

To Study the Anatomical Variations Of Mental Foramen In Indian Mandibles.

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Abstract :Mental foramen is present on the anterolateral aspect of the mandible and transmits mental nerves and vessels. The Knowledge of anatomical morphometry of mental foramen is essential in clinical dentistry when administering regional anesthesia and performing peri apical surgery in the mental region of the mandible. The aim of this study was to observe the morphological features and anatomical position of the mental foramen with reference to surrounding anatomical landmarks in an adult mandibles. The present study was conducted using 60 dried human mandibles of unknown sex obtained from the department of Anatomy, DVVPF's Medical college Ahmednagar. Size and position were determined using digital vernier calipers. Incidences and shapes of mental foramen and accessory mental foramen were also observed. In most of the cases the foramen was oval in shape and situated in the line with longitudinal axis of the 2nd premolar tooth.

Key words: Mandible; Mental foramen ;Accessory mental foramen;mental nerve ;Premolar; Molar.

Introduction : The mental foramen (MF) is present on external surface of body of mandible. It lies below either the interval between the premolar teeth or the second premolar tooth, midway between the upper and lower borders of the body. The mental nerve and vessels are transmitted through it. Mental nerve supplies the sensory innervations to the soft tissue of chin, labial mucosa, lower canines and premolar^[1]. Variations of the mental foramen are common which shows difference in shape, position, presence of accessory foramen or complete absence of it^[2,3,4,5]. Any foramen in addition to mental foramen in the body of mandible is called accessory mental foramen (AMF) which transmits the accessory branch from mental, facial ,mylohyoid, buccal , transverse cervical cutaneous and other nerves^[1].

The MF serves as an important landmark during anesthetic nerve blocks, surgeries and other invasive

procedures of oral and maxillofacial region^[6]. The knowledge of the variations of MF and AMF position is important for dental surgeons to achieve complete anesthesia and for better outcome of various surgical procedure.

Materials and methods : This study was carried out using 60 dried human mandibles in the department of anatomy, DVVPF's Medical College, Ahmednagar. We observed the following parameters:

- Presence or absence of MF
- Presence or absence of AMF unilaterally or bilaterally
- Position of MF** : for this we measured the distance of MF (in mm) from various landmarks including symphysis menti, posterior border of the ramus, alveolar crest and lower border of mandible with digital vernier caliper and calculated the size of mental foramen^[7]. [Fig. 1]



Figure1: Relation of mental foramen of the mandible .

A: point showing at alveolar crest lying on a longitudinal axis with mental foramen; B: point showing at lower border of mandible lying on a longitudinal axis with mental foramen; C: point showing at upper margin of mental foramen;D: point showing at lower margin of mental foramen; W:point showing symphysis menti lying on a transverse axis with mental foramen ;X: point showing at posterior border of ramus lying on transverse axis with mental foramen; Y: point showing at medial margin of mental foramen ; Z: point showing at lateral margin of mental foramen.

AC: Distance from alveolar crest to upper margin of mental foramen

BD: Distance from lower border of mandible to lower margin of mental foramen

AB: Distance from alveolar crest to lower border of mandible

- VD: Vertical dimension of foramen = AB-(AC+BD)
 WY: Distance from symphysis menti to medial margin of mental foramen
 XZ: Distance from posterior border of ramus of mandible to lateral margin of mental foramen
 WX: Distance from symphysis menti to posterior border of ramus of mandible
 HD: Horizontal dimension of foramen = WX-(WY+XZ)
 The results are expressed as mean and standard deviations (SD).

Results : Present study observed presence of MF bilaterally in all mandibles. Also, we observed only bilateral AMF in 9 (15%) mandibles (No unilateral AMF). The position of MF was classified in relation to teeth of the lower jaw in accordance with Tebo and Telford^[8]. [fig-2]



Figure 2: Variable relations of mental foramen to lower teeth as positions I-VI. C.A: Canine ;1st PM: first premolar ; 2nd PM: second premolar; 1st M: first molar.

- I- Foramen lying on a longitudinal axis passing between canine and first premolar
- II- Foramen lying on the longitudinal axis of first premolar
- III- Foramen lying on a longitudinal axis passing between first and second premolars
- IV- Foramen lying on longitudinal axis of second premolar
- V- Foramen lying on a longitudinal axis passing between second pre molar and first molar
- VI- Foramen lying on longitudinal axis of first molar

Most common position observed in this study was on the longitudinal axis of second premolar i.e. position IV, followed by III, V, VI, II and I positions. Results are tabulated in table 1.

Table : Relation of mental foramen with lower teeth (n=60)

Position	I	II	III	IV	V	VI
Right	2(3%)	2(3%)	9(15%)	40(67%)	3(5%)	4(7%)
Left	0(0%)	1(2%)	7(11%)	42(70%)	6(10%)	4(7%)

The location of MF and to measure the size, various parameters were considered and results are presented in Tables 2 and 3. Oval shape of MF was present in 65%(75/120) and round in 35% (45/120).

