Morphological variations of lingula and prevalence of accessory mandibular foramina in mandibles: A study

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Department of Oral Pathology/Oral Medicine and Radiology, Dr. Z.A. Dental College and Hospital, Lucknow, U. P (India) on fifty (100 sides) dry adult human mandibles to determine the different shapes of lingula. The shapes of the lingula were classified as triangular, truncated, nodular, and assimilated types.

Results: The most common shape found in the study was the triangular (61.6%) while the least common shape was the assimilated (11.6%). All types of lingule were more prevalent unilaterally. The prevalence of accessory mandibular foramina (AMF) was 12% on the right side and 4% on the left side of the mandible.

Conclusion: The present study provides information regarding different shapes of lingule and incidence of AMF in the populations of Lucknow and its surrounding areas (Uttar Pradesh) North India. The findings of the present study are very helpful to oro-dental surgeons, anthropologists, and forensic practice experts.

Keywords: Accessory mandibular foramina, dry adult human mandible, lingula

INTRODUCTION

Lingula has been described as a small tongue shaped, sharp bony projection located on the medial aspect of mandibular ramus close to the posterior margin of the mandibular foramen.[1] It is an important landmark as it lies in proximity to the mandibular foramen.[2] The inferior alveolar nerve and vessels pass laterally to the lingula through the mandibular foramen into the mandibular canal. The foramen and the lingula, because of their relations to the inferior alveolar nerve are of great clinical significance for the oro-dental surgeon. The lingula is used for identifying the site for injection of local anesthetics and for excision of nerve in case of facial neuralgia.[3] The relationship between lingula and lingual nerve may aid in risk associated with an impacted third molar.[4] Due to its connection to the nerve and vascular structures, the study of the lingula provides important information related to the oral and maxillofacial surgical procedures, such as sagittal split ramus osteotomy and intraoral vertical-sagittal ramus osteotomy carried out to correct dento facial deformities. Intra-operative complications such as hemorrhage, fracture, and nerve injury may occur if lingula is not correctly identified.
out to correct dentofacial deformities. Intraoperative complications such as hemorrhage, fracture, and nerve injury may occur if lingula is not correctly identified. Variation in shapes of lingula have been reported by many authors. Truncated type of lingula was described by Hollinshead. Nodular and assimilated were described by Berkovitz et al. and Margon et al. respectively. Tuli et al. classified lingula into four different types based on its shape, namely triangular, truncated, nodular, and assimilated.

All unnamed openings in the mandible are called Accessory foramina. Although these foramina are described in the literature their distributions are variable. They may contain nerve fibers or blood vessels. When they transmit nerve fibers, the local anesthesia given during dental extractions may fail as branches of the nerves passing through them escape the drug. The accessory vessels contained in them may result in difficulty in controlling intra-osseous hemorrhage.

The incidence of accessory mandibular foramina (AMF) has been found greater on the medial surface than on the lateral surface and found in the vicinity of the main mandibular foramen. Position and incidence of accessory foramina in mandible are important for dental surgeons and anesthetists in achieving complete nerve blocks and for avoiding injury to neurovascular structures passing through it. An accessory mandibular foramen is known to provide an easy route for the spread of tumor cells following radiotherapy.

The present study was undertaken to determine the different shapes of lingule and prevalence of AMF in dry mandibles of Lucknow and its surrounding areas.

**MATERIALS AND METHODS**

This study was conducted in the Department of Oral Medicine and Radiology, Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow on fifty dry adult human mandibles (25 male dry mandibles and twenty-five female dry mandibles) to determine the different shapes of lingula. The analysis of the lingual characteristics was conducted mainly through observation, without measurement tools.

The shapes of the lingule were classified as triangular, truncated, nodular, and assimilated as per Tuli et al. classification. Lingula with a wide base and narrow rounded or pointed apex were classified as triangular [Figure 1] and the lingula with the quadrangular top as truncated [Figure 1]. The entire lingula except for its apex merged into the ramus is nodular [Figure 1] and in assimilated type [Figure 1] the lingula becomes completely incorporated into the ramus. Presence or absence of accessory mandibular foramen was also recorded [Figure 2].

**RESULTS**

The distribution of different shape of lingule and AMF in male and female dry mandibles is shown in Table 1 and Chart 1. The distribution of different shapes of lingule in male and female mandibles with respect to the side is shown in [Figures 3-6] and distribution of AMF in male and female mandibles is shown in Figure 7.

