

Morphometric Study of Mental and Accessory Mental Foramen in Dry Adult Human Mandibles in Southern Odisha Population

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Abstract

Introduction: The knowledge of position, relation and variation of mental foramen is important for a dental surgeon and orthopaedician to perform successful surgical procedure in mental regions of mandible with minimal post surgical neurovascular complication. Verification of presence of an accessory mental foramen would prevent the accessory nerve injury in peri-apical surgery. The present study was aimed at elucidating its morphological features and morphometric parameters with reference to surrounding landmarks.

Materials and Method: 65 dry adult dentulous human mandibles of unknown sex were observed for the incidence, shape, position, and relation of mental and accessory mental foramen to the teeth of lower jaw and various bony landmarks. The measurements were done using slide callipers. Mean and standard deviations were described.

Result: in most cases (83 %) mental foramen was transversely oval in shape and situated on the longitudinal axis of second premolar tooth (53.8 % on right and 52.3 % on left side). The distance of mental foramen from various bony landmarks were measured on left and right sides. The mean distance of MF from symphysis menti were 1.17 ± 0.43 cm and 1.14 ± 0.41 cm on right and left side respectively. The mean distance of MF from posterior margin of mandible were 6.54 ± 0.47 cm and 6.57 ± 0.48 cm on right and left side respectively. The mean distance of MF from alveolar crest were 1.35 ± 0.26 cm and 1.37 ± 0.33 cm on right and left side respectively. The mean distance of MF from base of mandible were 1.37 ± 0.17 cm and 1.34 ± 0.24 cm on right and left side respectively.

Conclusion: Detail idea about the position, variation and relation of mental foramen and presence of accessory mental foramina will help the dental surgeons for a successful surgical procedure in mental region of mandible.

Keywords: Accessory mental foramen, Mental Foramen, Mental nerve, Molar, Premolar.

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I. Introduction

The oval or circular opening present in the anterolateral surface of the body of mandible located between its alveolar crest and inferior border is known as mental foramen (MF). It represents the termination of mental canal which is directed posteriorly upward and outward^[1]. Any foramen in addition to MF is known as accessory mental foramen (AMF) in the body of the mandible^[2]. Its location and the possibility that an anterior loop of the mental nerve may be present medial to the mental foramen needs to be considered before implant surgery to avoid mental nerve injury. The inferior alveolar nerve and artery after travelling through the mandibular foramen, exits at the mental foramen as the mental nerve and vessels which innervates the lower teeth, lip, gingiva and lower face^[3]. Variations of the mental foramina are often encountered ranging from the difference in shape and positions^[4,5,6] to presence of AMF^[7] or even complete absence in some cases^[8,9]. These variations has been reported to exhibit a clear racial trend^[6,10,11]. The MF is a strategically important landmark during osteotomy procedures, anaesthetic nerve blocks in prevention of neurovascular complications after invasive procedures on the lower jaw^[1]. Its anatomy is important for evaluating the morphometric symmetry of mental triangle, microscopic and macroscopic morphology and maturity of human mandible, bone remodelling activity and paleo-anthropologic features of facial skeleton in different population^[1]. Keeping in view to the

above factors and their importance with the present study was carried out by accessing morphological and morphometric features of mental foramen with their variation.

II. Materials And Method

Present study was carried out in 65 dry adult human mandibles of unknown sex in the department of Anatomy, M.K.C.G. Medical College, Berhampur, Odisha. The distance of MF from symphysis menti and posterior border of ramus of the mandible of both sides was measured by using slide callipers. We observed the position of the mental foramen with relation to teeth of lower jaw and also were vigilant about the shape and the number of the mental foramen and presence or absence of AMF. The distance of MF from the base of the mandible and from the alveolar crest on both sides were also recorded.



Fig-1: Slide callipers used for measuring distance of mental foramen from various landmarks

III. Observation And Result

Incidence and shape of MF

MF was present in all mandibles bilaterally. In one case on right side double mental foramina was observed. In most of the mandibles it was observed that the shape of MF were bilaterally symmetrical, and it was found that in 54 mandibles(83.0%)MF were transversely oval, in 5 mandibles (7.6%) vertically oval and in 6 mandibles(9.2%)rounded.



Fig-2:Double Mental Foramen On Right Side

Position of MF

In our study most commonly MF was found to be situated below the second premolar(P_2). On right side it was found in 53.8% mandibles and on left side in 52.3% mandibles. Next common position was between 1st and 2nd Premolar i.e. about 18.5% on right side and 16.9% on left side. Third common position of MF was between second premolar and 1st molar(M_1) i.e. 11.9% on right side and 16.9% on left side. In 12.31%

mandibles on left side and 9.2% mandibles on right side it was found below the 1st premolar (P₁). Only in 1.5% mandibles it was found below the first molar. These findings have been described below in table-1.



