



## RESEARCH ARTICLE

### MORPHOMETRIC ANALYSIS OF MENTAL FORAMEN IN DRY ADULT HUMAN MANDIBLES

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#### ABSTRACT

**Background:** The Mental foramen is an important landmark to facilitate local block, surgical and other dental procedures. The present study is aimed at the morphometric analysis of the mental foramen in dry adult human mandibles.

**Materials and Methods:** Fifty dry adult human mandibles of undetermined age and sex, from the Department of Anatomy, JKKN Dental College were used for the present study. The location, shape and presence of accessory foramen were noted by visual examination. The measurements were taken using a Vernier caliper, ruler, thread and a marker. The SPSS 16 software was used for statistical analysis, to calculate mean, Standard deviation, minimum, maximum and incidence.

**Results:** From the observation most of the mandibles showed the location of Mental foramen, opposite 2nd molar tooth, midway between upper and lower borders, with predominant oval shape on both right and left sides and accessory mental foramina were seen in five mandibles.

**Conclusion:** The knowledge of Mental foramen's position and variation is important for the dental surgeons especially in placing the dental implants.

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#### INTRODUCTION

The Mental foramen is located bilaterally in the antero-lateral aspect of the body of the mandible. It transmits mental nerve and vessels. Mental nerve is a branch of inferior alveolar nerve which in turn is a branch of the mandibular nerve. It supplies chin, labial gingiva of lower teeth. The mental artery is a branch of inferior alveolar artery and a branch of maxillary artery. It supplies the chin, lower teeth and gingiva. Mental vein, which drains into facial vein, is a part of pterygoid venous plexus (Picosse, 1982). The position of Mental Foramen vary among different races and variations in the shape of the foramen are often noted (Green, 1987; Agarwal, 2011). Any foramen in addition to mental foramen is called Accessory mental foramen. It may transmit the branches of mental nerve (Cag Irankaya, 2008). As the mental foramen is an important anatomical landmark to facilitate surgical, local anaesthetic, and other invasive procedures, the present study is aimed at assessing morphological and morphometric features of mental foramen with reference to surrounding landmarks, among south Indian population.

#### MATERIALS AND METHODS

The mandibles which were used for our study were procured from the Department of Anatomy, JKKN Dental College, Tamil Nadu, India. Fifty dry adult South Indian mandibles,

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irrespective of age and sex, with either all the teeth intact or with preserved alveolar margins, were used for our study. The bones with gross deformities were excluded from our study.

The position, shape and number of the foramen were noted by visual examination. The shape of MF observed was either oval or rounded. Mean horizontal and vertical diameters were measured. Location of MF was identified by using following parameters: the distance of MF from various anatomical landmarks, including symphysis menti, alveolar margin, posterior border of ramus of mandible and lower border of mandible using thread, ruler and vernier caliper. The position of MF was classified in relation to teeth of the lower jaw in accordance with Tebo and Telford classification (Tebo *et al.*, 1950).

- Foramen lying on a longitudinal axis passing between canine and first premolar;
- Foramen lying on the longitudinal axis of first premolar;
- Foramen lying on a longitudinal axis passing between first and second premolars;
- Foramen lying on the longitudinal axis of second premolar;
- Foramen lying on a longitudinal axis passing between second premolar and first molar;
- Foramen lying on longitudinal axis of first molar.
- Measurements of foramen:

**EF:** Distance from alveolar crest to upper margin of mental foramen.

**GH:** Distance from lower border of mandible to lower margin of mental foramen.

**EH:** Distance from alveolar crest to lower border of mandible.

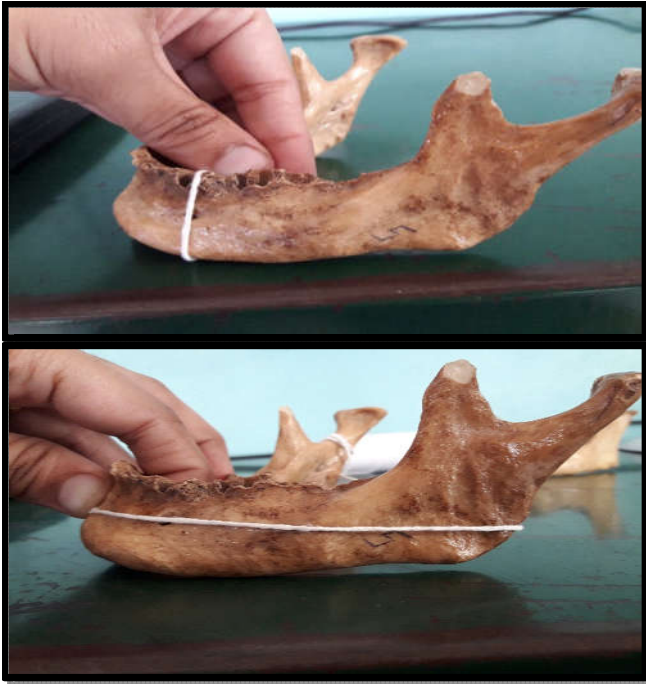
**VD:** Vertical diameter of foramen =  $EH - (EF + GH)$  (Fig 1).

