

The morphometric study of mandibular foramina in dentate and edentulous human mandibles in Tamil Nadu

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ABSTRACT

Aim: This study provides the morphometric study of the foramina located in the mandible. **Materials and Methods:** For this survey, 50 dry adult human mandibles are investigated. The lingual foramina are divided into medial and lateral foramina. Foramina located at the alveolar process and the midline is divided according to its location at the genial tubercles. The height of the mandible in the genial symphysis and the distances from the foramina to the alveolar crest and the lower border of the mandible are measured. **Results:** The measurements of medial and lateral lingual foramina are 97.9% and 78.4%, respectively. **Discussion:** The precise knowledge of the topography of the foramina and its contents is of importance to the dentists, oral maxillofacial surgeons during surgeries. The foramina's location is directly affected by the dental status. The morphology of edentulous mandibles increases the risk of intraoperative complications at the anterior mandible.

KEY WORDS: Alveolar process, Dental implants, Mandible, Mandibular foramina, Resorption

INTRODUCTION

The mandible is the largest and strongest bone of the face which works for the reception of the lower teeth. The mandibular foramen is an opening on the medial aspect of the vertical ramus of the mandible at approximately midway between the mandibular notch and the inferior border of mandibular ramus. The mandibular foramina lead to the mandibular canal, which continue downward below the alveoli nerve and vessels continuing into the mandibular canal after entering the mandibular foramen and way toward the mental foramen.^[1-3]

The deluge of the accessory foramina is observed in various locations of the external and the internal surfaces of the anterior mandible. The foramina are localized in the midline, superior, medial, and inferior to the genial tubercles called the medial lingual foramina (MLF), whereas those located at the lateral side are called lateral lingual foramina (LLF), which vary in number and location.^[4-9] Other foramina located at the alveolar part are named as nutrient foramina separately.

The relative position of the mandibular foramen was analyzed with measurements made from the posterior wall to the posterior mandibular rim, from the inferior wall to the inferior mandibular rim, from the most superior part of the lingula to the most caudal point of the mandibular notch, and from the anterior wall to the anterior ascending mandibular rim.

The precise knowledge and awareness of mandibular foramina would, therefore, be important for dental surgeons to perform nerve block. Precise knowledge of the location of reference points in the oral and maxillofacial area provides important data in local anesthesia and maxillofacial operations. The important maxillofacial anatomical entities are neurovascular bundles passing through different foramina. The mandibular foramen is an opening on the vertical ramus of the mandible approximately midway between the mandibular notch and inferior border of mandibular ramus.

MATERIALS AND METHODS

The materials for the present study consist of 50 mandibles of unknown sex collected from general anatomy laboratory of Saveetha Dental College and

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Hospitals, Chennai, Tamil Nadu and also Vernier caliper of 0.02 mm accuracy, digital camera, and a pencil. It shows that each individual foramen in dentate and edentulous human mandibles is statistically significant.

RESULTS

The present study reveals valuable information concerning the morphology of mandibular foramen in Tamil Nadu [Tables 1-3]. In this study, we took 50 dry adult mandibles, of which 30 are dentate and 20 were edentulous. We found that average distance of mandibular foramen (posterior wall) to posterior mandibular ramus rim in the right-sided dentate and edentulous mandibles is 11.42 mm and 13.42 mm,

respectively, which is statistically significant and same average distance in the left-sided dentate and edentulous mandibles is 12.94 mm and 13.38 mm, respectively, which is also statistically significant. We also found that average distance of mandibular foramen (anterior wall) to anterior mandibular ramus rim in the right-sided dentate and edentulous mandibles is 16.07 mm and 15.54 mm, respectively, which is statistically significant and same average distance in the left-sided dentate and edentulous mandibles is 16.31 mm and 15.95 mm, respectively, which is not statistically significant. We found that average distance of mandibular foramen (inferior wall) to inferior mandibular rim in the right-sided dentate

Table 1: Comparison in measurements of mandibular foramina in dentate and edentulous human mandibles in Tamil Nadu

Parameter	Right side			Left side		
	Dentate (n=100) in mm	Edentulous (n=40)	P value	Dentate (n=100)	Edentulous (n=40)	P value
Mandibular foramina to anterior mandibular ramus rim	11.42±2.02	13.42±1.36	<0.001	12.94±5.64	13.38±0.38	<0.001
Mandibular foramen to anterior mandibular ramus rim	16.07±2.80	15.54±0.78	0.007	16.31±3.24	15.95±0.49	NS 0.125
Mandibular foramen to inferior mandibular rim	21.06±5.23	24.85±2.07	0.002	20.73±5.23	24.40±1.31	0.03
Mandibular foramen to mandibular notch	15.54±2.70	18.71±2.43	<0.001	15.39±2.89	18.10±1.27	<0.001

Table 2: The incidence of the appearance of the medial and lateral lingual foramina according to their location to the anterior area of the mandible