From the chart 1, it was observed that triangular shape is found to be more in females than males and the nodular shape was found to be more among males than females. However, the percentage of mandibles of Truncated and Assimilated shape among male and female are found to be same. Furthermore, we have validated through applying Chi-square test for independence of attributes and assumed the hypothesis that the shapes of the mandible are of gender independent, i.e., there is no association between gender and shapes of mandibles. R-software is used to test the hypothesis as given below:

- Z-read. table (“clipboard,” header = T)
- Chi-squared test (z).

Pearson’s Chi-squared test

- $X^2 = 2.6571, df = 3, P = 0.4476$.

From the above-mentioned output, it is observed that $P$ value is 0.4476 is greater than 0.05 and hence we accept the null hypothesis and hence, it is concluded that shape of the mandible is gender independent meaning that there is no association between gender and shapes of the mandible.
From the above table, it was observed that prevalence of triangular shaped lingule were more followed by truncated, nodular and assimilated shaped lingule. The prevalence of triangularly shaped lingule (left side), and truncated shaped (left and right side) were statistically significant (As $P > 0.5$)

**DISCUSSION**

The frequency of different morphological types of lingula studied by different authors varied among different populations and races.
Different morphological shapes of the lingula were first classified by Tuli et al.[3] into triangular, truncated, nodular, and assimilated types in adult human mandibles of Indian origin. Tuli et al. reported triangular shape to be the most common and assimilated as the least common in Indian population.[3] Hossain et al.[19] reported three types of lingula namely triangular, truncated, and assimilated types in Bangladeshi skulls. Fabian[20] classified lingula into five major types based on shape and size in the Tanzanian population. The frequency of different morphological types of lingula studied by different authors varied among different population and races. Whereas, Devi et al.[1] described truncated and nodular types of lingula to be more frequently observed in South Indian population. In another study on South Indian population, the triangular and nodular shapes were most prevalent.[21] According to Nirmale et al.[22] triangular shape was most common. In Thai mandibles, the truncated type was most common followed by nodular, triangular, and assimilated types. Lopes et al.[5] reported the triangular shape to be most common and assimilated type the least common variety of shape of lingula in the Southern Brazil population.

In the present study, the most prevalent shape of lingula was triangular, and the least prevalent shape was assimilated type, which is in accordance with the result of Samanta et al. and Kharb et al.[14] study (on populations of Indian origin) and results of Lopes et al.[5] study (Southern Brazil Population). Chavez et al.[23] mentioned accessory foramina in fetus and reported that these foramina are connected with the mandibular canal. This connection implies that these accessory foramina may form an important route for the nerves and vessels. The passage of blood vessels and nerves makes the accessory mandibular foramen (AMF) clinically important. The embryological basis of the occurrence of the AMF has been described in the literature.[23] During development, initially, there are three inferior alveolar nerves, which innervate each of the three groups of the mandibular teeth. Later, there is a fusion of these nerves and a single inferior alveolar nerve is formed. The incomplete fusion of these three nerves leads to the development of double mandibular canals. It was reported that, in 60% of the cases, the mandibular canal was found to have the entire inferior alveolar nerve passing through it, whereas, in the remaining 40% cases, the nerves were found to be scattered.[24] The awareness of its alternate route through AMF and its position is important for achieving successful inferior alveolar nerve blocks. The presence of AMF makes it more vulnerable to the perineural spread of tumor cells from cortical to cancellous part of the bone.[25] The knowledge of AMF may thus be important for radiotherapist in planning radiation therapy.

In this study, out of 50 dry mandibles, 8 (16%) accessory mandibular foramen was found in the left side, whereas 6 (12%) AMF were found in the right side. This finding differs with the findings of Gupta et al.[17] (2013) who found 18% prevalence of accessory mandibular foramen bilaterally.

CONCLUSION

The present study provides information regarding different shapes of lingula and incidence of the accessory mandibular foramen in the Lucknow and surrounding populations (North India). In this study, the most prevalent shape of lingula was triangular, and the least prevalent shape was assimilated type. The findings of our study are very helpful to oro-dental surgeons, anthropologists, and forensic practice experts.

