferiorly. The mandibular foramen is slightly posterior in relation to the center of the ramus.

KEYWORDS : Mandibular foramen (MF), lingula, antilingula & Digital Vernier calliper.

INTRODUCTION

The mandible forms the lower jaw and is the only movable bone of skull. It consists of a horizontal horseshoe shaped body and two broad and oblong rami projecting upwards. Viewed from the side, each half of the bone is L-shaped.[1]

The ramus of the mandible is quadrangular in shape and has medial & lateral surfaces and condylar & coronoid processes. The lateral surface of the ramus is generally smooth except for the presence of a few obliquely oriented ridges. Most of the lateral surface provides attachment for the masseter muscle.[2] The **antilingula** is bony tubercle (variable) on the lateral surface of the mandibular ramus, which is the expression of the underlying mandibular foramen (MF) on the medial side of the mandible, according to some authors. Thus surgical procedures could be performed superior and posterior to the antilingula without risk of damage to the inferior alveolar nerve.[10-12] Other studies have shown that while doing vertical ramus osteotomy from either intraoral or extra oral approach, with the antilingula as a guide, it does not guarantee the absence of nerve injury. Those studies have shown an Incidence of inferior alveolar nerve palsy in up to 30% of cases.[4,5,13-16]

The posterior & inferior borders of the ramus intersect to form the **angle of mandible**, while the superior border between two processes is notched to form the **mandibular notch**. The medial surface of ramus of mandible is the lateral wall of infratemporal fossa. It's most distinctive feature is the **mandibular foramen** which is the superior opening of the mandibular canal. The inferior alveolar nerve and vessels pass through this foramen and reach the mandibular body and gives fine branches which supply the lower jaw teeth and lower lip. Immediately anterosuperior to the mandibular foramen is a triangular elevation called **lingula** for attachment of the mandibular end (lower end) of the sphenomandibular ligament[4]. An elongated groove i.e. the mylohyoid groove extends anteroinferiorly from MF. The nerve to mylohyoid lies in this groove. Posteroinferior to the mylohyoid groove and MF, the medial surface of the ramus of mandible is roughened for the attachment of the medial pterygoid muscle.[2]

The inferior alveolar nerve block (IANB) is a very common local anesthetic technique for lower jaw anesthesia (e.g. tooth-extraction, skeletal mal-occlusion correction, reduction of fractures) and in many other dental & surgical operations. The site of injection is around the MF, an opening into the mandibular canal on the medial aspect of ramus of mandible. There are possible problems associated with an IANB such as injection of anesthetic agent into the parotid gland or the medial pterygoid muscle. This would affect the ability to open the mouth called **pterygoid trismus**.[3] The success of IANB depends on the proximity of the needle tip to the MF at the time of the anesthetic injection. That's why this technique must be based on the precise anatomical knowledge of the MF. Variations in the MF position and the presence of accessory MF are reasons for failure of IANB technique. Sagittal split ramus osteotomy which is among one of the most widely used procedure by oral & maxillofacial surgeons was first proposed by Schuchardt in 1942. This process involves the surgical repositioning of the mandible with many added advantages like intraoral approach, broad bone interface, the possibility of rigid internal fixation and early jaw function. Lingula and Antilingula landmarks were suggested as reference marks for these surgical procedures to correctly localise MF due to their close proximity to the IAN.[4-8,16,19&20]

The lingula is a tongue shaped bony projection on the medial aspect of ramus of mandible. It is very important landmark as it lies in the close proximity to the MF and these two anatomical structures are of clinical significance for the maxillofacial-oral & dental surgeons because of their relation to the inferior alveolar nerve.[8,17&18]

The various studies have shown the variation in results which is due to racial differences of the landmark, growth pattern of the study material and the examiner variations.