Foramina location	Medial lingual foramina number – n (%)	Lateral lingual foramina (%)	
		Right side	Left side
Alveolar crest	19 (19.6)	23 (23.7)	30 (30.9)
Superior to GT	75 (77.3)	2 (2.1)	1 (1)
Medial to GT	33 (34)	23 (23.7)	28 (28.9)
Inferior to GT	60 (61.9)	28 (28.9)	26 (26.8)
Total	95 (97.2)	59 (60.8)	70 (72.2)

GT: Genial tubercles

Table 3: Descriptive statistics of the distances from the LF to the AC, the GT, and the LBM in dentate mandibles. the r and P coefficient to the results of Pearson correlation

Distances	Mean±SD	Minimum	Maximum	r	P
From AC to the foramen superior to the GT	18.30±3.97	9.01	26.59	0.831	0.001
From LBM to the foramen superior to the GT	18.28±3.20	10.96	24.08	0.641	0.001
From AC to the foramen medial to the GT	22.34±7.67	7.09	37.06	0.77	0.001
From LBM to the foramen medial to the GT	14.37±3.76	8.21	21.28	-0.002	0.992
From AC to the foramen inferior to the GT	26.77±6.38	11.57	40.5	0.809	0.001
From LBM to the foramen inferior to the GT	8.21±4.52	0.02	29.19	0.101	0.286
From AC to the lateral LF right	24.50±4.45	15.29	34.58		
From LBM to the lateral LF right	12.37±4.74	5.17	24.08		
From AC to the lateral LF left	23.39±5.76	6.84	35.32		
From LBM to the lateral LF left	12.31±5.41	2.77	24.51		
From right lateral LF to the GT		2.59	28.18		
From left lateral LF to the GT	12.39±6.80	1.9	26.73		
Height of the genial symphysis	32.06±4.88	21.26	43.23		

SD: Standard deviation, LF: Lingual foramina, LBM: Lower border of the mandible, LF: Lingual foramina, AC: alveolar crest, GT: genial tubercles

and edentulous mandibles is 21.06 mm and 24.85 mm, respectively, which is statistically significant and same average distance in the left-sided dentate and edentulous mandibles is 20.73 mm and 24.40 mm, respectively, which is also statistically significant. We found that average distance of mandibular foramen (superior lingual) to mandibular notch in the right-sided dentate and edentulous mandibles is 15.54 mm and 18.71 mm, respectively, which is statistically significant and same average distance in the left-sided dentate and edentulous mandibles is 15.39 mm and 18.10 mm, respectively, which is also statistically significant.

DISCUSSION

Since the placement of dental implants in the anterior mandible has been widely applied, the meticulous knowledge of the foramina topography and their content is of paramount importance for dentists and maxillofacial surgeons.^[11-14] In our research, the presence of at least one MLF indicates that the MLF is a constant structure. A negative correlation between the MLF presence in the areas superior and medial to GT was found, indicating that usually a single foramen exists at the level of GT and above. This finding is indicating that the most frequent location of the MLF was at the level of GT and above highlights the clinical significance of the MLF location during dental implants placement.^[13,18,20] The LLF were detected in 78.4% of the mandibles (60.8% on the right and 72.2% on the left side) in our study. The LLF occurrence presents a wide range from 30 to 76%^[4,10,13,20] among several studies,^[15-20] due to the different methodology in their topography determination. In our study, the LLF were observed at the level of GT and below.

In this study, the distance of mandibular foramen (posterior wall) to posterior mandibular ramus rim in dentate and edentulous mandibles is statistically significant in both sides. The distance of mandibular foramen (anterior wall) to anterior mandibular ramus rim in dentate and edentulous mandibles in the right side is statistically significant, but it is not significant in the left side. The distance of mandibular foramen (inferior wall) to inferior mandibular rim in dentate and edentulous mandibles is statistically significant on both sides. The distance of mandibular foramen (superior lingual) to mandibular notch in dentate and edentulous mandibles is statistically significant on both sides. Thus, the position of the mandibular foramen in relation to the anterior and the posterior mandibular ramus rim was statistically significant difference between dentate and edentulous mandibles except on the left side in case of distance of mandibular foramen (anterior wall) to the anterior mandibular ramus rim.

When we compare the results of both the studies, distance of mandibular foramen is statistically significant in all the parameters except the distance of mandibular foramen (anterior wall) to anterior mandibular foramen (anterior wall) to anterior mandibular ramus rim on the left side. Thus, the anteroposterior width of the mandibular ramus was statistically significantly smaller in edentulous than in dentate mandibles ($P \leq 0.001$). Mandibular foramen (inferior wall) to inferior mandibular rim measurement, mandibular foramen (superior lingual) distance to mandibular notch was also more in edentulous mandible and the difference was statistically significant.

CONCLUSION

The precise knowledge of the distances from surgically encountered anatomical landmarks in this present study provides valuable information to dental surgeons that will facilitate effective localization of the neurovascular bundle passing through mandibular foramen, thus avoiding complications from local anesthetic, surgical, and other procedures. The dental status has a higher influence on the mandibular anatomy.

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