



THE PRESENCE OF ANTILINGULA AND ITS RELATION TO THE TRUE LINGULA – AN ANATOMICAL STUDY

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ABSTRACT

Background: Accurate and precise localisation of mandibular foramen during mandibular ramus osteotomies is an essential factor in avoiding damage to inferior alveolar nerve bundle. There are literatures suggesting lingula as a landmark for identifying mandibular foramen. But identification of lingula during the surgical procedure is difficult as it is on the medial aspect of ramus. The only external surface marking on the ascending ramus which is of any importance is a small bony prominence, the antilingula. So to establish a reliable relation between lingula and antilingula will be helpful to minimise damage to inferior alveolar bundle during mandibular ramus osteotomies.

AIM - The purpose of the study is to evaluate the presence of antilingula and its true relation to Lingula in mandible

Methods and Material: 17 human cadaver mandibles were used for this study. The mandibles were then sectioned through the symphysis. After stabilizing the hemi mandible, holes were made corresponding to lingula and antilingula. The relationship of the hole drilled from the true lingula was measured in millimeters to the marks denoting the position of the antilingula in the horizontal and vertical planes.

Results: In our study all the observers identified the antilingula in all specimens. The greatest distance between the two points denoting the antilingula was 9 mm. The position of the antilingula varied from 7.5mm anterior to 4.5mm posterior and 8mm superior to 11.5mm inferior. It was located anterior to the foramen in 53.92% of cases and in 20.58% of cases it was posterior to the foramen. In our study 25.49% of cases the marked antilingula were found to be in the antero superior quadrant, In 26.47% of cases the antilingula was anteroinferior to lingula

Conclusion : After anatomical and statistical evaluation we concluded that, the antilingula can be identified in all the mandibles and it can be used successfully for locating the mandibular foramen. It can be used as a reliable land mark during mandibular ramus osteotomy procedures to avoid damage to inferior alveolar nerve

KEYWORDS :

INTRODUCTION

Growth of the face normally occurs in an orderly and regular fashion, resulting in a face befitting the concept of normal proportions with relation to sex, race and prevailing culture. Mild variation from the normal may be accepted but when it deviates drastically from norms it creates aesthetic concerns.

The ascending ramus of the mandible is often surgically fractured in order to reposition the tooth bearing section of the mandible. It is important to avoid transection of the inferior alveolar neurovascular bundle, as failure may lead to troublesome haemorrhage intraoperatively or permanent neural damage.

Among the many sequelae of surgical correction of the mandible, one of the common ones which is of equal annoyance to the surgeon and the patient is involvement of the inferior alveolar nerve. In surgical techniques like sub condylar vertical osteotomies, inverted L osteotomies where the ramus is approached from the lateral surface, it is valuable to have an external anatomical landmark, corresponding to the mandibular foramen, as the bone cut must be made above and behind this point in order to avoid the neurovascular bundle.

There are literature suggesting lingula as a landmark for identifying mandibular foramen(6,14,11). But identification of lingula during the surgical procedure is difficult as it is on the medial aspect of ramus.

The only external surface marking on the ascending ramus which is of any importance is a small bony prominence the antilingula, corresponding to the apex of the masseteric insertion. Many mandibles seem not to have any antilingula, or at least its recognition was impossible(1,5).

This study was undertaken to assess the frequency of the presence of antilingula and its relationship to the true lingula which is the landmark for identifying mandibular foramen.

MATERIALS AND METHODS

This study was undertaken to determine the following

1. Whether the antilingula can be consistently identified
2. Whether there was a variation between different observers.
3. To find out the relationship between the true lingula and the antilingula.
4. To find out the correlation between the position of antilingula on the right and left sides of the same mandible.