**AB:** Distance from Symphysis menti to medial margin of mental foramen.

**CD:** Distance from posterior border of ramus of mandible to lateral margin of mental foramen.

**AD:** Distance from Symphysis menti to posterior border of ramus of mandible.

**TD:** Transverse diameter of foramen =  $AD - (AB + CD)$  (Fig 1).



**Figure 1. Measurement of vertical diameter and transverse diameter of mental foramen**

All the measurements were recorded by one of the authors to reduce bias. The SPSS, version 16 software was used for the statistical analysis, to find out the minimum and the maximum incidences, the mean and the standard deviation.

## RESULTS

### The mental foramen

#### Number

Of the 50 mandibles, 45 showed single mental foramen on the right side, 48 mandibles showed single mental foramen on the left side.

#### Position

Using Tebo-Telford classification<sup>5</sup>, the common position of mental foramen was observed to be position IV followed by positions III, V, II and VI on both right and left sides. We did not observe position I in any of the 50 mandibles used in our study (Table 1). The mental foramen was positioned at an average distance of 26.5 and 26.7 mm respectively on right and left sides, from symphysis menti.

**Table 1. The position of MF in relation to lower teeth**

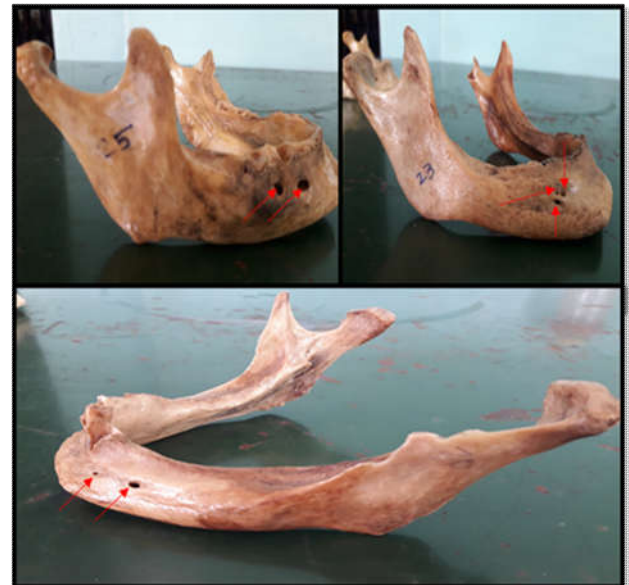
Position	I	II	III	IV	V	VI
Right	0%	8%	24%	48%	18%	2%
Left	0%	6%	34%	44%	14%	2%

The average distance of 64.2 and 64.8 mm respectively on right and left sides from posterior border of the mandible. The foramen was located at an average distance of 9.6mm from the alveolar margin on right side and 9.5 mm from the alveolar margin on the left side. The average distance from lower margin of mandible was calculated to be 11.4 mm on both sides of the mandible.

The average vertical diameter of the mental foramen was observed to be 3 and 2.8 mm respectively on the right and left sides (Table 2). The average transverse diameter was calculated as 4.2 and 4.3mm on the right and left sides respectively (Table 3). Of the 50 mandibles, 32 showed oval mental foramens and 6 showed round foramens bilaterally. The oval mental foramens were observed in 37 mandibles on the right side and 39 mandibles on the left side. The round mental foramens were observed in 13 and 11 bones respectively on the right and left sides.

### The accessory mental foramen

Out of the 50 mandibles, 5 mandibles showed accessory mental foramen, of which two are bilateral and remaining three are unilateral on right side only (Fig 2).



**Figure 2. Accessory mental foramen**

## DISCUSSION

The location of the MF is an important factor when considering the mental incisive anaesthetic block and surgery in the outer premolar mandibular region. There are significant differences reported in the location of MF among different ethnic groups. The present study showed that the most common position of the MF, was position IV, followed by position V, which was like that of North Americans (Tebo *et al.*, 1950), North Indians (Singh *et al.*, 2010) Turks (Oguz *et al.*, 2002), Malawians (Igbigbi *et al.*, 2005) and Zimbabweans (Mbajioru *et al.*, 1988).