MATERIALS AND METHODS

Irrespective of dentulous and edentulous mandible randomly selected 45 (i.e. 90 sides) dry adult human mandibles were procured from anatomy department of IQ City Medical College and Hospital, Durgapur West Bengal as in the study material. The mandibles were measured according to predetermined landmark for the mandibular foramen, lingula and antilingula on both sides of the mandibular ramus. All the measurements were carried out in millimeters using Digital Vernier Callipers (Fig.1) as follows-

1. MX- represents the distance between the anterior most part of the mandibular foreman, lingula and antilingula landmarks to the anterior border of mandibular ramus in a straight horizontal orientation
2. MY- represents the distance between the posterior most part of the mandibular foramen, lingula and antilingula landmarks to the posterior border of the mandibular ramus in the same horizontal orientation

3. MW- represents the distance between the lower limit of the mandibular foramen, lingula and antilingula landmarks to the angle of mandible in a straight vertical Line
4. MZ- represents the distance between the lower limit of the mandibular foramen, lingula and antilingula landmarks to the to the lowest point of mandibular notch in straight vertical line

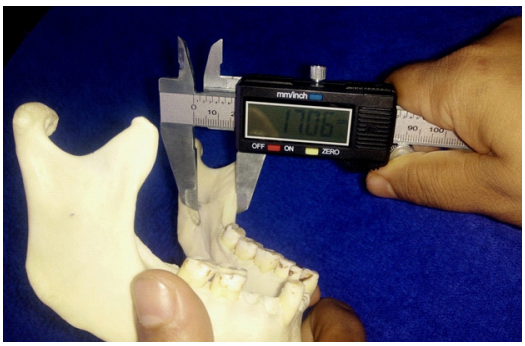

Fig.1. Measurement being taken by Digital Vernier Calliper

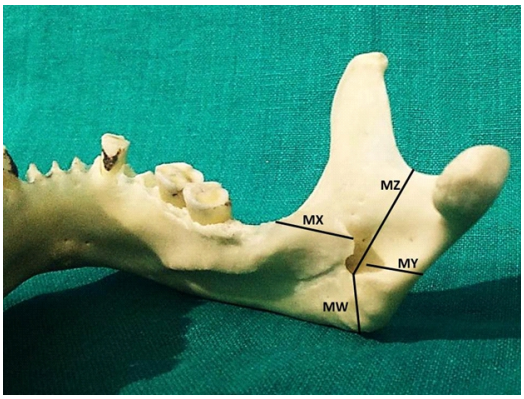

Fig.2- Showing measurements taken from various anatomical landmarks for Mandibular Foramen.

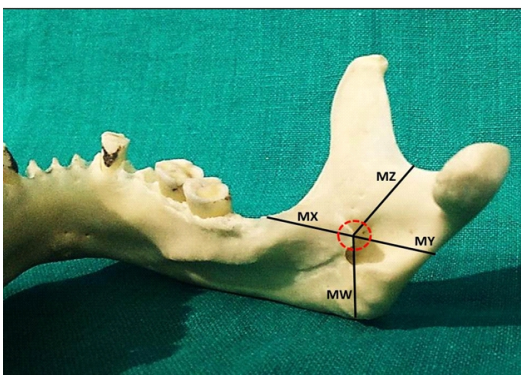

Fig.3- Showing measurements taken from various anatomical landmarks for Lingula.

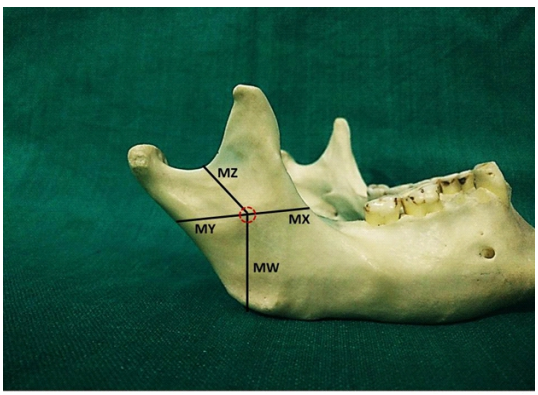

Fig.4- Showing measurements taken from various anatomical landmarks for Antilingula.

The horizontal measurements were parallel to the mandibular base whereas vertical measurements were perpendicular to the horizontal ones. The lingula landmark studied was the medial most prominence of the lingula irrespective of it shape. The antilingula landmark was identified by prior palpation on the lateral surface of ramus of mandible by two independent observers. (Fig. 2, 3 & 4) All the values obtained from measurements (Fig. 2, 3 & 4) were tabulated and their respective mean and a standard deviations (SD) was calculated. Their statistical analysis was done to verify any positional correlation between the MF lingula and antilingula. All the analysis was done by SPSS version 14. A "p" value of less than 0.05 was considered statistically significant. Comparison of mean values was carried out by paired T test. Intra examiner reliability was calculated by Pearson correlation Coefficient was found to be 0.98 which is nearby accurate result.