This study was conducted in the department of oral and maxillofacial surgery, Government Dental College, Trivandrum, Kerala, India. 17 human cadaver mandibles were used for this study. The age of mandibles was unknown, but it can be assumed that they were elderly. The five mandibles were from women. The presence or absence of teeth in the posterior mandible was noted. Three independent observers palpated the lateral aspect of the ramus of the mandible in an effort to identify the antilingula. The subjects were one assistant professor with post graduate degree in oral and maxillofacial surgery, others were a junior lecturer with post graduate degree and a final year post graduate student, all three from the same department. They palpated the mandible from the front only without looking at it to simulate the surgical experience as closely as possible. When the first subject identified the antilingula, it was marked with red colored marking pen. After taking 2 different measurements from fixed points on both horizontal and vertical directions, the mark was erased. Then the second subject marked the antilingula with green colored erasable marking pen which was erased after taking two measurements in the same manner. The third subject repeated the same, but the marking was not erased. Previously erased markings of the first two subjects were then reproduced by using the measurements taken from the fixed points.

The mandibles were then sectioned through the symphysis. After stabilizing the hemimandible, with a 1.5 mm twist drill a hole was then drilled through the mandible from the medial to the lateral surface commencing at the point of the lingula on the medial side. The

relationship of the hole drilled from the true lingula was measured in millimetres to the marks denoting the position of the antilingula in the horizontal and vertical planes. The correlation between the position of the antilingula on the right and left sides of the same mandible was calculated. Figure 1 shows the materials used for this study and figure 2 shows the specimen with the marked antilingula, hole drilled from the lingula and midwaist point



Figure 1 : Armamentarium



Figure2: Specimen with the marked antilingula, hole drilled from the lingula and midwaist point

Data was entered into a master sheet and necessary statistical constants like mean, standard deviation were computed. The difference in the mean values of different observers and that of right and left sides of the same mandible were tested statistically by using Student "t" test. In order to test whether the distance from the lingula to the marked antilingula, is significant, the paired "t" test was used. To find out the correlation between the measurements of the left and right sides of the same mandible, the Pearson correlation was used.

RESULTS

A total of 17 human cadaver mandibles were used for this study. Teeth were present in six of them in four cases bilaterally and in two, unilaterally. In all the cases, the three observers felt that they could identify the antilingula and marked them accordingly. In 3 cases, two of the observers agreed on the position of the antilingula. In 31 cases all the observers differed, the greatest variation being 9mm. The greatest distance was 11.5mm. In 1 case, one observer marked the antilingula exactly at the hole drilled from the true lingula. The mean distance of the antilingula from the true lingula was 3.96 mm. Standard deviation was 2.43 mm. The mean distance between the lingula and the antilingula was 3.7mm in men and 4.1mm in women. Among 102 marked antilingula, 78 (74.47 %) marks lies within 5mm range from the bur hole which represents the lingula. 24 (21.56%) marks lies within 5 to 10mm range from the true lingula. One mark lies more than 10mm apart from the lingula. The distance between the most inferiorly placed antilingula and true lingula was 11.5mm and that of the superiorly placed antilingula was 8mm. Anteriorly it was 7.5mm and posteriorly it was 4.5mm.

Antilingula in relation to the bur hole denoting the true lingula which falls at the centre of the quadrants (Figure3). Of the 102 points marked, 1 (0.98%) corresponded exactly with the true lingula, 26 (25.49%) had the antilingula anterosuperior and 27 (26.47%) anteroinferiorly in relation to the true lingula. In 6(5.8%) cases, antilingula was posterosuperior to the true lingula and in 15 (14.7%) cases, it was postero-inferior to the lingula. In another 6 (5.88%) cases the antilingula was

exactly superior to the true lingula and in yet another 6(5.8%) cases, it was exactly anterior. 13 cases (12.75%) had the antilingula exactly inferior to the true lingula and in 2 cases (1.96%) it was exactly posterior. In 8 cases, all the observers placed the antilingula in the same quadrant while in 13 cases, only two observers placed it in the same quadrant. In 2 cases, two observers placed the antilingula exactly inferior to the true lingula. In 1 case, two observers placed it exactly superior to the lingula. In 10 cases, all the observers placed the antilingula in different quadrants. Among the 17 specimens, in 1 specimen did the position of the antilingula on the right side marked by one observer coincide with that of the left side which was marked by another observer.