Table II: Parameters to locate the Right and Left mental foramen with relation to Lower border of mandible, Alveolar crest and foramen vertical diameter.

Parameters	AC		BD		AB		VD	
	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt
Mean (mm)	11.87	11.78	13.9	13.9	25.6	25.6	4.0	3.8
SD (mm)	0.30	0.25	0.19	0.25	0.36	0.49	0.08	0.08

Table III : Parameters to locate the Right and Left mental foramen with relation to symphysis menti and posterior border of ramus of mandible and foramen horizontal diameter.

Parameters	WY		XZ		WX		HD	
	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt
Mean (mm)	26.0	25.6	64.7	64.5	94.3	94.4	4.5	4.3
SD (mm)	0.60	0.38	0.46	0.45	0.43	0.44	0.09	0.09

Discussion : Canines and premolar are anaesthetized by injecting anesthetic solution adjacent to mental foramen instead of giving inferior alveolar block^[9]. Anatomically, the mental foramen is the opening of the mental canal. According to standard text books mental foramen is most commonly situated between the apices of the first and second lower premolar^[10,11]. Racial variations in the position of mental foramen were studied by many authors. In Chinese it was in the line with the second premolar, where as in Britishers it was between the first and second premolar^[11], another interesting note is that the position of mental foramen was more posterior in Blacks than Whites^[12]. In our study we observed that, the position of the mental foramen lying on longitudinal axis of second premolar tooth (Table no.4).In the present study the most common position of MF was IV followed by III. Our results are similar to those of Amorim et al., Yesilyurtet.al^[13] Virendra Budhiraja^[7].

Table IV: Comparison of present study with similar studies by different population groups

Authors	Population	Side	Positions of foramen in percent (%)					
			I	II	III	IV	V	VI
Agarwal and Gupthaz(14)	Central India	Rt	0	0	7.8	81.5	2.7	7.9
		Rt	0	0	7.6	81.5	3.1	7.8
Amorim et al. (15)	Brazilian	Rt	0	0	19.8	71.4	8.8	0
		Rt	0	0	23.1	68.1	8.8	0
Yesilyuret et al (13)	Turkis	Rt	0	5.7	34.3	55.7	4.3	0
		Rt	0	7.1	25.7	61.4	5.7	0
Virendra Budhiraja (7)	North Indians	Rt	0	3.8	20.0	61.0	14.3	0.9
		Rt	0	2.9	20.9	59.1	15.2	1.9
Present study	Maharashtra	Rt	3	3	15	67	5	7
		Rt	0	2	11	70	10	7

According to Yesilyuret. al. variability in MF position may be related to different feeding habits subsequently affecting mandibular development^[13]. Rarely an anterior loop of the mental nerve may be present medial to the MF and may cause mental nerve injury during dental implantation^[14]. Therefore it is essential to know the variable positions of MF for establishing the zone of safety for implant placement to avoid nerve injury. We also measured the size of MF the mean vertical diameter was 4mm on right and 3.8mm on left side. Horizontal diameter was 4.5 mm on right and on left it was 4.3 mm^[15,16,17].

In the present study we observed an oval-shaped mental foramen in 65% and round shaped 35%. A comparison between the results of the present study and previous ones is presented in table no.5

Table V: Comparison of shape of mental foramen between the present study and other studies.

Authors	Shape of mental foramen in percent	
	Oval	Round
Mbajjorgu et al (17)	56.3%	43.8%
Singh and Srivastav (18)	6.0%	94.0%
Gershenson et al (19)	65.5%	34.5%
Prabodra and Nanayakkara (20)	66.7%	33.3%
Virendra Budhiraja (7)	74.3%	25.7%
Agarwal and Gupta (14)	92.0%	8.0%
Present study	62.5%	37.5%

Incidence of AMF varies in the literature. Singh and Srivastav^[18] reported AMF 13%. Gershenson et al.^[19] observed 4.3%, Serman^[20] reported the incidence of AMF is 2.7%. In present study we observed an AMF in 18/120 (15%) mandibles. AMF 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.

Variations in MF position, shape, number and no may be due to epigenetic traits. They may be seen as the products of genetically determined growth process of other tissues affecting bone formations. Consequently, they undergo modification during ontogeny in the presence of modifying genes or relevant environmental conditions and they generally show variable degree of expression. Thus, variations of MF depend on the modification of genes.

Conclusion : The present study reveals valuable insights of the information concerning the morphology of mental foramen in Indian population. The knowledge of the distances from surgically encountered anatomical land marks in the present study provide voluble information to dental surgeons that will facilitate effective localization of neurovascular bundle passing through mental foramen thus avoiding complications from local anesthetic, surgical and other invasive procedures.

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