**Table 2. Parameters to locate the right and left mental foramen in relation to lower border of mandible and alveolar crest, and its vertical diameter**

Parameters	EF		GH		EH		VD	
	R	L	R	L	R	L	R	L
Mean	0.96	0.95	1.136	1.136	2.406	2.368	0.3	0.28
SD	0.33	0.39	0.14	0.13	0.35	0.41	0.11	0.10

**Table 3. Parameters to locate the right and left mental foramen in relation to symphysis menti and posterior border and its transverse diameter**

Parameters	AB		CD		AD		TD	
	R	L	R	L	R	L	R	L
Mean	2.65	2.67	6.42	6.48	9.548	9.594	0.42	0.48
SD	0.24	0.26	0.43	0.44	0.50	0.56	0.15	0.12

**Table 4. Comparison of position of mental foramen in different study groups**

Author	Population	Side	Position in percentage					
			I	II	III	IV	V	VI
Agarwal and Gupta	Central Indian	R	0	0	7.8	81.5	2.7	7.9
		L	0	0	7.6	81.5	3.1	7.8
Amorim et al	Brazilian	R	0	0	19.8	71.4	8.8	0
		L	0	0	23.1	68.1	8.8	0
Yesilurt et al	Turkish	R	0	5.7	34.3	55.7	4.3	0
		L	0	7.1	25.7	61.4	5.7	0
Virendhra et al	North Indian	R	0	3.8	20	61	14.3	0.9
		L	0	2.9	20.9	59.1	15.2	1.9
Udhaya et al	South Indian	R + L	0	4.4	16.67	52.22	27.78	0
		Present study	R	0	8	24	48	18
		L	0	6	34	44	14	2

**Table 5. Comparison of shape of mental foramen in different mandibles**

S.no	Studies	Shape of mental foramen	
		Round	Oval
1	Gerhenson et al (1986)	65.5	34.5
2	Mbajioru et al (1998)	56.3	43.8
3	Prabodha and Nanayakkara (2006)	66.7	33.3
4	Singh and Srivatsava	6.0	94.0
5	Agarwal and Gupta (2011)	92.0	8.0
6	Rakhi Rastogi et al (2012)	48.3	51.7
7	Udhaya et al (2013)	83.33	16.67
8	Present study (2017)	24	76

The results of our study do not coincide with the findings of Gershenson *et al.* (1986) who reported a higher prevalence of the positions I, II and VI between the Indians and the Sinai population. The common positions were III followed by II in some of the studies on Nigerian and Kenyan population (Mwaniki *et al.*, 1992). The positions IV and III were common in Malays and in the Sri Lankan population (Ngeow, 2003; Ilayperuma *et al.*, 2009). Thus, the position of mental foramen significantly different among the various ethnic groups (Table 4).

Variability in MF position may be related to different feeding habits subsequently affecting mandibular development<sup>9</sup>. Sometimes, an anterior loop of the mental nerve may be present medial to the MF and it may cause a mental nerve injury during a dental implantation (Arzouman *et al.*, 1993). Prior knowledge of common positions in local populations may be helpful in effective nerve blocks and surgeries in those regions. The oval shaped foramen was the common shape compared to round shape on both right and left sided in our study. But the round shaped foramen was common in the results of studies from central India (Apinhasmit *et al.*, 2006) and east India (Singh *et al.*, 2010).

Our results were in close association with those of Gershenson (Gershenson *et al.*, 1986), Mbajioru *et al.* (Mbajioru *et al.*, 1988) Prabodra and Nanayakkara (Prabodra, 2006) and Agarwal and Gupta (Table 5). According to Hauser and De Stefano (Hauser, 1989), the different variants may have occurred due to the epigenetic traits, as they could be the products of the genetically determined growth processes of other tissues, affecting the bone formation. Subsequently, they undergo modifications during ontogeny and variable degrees of expression. Thus, gene modification determines the variations in the position, shape, number and size of the mental foramen.

#### The accessory mental foramen (AMF)

The incidence of accessory mental foramen in our study was 10% on right side and 4% on the left side. The results of our study were in contrast with that of Udhaya *et al.* (2013) where the incidence of accessory mental foramen on the right side was 2.22% and 3.33% on the left side. Also, our results contrasted with those of Singh and Srivastava (Singh *et al.*, 2010), where the incidence was 5% and 8% on the right and left sides respectively.

An Accessory Mental Foramen is due to branching of mental nerve prior to its passing through mental foramen. Thus, the verification of the existence of an AMF would prevent nerve injury during periapical surgery.

### Conclusion

The knowledge on the variations of the mental foramen is of much use for dental surgeons. In most mandibles, we have found oval-shaped foramina lying in position IV. However, variations do exist in the position, shape, and size of mental foramen in different population groups. The probability of the existence of an accessory mental foramen should be kept in mind to give a proper and effective anaesthetic block and to proceed with further surgical procedures and to avoid neurovascular complications during implant placement, regional anaesthesia, surgical correction of jaw deformities, peri-apical surgery and other dental procedures.

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