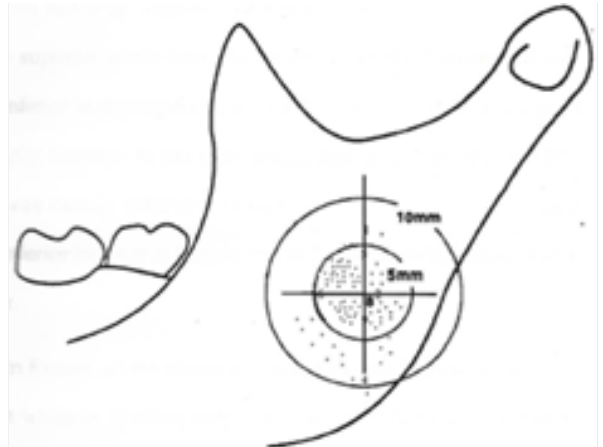


Figure 3: Diagrammatic representation of the lateral ramus of the left side of mandible showing the four quadrants centered on the drill hole representing true lingula. The position of 102 antilingula are shown related to the lingual

When one side of a mandible was compared with the contralateral side, in 3 cases 2 observers marked the antilingula on the same quadrant and in 14 cases, it was placed in different quadrants. Comparison of the vertical and horizontal measurements from the antilingula to the true lingula on the right and left sides of the same mandible are presented in Table 1 and 2. As per the results obtained from the table, there was no statistically significant variation in vertical measurements of left and right sides of the mandible but in the horizontal distance, the difference was significant at a 5% level.

The vertical and horizontal distances from the antilingula marked by the 3 observers to the lingula are compared in Table 3 and 4. There was statistically no significance; that means the apparent difference in the horizontal and vertical distance between the antilingula marked by 3 observers and hole drilled from the lingula were negligible.

When one side was compared with the other side there was no correlation in the horizontal plane but a positive correlation in the vertical plane was present. Correlation between the measurements on the left and right side is given in Table 5.

The significance of the distance from the antilingula to the lingula was also calculated and tabulated (Table 6). The results indicate a statistical significance. That means the antilingula is always situated at some distance from the lingula.

DISCUSSION

Since the orthognathic surgery is an elective procedure for the correction of jaw deformities, one of the main aims of the surgeon is to minimise post-operative complications. It is one of the crucial factors for acceptance of the surgery by patient and avoiding medicolegal problems. Among the many of the complications in orthognathic surgery, injury to the inferior alveolar neurovascular bundle is the most frequent one. In osteotomies like vertical oblique and inverted -L, where the ramus is approached from the external surface it is valuable to know a definite anatomical landmark which corresponds to the tip of the lingula and the mandibular foramen, in order to avoid damage to the inferior alveolar neurovascular bundle. Many literatures considered a bony prominence on the lateral surface of the ramus which is very much related to the position of the mandibular foramen on the medial surface (7,17).

In our study all the observers identified the antilingula in all specimens.

The greatest distance between the two points denoting the antilingula was 9 mm. Yates et al in a study utilizing three observers in an attempt to identify the antilingula on 75 dried mandibles, could only positively identify it in 44 % of cases, with an indefinite identification in 41% of cases, and no antilingula identified in 15% of cases. Langston et al [12] in a study of 50 dried mandibles were able to identify the antilingula in all cases. Martone et al [13] identified the antilingula in 42% of cases when he examined 63 hemi mandibles.