Fig-3: Position of Mental foramen on right side

Table-1: Location of mental foramen with respect to teeth alignment

Sl. No.	Positions	Rt. side		Lt. Side	
		No. Of mandibles	Percentage %	No. Of mandibles	Percentage %
1	Below the M ₁	1	1.5 %	1	1.5 %
2	Between M ₁ and P ₂	11	16.9 %	11	16.9 %
3	Below the P ₂	35	53.8 %	34	52.3 %
4	Between P ₂ and P ₁	12	18.5 %	11	16.9 %
5	Below the P ₁	06	9.2 %	8	12.3 %

The mean distance of MF from symphysi menti was 1.177± 0.43cm and 1.142± 0.41cm on right and left side respectively. The mean distance of MF from posterior margin of ramus of mandible was 6.534± 0.47cm on right side and that on left side was 6.57± 0.48cm. The mean distance of MF from alveolar crest was 1.35±0.26cm and 1.37±0.33cm on right and left side respectively. The mean distance of MF from base of mandible was 1.37± 0.17cm on right side and that on left side was 1.34± 0.24cm. These distances have been described in table-2.

Table-2: Distance of mental foramen from various bony landmarks

Sl. No.	Bony landmarks	Mean distance of MF from parameters in Rt. Side (in cm)	Standard Deviation	Mean distance of MF from parameters in Lt. Side (in cm)	Standard Deviation
1	Distance from symphysi menti	1.177	0.43	1.142	0.41
2	Dist. From posterior margin of ramus of mandible	6.534	0.47	6.57	0.48
3	Dist. From alveolar crest	1.35	0.26	1.37	0.33
4	Distance from base of mandible	1.37	0.17	1.34	0.24

Incidence and position and of AMF:

We found AMF in 6(9.3%) mandibles out of 65, in which in 4(6.15%) mandibles it is present bilaterally and in 2(3.07%) mandibles it is present unilaterally i.e. on left side only. In four mandibles it is present below 1st molar and in one mandible it is present between and below 1st molar and 2nd premolar. In another mandible it is present below the canines of both sides.



Fig-4: Mental Foramen and Accessory Mental Foramen on left side

IV. Discussion

Incidence of MF

In our observation under present study, MF was present in all mandibles on both left and right side. R Singh and A K Srivastav also found MF bilaterally in all 100 mandibles they had taken on their study^[2]. According to T. Hassan, absence of MF is an extremely rare Anatomic variation^[1]. AMF is a more common variation than MF absence in human^[28]. The frequent reasons for absence may range from atrophy, post traumatic fibrosis, osteoblastic hyperplasia, geriatric bony resorption or congenital agenesis^[28]. The incidence of absence has been equally reported between Caucasians and Blacks. However no specific genetic and racial trend has been ascribed to this phenomenon^[28]. So in this regard our finding is in accordance with the previous authors.

Shape of MF

In study sample, in 83% mandibles the MF was transversely oval and in 9.2% mandibles it was rounded. In 7.6% mandibles it was vertically oval. The shape of MF was similar on both sides. In the study of R .Singh & A. K. Srivastav, MF was rounded in 94% and oval in 6% mandibles on right side, whereas in 87% mandibles it was rounded & in 13% mandibles it was oval on left side^[2]. In the study of Human mandibles from north India, Virendra Budhiraja et al found MF in 74.3% mandibles as oval and in 25.7% mandibles as rounded on right side as well as on left side^[26]. In Tanzanians MF were symmetrically located in right and left sides and were predominantly oval^[12]. In the Japanese, MF was predominantly single and oval with larger horizontal diameter^[15]. In Srilankans also MF was oval in majority of cases^[16]. In Israelis, Zimbabweans and Malawians also the shape of mental foramen was oval in majority of cases^[17,18,27]. So our study tallies with that of many authors on different ethnic groups in the shape of MF but there is a definite racial and geographic variation.

