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A STUDY OF MORPHOLOGY AND MORPHOMETRIC PARAMETERS OF HUMAM MANDIBLE

Anatomy

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ABSTRACT

Background: The mental foramen, from which the mental nerve and vessels emerge,the mental nerve is the terminal branch of the inferior alveolar nerve and gives sensory innervations to lower lip,the study was to assess various parameters pertaining to the morphology and morphometry of the mental foramen. **Materials and methods:** Total 124 dry human mandible taken in different medical college in bihar.mental foramen and posterior border of the ramus of the mandible.all the samples had properly aligned teeth and did not show any evidence of periodontal lesions. **Conclusion:** identification of mental foramen in its various positions and its morphometric analysis is important for dental surgeons in nerve block. Anatomical variations while planning surgery in that region to avoid nerve damage, various geometric variability related to the MF which carries along with it great importance.

KEYWORDS

Morphometry, morphology, mandible, mental nerve, mental foramen

INTRODUCTION

The mandible ,lower jaw or jawbone is the largest, strongest and lowest bone in the human facial skeleton. It forms the lower jaw and holds the lower teeth in place. The mandible sits beneath the maxilla. It is only movable bone of the skull, it is connected to the temporal bone by the temporomandibular joints. The bone is formed in the fetus from a fusion of the left and right mandibular prominences, and the point where these sides join, the mandibular symphysis, I still visible as a faint ridge in the midline. Like other symphysis in the body, this is a midline articulation where the bones are joined by fibrocartilage, but this articulation fuse together in early childhood.the wors “mandible,, derived from the latin word mandibula" jawbone" literally one used for chewing" from mandere to chew and bula. The mandible consists of ,the body of the mandible is curved, and the front part gives structure to the chin. It has two surface and two borders. From the outside, the mandible is marked in the midline by a faint the ridge, indicating the mandibular symphysis, the line of junction of the two pieces of which the bone is composed at an early period of life. This ridge divides below and encloses a triangular eminence, the mental protuberance, the base of which is depressed in the centre but raised on either side of the symphysis,which is continuous with the anterior border of the ramus, it affords attachment to the depressor labii inferioris and depressor angli oris, the platysma is attached below it. MF must be taken into account to reduce post operative symptoms. The trauma to the mental neurovascular bundle (that may result in paresthesia/ anaesthesia) can be avoided after an accurate localization of the MF. Furthermore, the accuracy of localization depends a lot on the knowledge of the variability of the position and orientation of the MF.

This study was undertaken to investigate the morphology and variations in the position of the MF by the morphometric assessment of the relation of MF to the lower teeth, body of the mandible, mandibular symphysis and to the posterior border of the ramus.the inferior alveolar nerve a branch of the mandibular nerve[a major division of the trigeminal nerve]. Enters the mandibular foramen and runs, forward in the mandibular canal, supplying sensation to the teeth, at the mental foramen, the nerve divides into the two, terminal branches, incisive and mental nerve. The incisive nerve runs forward in the mandible and supplies the anterior teeth, the mental nerve exits the mental foramen and supplies sensation to the lower lip.

MATERIALS AND METHODS

Total 124 dry adult human mandibles of unknown sex obtained from the Anatomy Department of various medical college in bihar.formed the material for study we observe the position, shape, and number the distance of mental foramen [in mm] from landmarks. but we incorporated 93 out of these; out of which 53 were procured from the first year students while 40 were from the departmental collection.All the mandibles selected for the study were without any gross deformity or pathology. The samples that were included had a complete dentition (no missing teeth or socket for the same). All the samples had properly aligned teeth (no malpositioning) and did not show any evidence of periodontal lesions. The study was conducted in the Department of Anatomy,at Indira Gandhi institute of medical sciences,patna bihar india.The situational variability of the MF, the morphology of the MF (especially the shape) and the morphometric measurements which were recorded using Vernier calipers, a non flexible thread and a hand lens. The findings were recorded as 1) the relation of MF with the lower teeth(the position of the MF was recorded as lying in line with the long axis of a tooth or interdental space in one of the six relations [4] (Figure 1) : Anterior to the first premolar-Type 1, below the first premolar-Type 2, between the premolars-Type 3, below the second premolar-Type 4, posterior to the second premolar-Type 5, and below the first molar-Type 6; 2) Distance between symphysis menti(S) and anterior margin of MF ; 3) Distance between posterior margin of MF and posterior border of ramus (PB) 4)Distance between alveolar crest(X) and superior margin of MF, 5) Distance between inferior margin of MF and lower border of the body of mandible (Y) Figure 2.