Pogrel (16) identified the antilingula in all cases when 20 cadaver mandibles were examined by three independent observers. He found that the greatest distance between the lingula and the antilingula on the same mandible was 11 mms. Pogrelet al also noted that the mean distance between the antilingula and true lingula was 5.39mm and standard deviation was 3.33 mm. Langston et al (12) noted that the position of antilingula varied from 4.7 mm posterior to 4.7mm anterior to the mandibular foramen and 0.9mm to 16.2 mm superior to the foramen. It was located anterior to the foramen 66%of the time.

In our study the mean distance was 3.96mm and the standard deviation was 2.43mm. Mean distance between the antilingula and the lingula was 3.7mm in men and 4.1mm in women. The position of the antilingula varied from 7.5mm anterior to 4.5mm posterior and 8mm superior to 11.5mm inferior. It was located anterior to the foramen in 53.92% of cases and in 20.58% of cases it was posterior to the foramen. In our study 25.49% of cases the marked antilingula were found to be in the antero superior quadrant which was less than half of the observations in the previous studies made by Pogrel and Yates. This may be due to geographical and racial change of specimens. In 26.47% of cases the antilingula was antero inferior to the lingula. This percentage was much higher than what was observed by the Pogrel and others which was 10% out of 120 marked antilingula.

We also found that 5.8% of cases, the antilingula was exactly anterior to the lingula. In another 5.8% of cases, it was exactly superior to the lingula. In 12.75% of cases, it was exactly inferior to the true lingula. In 14.7% of cases, it was postero- inferior to the lingula. Yet another 5.8% cases, it was postero-superior. From these findings we can assume that the position of antilingula in relation to the lingula may vary, but the most frequent position is anterior (53.92%). The distances between the lingula and the antilingula on the left and right side of the mandible when compared showed no statistical significance. Contradictory to this data Mamatha Hosapatna et al found that there was a significant difference in distances in mean between the antilingula and mandibular foramen of both right and left the sides Even though there is an apparent difference in the distances between the antilingula marked by different observers and the lingula, that difference was not statistically significant.

From this result we concur with the opinion of Pogrel (16) when carrying out the orthognathic surgery, opinion of more than 1 observer should be considered.

Even though there was an apparent difference in left and rightside measurements of the antilingula to the lingula, there was statistically no significant difference between the left and right-side measurements of the same mandible. When compared left and right sides of the same mandible, there was a positive correlation in the vertical plane which was statistically highly significant. But there was no correlation in the horizontal plane.

Many authors disagree with the concept of considering antilingula as a reliable land mark for identifying mandibular foramen in lateral ramus osteotomies. JinHoo Park et al (15) stated a comment based on a study on dried mandibles that when the antilingula alone is taken as a reference point, prevention of damage to the IANB cannot be guaranteed. But the antilingula is still important as a reference point for the surgeon in the surgical field. Hogan and Ellis [8] suggested that the antilingula presents no scientific basis to be chosen as anatomical landmark and surgical guide in mandibular ramus osteotomies. But the present study disagrees with this statement. Deepika Chenna et al's findings are also supporting our study but they suggested that Lingula can be used as landmark to avoid the mandibular foramen to perform ramus osteotomies. Antilingula if palpable can be used as supplementary landmark for the same. With respect to both the landmarks, mandibular foramen is located posteroinferiorly. Lingula and antilingula cannot serve as absolute setbacks for mandibular surgery. Gender and skeletal patterns were non significantly correlated

with the presence of lingual and antilingula [10]. On contrary our study revealed statistically significant correlation between the position of antilingula and lingual, probable reason could be that our study was on physical cadaveric specimen with human palpation whereas their particular study was purely a software aided study on CBCT images of vital mandibles, where physical palpation and human judgement were nil. A CBCT study conducted by Zaho et al [18] showed similar results with our study and they also stated that the lingual mainly located in posterior superior and inferior position from antilingula within a 5-10mm range.