The prevalence of accessory mandibular foramen found to be an average of 14%, so awareness of it is important for achieving successful inferior alveolar nerve blocks. The presence of AMF makes it more vulnerable to the perineural spread of tumor cells from cortical to cancellous part of
bone. The knowledge of AMF may thus be important for radiotherapist in planning radiation therapy.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Devi R, Arna N, Manjunath KY, Balasubramanyam M. Incidence of morphological variants of mandibular lingula. Indian J Dent Res 2003;14:210-3.
2. Williams P, Warwick R, Dyson M, Bannister L. Lawrence Gray’s Anatomy. 37th ed. Edinburgh, UK: Churchill Livingstone; 1995. p. 367-8.
3. Tuli A, Choudhry R, Choudhry S, Raheja S, Agarwal S. Variation in shape of the lingula in the adult human mandible. J Anat 2000;197(Pt 2):313-7.
4. Samanta PP, Kharb P. Morphological analysis of the lingula in dry adult human mandibles of North Indian population. J Cranio Maxillary Dis 2012;1:7-11.
5. Lopes PT, Pereira GA, Santos AM. Morphological analysis of the lingula in dry mandibles of individuals in Southern Brazil. J Morphol Sci 2010;27:136-8.
6. Acebal-Bianco F, Vuylsteke PL, Mommaerts MY, De Clercq CA. Perioperative complications in corrective facial orthopedic surgery: A 5-year retrospective study. J Oral Maxillofac Surg 2000;58:754-60.
7. Hollinshead WH. Text Book of Anatomy. 1st ed. Calcutta, India: Harper and Row; 1962. p. 855-6.
8. Berkovitz BK, Holland GR, Moxham BJ. Colour Atlas and Textbook of Oral Anatomy. 2nd ed. London, UK: Wolfe Medical Publication; 1978. p. 15.
9. Morgan DH, House LR, Hall WP, Vamuas SJ. Diseases of Temporomandibular Apparatus. 2nd ed. St. Louis, USA: C.V. Mosby; 1982. p. 19.
10. Sutton RN. The practical significance of mandibular accessory foramina. Aust Dent J 1974;19:167-73.
11. Chapnick L. A foramen on the lingual of the mandible. J Can Dent Assoc 1980;46:444-5.
12. Liang H, Frederiksen NL, Benson BW. Lingual vascular canals of the interferominal region of the mandible: Evaluation with conventional tomography. Dentomaxillofac Radiol 2004;33:340-1.
13. Liang X, Jacobs R, Lambrichts I. An assessment on spiral CT scan of the superior and inferior genial spinal foramina and canals. Surg Radiol Anat 2006;28:98-104.
14. Liang X, Jacobs R, Lambrichts I, Vandewalle G. Lingual foramina on the mandibular midline revisited: A macroanatomical study. Clin Anat 2007;20:246-51.
15. Ossenberg NS. Retromolar foramen of the human mandible. Am J Phys Anthropol 1987;73:119-28.
16. Haveman CW, Tebo HG. Posterior accessory foramina of the human mandible. J Prosthet Dent 1976;35:462-8.
17. Gupta S. Morphological study of accessory foramina in mandible and its clinical implication. Indian J Oral Sci 2013:4:12-6.
18. Brown JS, Browne RM. Factors influencing the patterns of invasion of the mandible by oral squamous cell carcinoma. Int J Oral Maxillofac Surg 1995;24:417-26.
19. Hossain SM, Patwary SI, Karim M. Variation in shape of the lingulae in the adult human mandibles of Bangladeshi skulls. Pak J Med Sci 2001;17:233-6.
20. Fabian FM. Observation of the position of the lingula in relation to the mandibular foramen and the mylohyoid groove. Ital J Anat Embryol 2006;111:151-8.
21. Murlimanju BV, Prabhu LV, Pai MM, Paul MT, Saralaya VV, Kumar CG, et al. Morphological study of lingula of the mandibles in South Indian population. Morphologie 2012;96:16-20.
22. Nirmale VK, Mane UW, Sukre SB, Diwan CV. Morphological features of human mandible. Int J Recent Trends Sci Aechnol 2012;3:33-43.
23. Chávez-Lomeli ME, Mansilla Lory J, Pompe JA, Kjaer I. The human mandibular canal arises from three separate canals innervating different tooth groups. J Dent Res 1996;75:1540-4.
24. Olivier E. The mandibular canal and nerve in adult. Ann Anat Pathol Anat Norm Med Chir 1927;4:975-87.
25. Fanibunda K, Matthews JN. Relationship between accessory foramina and tumour spread in the lateral mandibular surface. J Anat 1999;195(Pt 2):185-90.