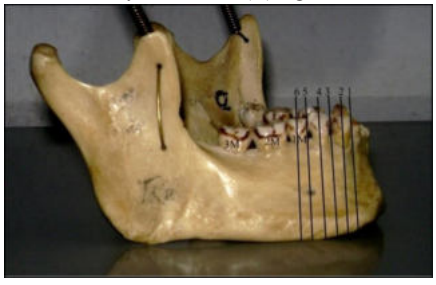

Figure 1: 1M-First molar, 2M –Second molar, 3M-Third Molar. ½,3,4,5,6- the lines showing relation of mental foramen to the lower teeth/interdental space (Types 1 to 6 as mentioned in Table No 2).

For measuring the parameters, a standard horizontal plane as defined by Morrant was utilized which states that- The mandible when placed on a horizontal surface, the lower border of the mandible comes into

greatest contact when vertical pressure is applied to the second molar teeth. The measurements were recorded independently by two observers and the mean of the values recorded. The findings were charted, analyzed and compared with the findings of other workers and studies on different geographical locations and ethnic groups.

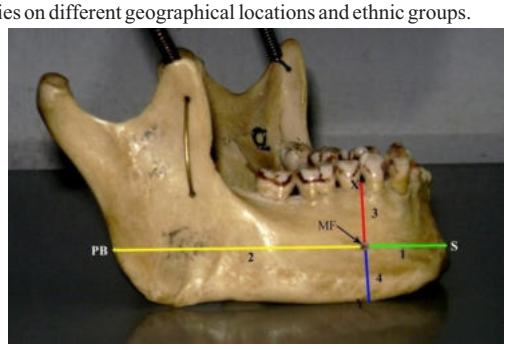

Figure 2: S- Symphysis menti, MF-mental foramen, PB-posterior border of ramus of Mandible, X-alveolar crest, Y-lower border of body of Mandible,1- Distance between S and MF, 2- Distance between MF and PB, 3- Distance between X and MF and 4- Distance between MF and Y. (Refer Table 3)

RESULTS

The most commonly present position of the MF as related to the lower set of teeth was in line with the second premolar, i.e Type 4. This position was present in 44.08 % cases on the right and 46.23% cases on the left side. Next common position was Type 3, i.e between the premolars (41.93% on right and 35.48% on the left sides)-Table 2. Referring to table 3, the mean distance between symphysis mentii and anterior margin of MF was 18.8mm (SD= 12.02) and 19.6mm (SD= 12.18), on the right and left sides respectively. Mean distance between posterior margin of MF and posterior border of ramus was 48.8 mm (SD=28.6) on the right side and 47.9 mm (SD=28.1) on the left side. Mean distance between alveolar crest and superior margin of MF was 10.2 mm (SD= 5.4) on right side and 10 mm (SD=5.2) on the left side. Mean distance between inferior margin of MF and lower border of the body of mandible was 9.9 mm (SD= 5.12) on the right side and was 10.1 mm (SD= 5.2) on the left side. Similar findings have been reported in Turkish mandibles. The variability in the readings may be attributed to the chewing habits, age.

Our study indicated the situational variability of the Mental Foramen (MF) as well its morphological parameters. The MF was present bilaterally in all the mandibles. It was predominantly present as an oval opening (70%).This opening was observed as horizontal as well as vertical in disposition. Rounded openings were also observed in 30% of the bones examined (Table 1).

Table 1 Shape of the Mental Foramen (MF)

Shape	**Present study (n=93)**	Ilayperuma [7](n=51)	Fabian [8] (n=100)	Prabodha [9] (n=24)
	2010	2009	2007	2006
	Western India	Sri Lanka	Tanzania	Sri Lanka
Oval	**65(70%)**	30(59%)	54(54%)	16(66.67%)
Rounded	**28(30%)**	21(41%)	46(46%)	8(33.33%)

The data from other studies have been presented in a tabular form for a better comparative analysis amongst different geographical locations.

Table 2 Position of the MF in relation to lower teeth/interdental space (Comparison with other studies)

	Location	Year		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Present study (n=93)	Western India	2010	R	1(1.07%)	6(6.45%)	39(41.93%)	**41(44.08%)**	6(6.45%)	0
			L	1(1.07%)	8(8.60%)	33(35.48%)	**43(46.23%)**	8(8.60%)	0
Ilayperuma et al [6] (n=51)	Sri Lanka	2009				26.47%	52.94%		
Yesilurt [9](n=70)	Turkey	2008	R			34.3%	55.7%		
			L			25.7%	61.4%		
Fabian [7](n=100)	Tanzania	2007					45%	35%	
Kim et al [10](n=72)	Korea	2006				26.8%	64.3%		
Ngeow [11] (n=169)	Malaysia	2003				19.6%	69.2%		
Gingor [12](n=361)	Turkey	2006				71.5%	22.4%		