CONCLUSION

This anatomical study was an attempt to identify the antilingula and its relationship to the lingula. We came to the following conclusions

1. The antilingula can be identified in all the mandibles and it can be used successfully for locating the mandibular foramen
2. The antilingula is a highly variable anatomical landmark and in most instances, it is situated anterior and inferior to the lingula. However, a cut made between 5 to 10mm posterior to the antilingula is within a statistically safe area, in over 90% of cases, to avoid encroaching upon the inferior alveolar foramen. A cut made between 7.5mm to 10mm above the antilingula is within a statistically safe area, in over 75% of cases.
3. When the antilingula is used as a landmark, the opinion of more than 1 observer should be taken.
4. Even though the number of specimens studied were less, we arbitrarily concluded that there was not much difference in the distance between the antilingula and the lingula in male and female specimen.

However, the female specimen showed a slight increase in this distance than male specimen.

- Review of literature regarding the neurological damage after different types of ramus osteotomies reveal a high incidence of neurovascular bundle involvement. To minimise this, many surgeons used the antilingula to localise the mandibular foramen on the medial surface of the ramus of the mandible. Our study concluded that, in procedures like C- Osteotomy, and subsigmoid osteotomy, saving the inferior alveolar nerve purely relies upon the location chosen by the surgeon to cut the ramus from the lateral aspect. Since the lingula could not be located from the lateral side of the ramus by any means (only surgeons experience and decision), a statistically significant correlation with the located antilingula on the lateral surface to the lingula on the medial side of ramus should help in saving the inferior alveolar nerve rather than proceeding without any reference points on the lateral ramus of mandible. In spite of using this landmark, the occurrence of neurovascular damages reveals the need for further study into the relationship between the lingula and the antilingula.:

Table 1: Comparison of vertical distance from the marked antilingula to the lingula on the right and left side of the same mandibles

Observer	Vertical Distance (in mm)				t Value	P Value
	left		right			
	Mean	S.D	Mean	S.D		
I	+1	5.16	-1.70	3.56	0.46	P>.05*
II	-1.12	4.50	-2.90	3.90	1.22	P>.05*
III	-1.15	3.17	-0.85	2.47	0.31	P>.05*

SD = standard deviation

* Statistically not significant

Table 2: Comparison of horizontal distance from the antilingula to the true lingula of the right and left side of the same mandibles

Observer	Horizontal Distance (in mm)				P Value	P Value
	left		Right			
	Mean	S.D	Mean	S.D		
I	1.17	2.27	0.29	1.94	1.22	P>.05*
II	1.03	1.54	0.32	1.94	1.18	P>.05*
III	1.47	2.56	0.03	1.57	2.06	P<.05**

SD = standard deviation

* Statistically not significant

** Significant at 5% level

Table 3: Comparison of the horizontal distance from the marked antilingula to the lingula (different observers)

Site of	Mean Horizontal Distance (mm)			P
Measurement	Observer 1	Observer 2	Observer 3	Value
Left	1.17	1.03	1.47	P>.05*
Right	0.29	0.32	-0.03	P>.05*

* Statistically not significant

Table 4: Comparison of the vertical distance from the marked antilingula to the lingula (different observers)

Site of	Mean Vertical Distance (mm)			P
Measurement	Observer 1	Observer 2	Observer 3	Value
Left	-1.00	-1.12	-1.15	P>.05*
Right	-1.70	-2.9	0.85	P>.05*

* Statistically not significant

Table 5 Antilingula To The Hole Drilled From The Lingula.

SI. No.	Measurement related	Correlation Coefficient	t Value	P value
1.	Vertical distances from the marked antilingula to the hole drilled from the lingula	+0.74	4.25	pc.001*
2.	Horizontal distance from the marked antilingula to the hole drilled from the lingula	0		No correlation

* Statistically not significant

Table 6 Comparison of the distances of the antilingula to the hole drilled from the lingula

Mean distance	standard deviation	number of sample	"t" value	"P" value
3.96	2.43	102	16.45	P<.001**

**Highly significant

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