RESULTS & OBSERVATIONS

A total of 45 dried adult mandibles (i.e. 90 sides) were studied for MF with lingula and antilingula. Only 46 sides had palpable antilingula. Hence the evaluation of the correlation between anti lingula and MF were done for only 46 sides. 19 specimens had bilateral palpable lingula and 8 specimens had unilateral palpable lingula. The mean values were significantly higher for MY and MW and were significantly lower for MX and MZ of lingula landmark in comparison to MF. Antilingula also showed a similar trend when compared to MF. Table1, 2 & 3 showing comparison data between lingula, antilingula and MF.

Table1. Mean values and standard deviation (SD) obtained for each MX, MY, MW & MZ measurements at the **mandibular foramen** landmark and compared with results of Monnazzi et al.

		MX	MY	MW	MZ
Monnazzi et al	Mean	17.67	14.35	20.96	21.89
	SD	3.03	1.87	4.50	3.50
Present study	Mean	18.02	12.08	16.25	25.80
	SD	2.80	2.14	4.21	3.24

Table2. Mean values and standard deviation (SD) obtained for each MX, MY, MW & MZ measurements at the **Lingula** landmark and compared with results of Monnazzi et al.

		MX	MY	MW	MZ
Monnazzi et al	Mean	16.50	14.63	27.09	16.38
	SD	2.32	2.13	5.44	2.59
Present study	Mean	17.03	15.15	26.08	18.85
	SD	2.45	2.02	4.56	2.38

Table3. Mean values and standard deviation (SD) obtained for each MX, MY, MW & MZ measurements at the **Anti-Lingula** landmark and compared with results of Monnazzi et al.

		MX	MY	MW	MZ
Monnazzi et al	Mean	14.77	16.14	26.03	14.55
	SD	4.04	2.47	4.55	3.53
Present study	Mean	16.04	16.17	26.40	15.97
	SD	2.88	2.14	3.88	2.98

DISCUSSION

Our study evaluated the applicability of lingula and antilingula landmarks as surgical guide for position of the MF. The measurements for lingula and antilingula were significantly different when compared to MF. Our results concluded that with respect to both lingula and antilingula landmarks, mandibular foramen was posteriorly located when measured from the anterior border of MF in a horizontal orientation. When compared to MF lingula and anti lingula where located superiorly. Our result was consistent with the result reported by Monnazzi et al.[4] But these reference landmark are useful only if they are palpable. Progrel et al[5] had identified antilingula in all the specimens while Monnazzi et al reported that antilingular was not palpable on 15 sides out of 88 sides studied. Yats et al.[6] and Martone et al.[7] also reported that antilingula was not palpable in all the specimens. Our study was consistent with literature in which 48% of the specimen did not have palpable antilingula.

Langston and Tibo[8] described the anti lingula position as being 4.7 mm anterior and 4.7 mm posterior to the MF and they also stated it was between 0.9 and 16.2 mm superior to the MF. Monnazzi et al.[4] described the MF to be posterior (approx. 3 mm) and inferior (6mm)

when averaged compared to the antilingula. There is a large discrepancy in those values reported in the literature and the present study which shows the MF is 1.98 mm posterior and 9.83 mm inferior when averaged compared to antilingula. Similarly it was seen the MF was 0.99 mm posterior and 6.95 mm inferior to the lingula.

We conclude that antilingula can be only supplementary landmark along with lingula and cannot be used solely as main landmark for surgical guide in mandibular areas. Hogan and Ellis[9] suggested that antilingula can't be reliable landmark that attaches to that portion of the mandible, rather than to the entrance of the inferior alveolar nerve on the medial surface of the mandible and stated that the use of the antilingula as a surgical guide during ramus osteotomies is unreasonable and is more related to musculo-tendinous apparatus than to the entrance of inferior alveolar nerve

CONCLUSION

On the basis of the present study, we can conclude that with respect to lingula and antilingula landmarks, the position of mandibular foramen is posteriorly and inferiorly. For lingula landmark, the greatest prominence of it is considered. So lingula is a reliable and useful anatomical landmark to locate MF position for performing ramus osteotomies and other maxillofacial-oral & dental surgery, but antilingula is not a reliable landmark reference to locate MF position for the same. Antilingula if possible, can be used as a supplementary landmark for the same.

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