Table 3 Situation of MF with respect to mandibular parameters (Comparison with other studies)

Variable studied	**Present study (n=93)**	Yesilurt [4] (n=70)	Kim et. al [10] (n=72)	Prabodha [9] (n=24)	Apinhasmit et al [13] (n=69)	Singh et al [14] (n=96)
	Western India	Turkey	Korea	Sri Lanka	Thailand	North India
	2010	2008	2006	2006	2006	1992
	Mean values	Mean values				
Distance between S and MF	**R=18.8**	R= 19.18		26.52	28.83	23.6
	L=19.6	L= 19.37				
Distance between MF and PB	**R=48.8**	R= 48.58		65.38	68.85	76.2
	L=47.9	L= 48.27				
Distance between X and MF	**R=10.2**	R= 10.5				15.3
	L=10	L=10.64				
Distance between MF and Y	**R=9.9**	R=9.44	14.33	12.25	14.88	14.0
	L=10.1	L=9.46				

All values in mm. S- Symphysis menti, MF-Mental Foramen, PB- posterior border of ramus, X- Alveolar crest, Y- Lower border of the body of mandible

DISCUSSION

The location of the mental foramen is an important factor when considering the mental incisive anesthetic block and surgery in the outer premolar mandibular region the credibility of this study lies in the fact that the accurate knowledge of the various morphologic and morphometric parameters of the MF can be of immense help in proper localization of the important maxilla-facial neurological structures in and around the MF.

The most commonly encountered shape of the MF was oval (70%) followed by a rounded shape in 30% cases. Referring to table no 1, this predominance of the oval shape has also been reported by other workers, though the values vary in different populations .

The most commonly seen position of the MF in relation to the lower teeth/interdental space was seen below the 2nd premolar (Type 4) in 44.08% cases on the right and 46.23% on the left. Referring to Table No 2, this commonest position has been described in 52.94% cases in Sri Lankan cases. 55.7%(R) and 61.4%(L) cases in Turkish mandibles, 45% in Tanzanian studies, 64.3% in Koreans and 69.2% in Malay populations.

Yesilyurt et al (2008) in their study have quoted that the most common positions for the MF were a) below the second premolar tooth (Type 4) in Chinese, Kenyan Africans, Nigerians and Mongoloid populations, b) posterior to the second premolar (Type5) in Caucasians and Zimbabweans, between the premolars (Type 3) in Negroid, British, Central Anatolian and North American white populations. A very similar scenario for Types 3 and 4 was present in Saudi population.

Haghanifar and Rokouei(2009) in their radiological study of the MF ,reported that the most common position of the MF was between the two premolars (as in Type 3 in our case),it being 47.2%.Another study from Turkey has shown that the most common position of the MF was between the two premolars, Type 3, (71.5% cases). As regards the situation of the MF with respect to mandibular parameters (Table No 3), differences are seen amongst Turkish, Korean, Sri Lankan , Thai and North Indian samples .

The review of the available literature shows that the MF shows racial and ethnic variations. Moreover the variations in the values indicate towards the variational mandibular dynamics of the population under consideration. Many of the differences can also be attributed to the variability in the chewing habits of different populations, leading to differential development of the mandible. The relative position of the MF may be influenced by factors which include age, race, ethnicity, mesiodistal tooth size and attrition of the proximal surface.

The restoration and form and function without violating important anatomic structures are the fundamental goal in the surgical management of any patient. One of these is the Mental Foramen. Its identification and preservation in periapical surgery, implant surgery, maxillofacial surgery and orthognathic procedures is of utmost importance. Moreover, it also aids in interpreting landmarks in oral pathology and forensics. To avoid nerve injury during surgery in the foraminal area, variability in MF position may be related to different feeding habits subsequently affecting mandibular development.

CONCLUSION

The paralysis of the mental nerve is one of the principal complications of surgery of the mandibular canal and mental foramen regions.Knowledge of various morphological and morphometric parameters shall facilitate accurate anaesthetic maneouvres and avoid repeated failures pertaining to mental nerve block. The major limitation of this study was the non-availability of records pertaining to the sex of the bone being examined. Nonetheless, the study suggests various geometric variability related to the MF which carries along with it great importance in diagnosing radiographic periapical areas and whenever performing periodontal and endodontic surgery in the area from the canine to the mesial root of the first molar. It is suggested that pre-operative radiographs and additional radiographs from different angles if necessary should be taken to locate the MF prior to surgery. It is essential to be aware of the possibility of these anatomical variation while planning surgery in that region to avoid nerve damage and also to enable effective mental nerve block anaesthesia.

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