Position of MF

In the present study most common position of MF is below the apex of the 2nd premolar tooth (in 53.8% on Rt. Side and in 52.3% on Lt. Side) in south Odisha population. According to R. Singh and A. K. Srivastav, it is 68.8% below second premolar in Indian mandibles^[2] which is in accordance with our observation. In 65% British mandibles it is between first and second premolar^[10]. MF is frequently located below the apex of second premolar and between second premolar and first molar in Tanzanian population^[12]. In Mongoloids the MF is observed to be located in line with the longitudinal axis of the lower 2nd premolar^[10]. In Caucasoids it is more medially located between 1st and 2nd Premolars^[1]. In Blacks it is found to be placed more posteriorly between 2nd premolar and 1st molar^[10,13]. In Byzantiums, the most common position of MF is between 1st and 2nd Premolars on right side, whereas on left side it is in line with lower second premolar^[14]. In Japanese MF is located in similar statistical proportion between 1st and 2nd premolars and below the second premolar on the right side and on the left side it is mostly located between the 1st and 2nd premolars^[15]. In Srilankans the most common MF position is in the line with the longitudinal axis of the lower second premolar followed by position between 1st and 2nd premolars^[16]. In the Israelis the common location of MF is between roots of 1st and 2nd premolars^[17]. In Zimbabweans, the MF is predominantly located under the long axis of lower second premolar

on Rt. Side and between 2nd premolar and first molar on left side^[18]. In Turkish population, the MF is found under the root of second premolar in most mandibles^[25]. Among Jordians the MF is seen most commonly below and between mandibular premolar teeth^[19]. So there is a constant racial variation in the position of MF with respect to teeth of lower jaw.

Table -3: Study Reports On Mental Foramen Published By Other Authors

Author	Side	Distance of MF from symphysis menti in cm (mean ± SD)	Distance of MF from posterior margin of Ramus in cm (mean ± SD)	Distance of MF from alveolar crest in cm (mean ± SD)	Distance of MF from base of mandible in cm (mean ± SD)
Apinhasmit et al. 2006 ^[21]		2.883	6.888		1.488
Prabodha et al. 2006 ^[22]		2.652	6.538		1.225
Rajni Singh & A.K. Srivastav, 2010 ^[2]	Right	2.93	7.18	1.70	1.73
	Left	3.06	8.47	1.86	1.37
Sumit Gupta & Jagdish S. Soni 2012 ^[20]		2.912	7.616		1.445
Cabanilas Padilla et al. 2014 ^[23]	Right			1.5 ± 0.24	1.36 ± 0.20
	Left			1.49 ± 0.21	1.39 ± 0.18
Vimala v. et al 2015 ^[24]		2.667	6.235		1.125
Present Study	Right	1.177 ± 0.43	6.534 ± 0.47	1.35 ± 0.26	1.37 ± 0.17
	Left	1.142 ± 0.41	6.57 ± 0.48	1.37 ± 0.33	1.34 ± 0.24

Incidence of Accessory mental foramen

In our study AMF is present in 6 mandibles (9.23%). Out of 65 in which 4 (6.15%) show bilaterally and 2 (3.07%) show unilaterally i.e on left side only. So 66.66% of total AMF are found bilaterally and in 33.33%, it is unilateral. According to R Singh and A K Srivastav 67% of total AMF was observed on left side and the rest in 33.33% mandibles in right side^[2]. Sing and Srivastav observed AMF in 13% mandible^[2], whereas Gershenson et al reported double mental foramen in 4.3% mandibles and triple mental foramen in 0.7% mandibles^[17]. However Serman reported the incidence of AMF to be 2.7%^[29]. The incidence of AMF among various ethnic groups is reported as 2.5% in French, 1.4% in American White, 5.7% in American Blacks, 3.3% in Greeks, 1.5% in Russians, 3.0% in Hungarians, 9.75% in Malaysians and 3.6% in Egyptians^[7]. In Japanese population the incidence was found to be 6.7-12.5% which is rather higher as compared to other ethnic groups. So the incidence of AMF varies in different ethnic groups^[30]. Their bilateral distribution also varies in different populations. It has been suggested that separation of mental nerve into several fasciculi earlier than the formation of mental nerve into several fasciculi earlier than the formation of mental foramen until 12th gestational week could be a reason for the formation of AMF^[31].

Position of Accessory Mental Foramen:

Rajani Singh and A. K. Srivastav found A.M.F. below apex of 1st molar tooth in 8 mandibles out of 100 (8%) and in 5 mandibles (5%), below the interval between 1st and 2nd premolar tooth^[2]. In our study we found AMF below the apex of 1st molar in 4 out of 65 (6%) mandibles and in one (1.5%) mandible below the interval between 1st molar and 2nd premolar. So also in another mandible it was found below the canines of both sides. So our finding is similar to the findings of Rajani Singh and A. K. Srivastav in the position of AMF.

V. Conclusion

To have a successful implant on orthognathic surgeries, the location of mental foramen and its variation should be confirmed. For effective nerve block and to minimise post surgical neurovascular complication in the mental region, detail idea about the morphology of MF is necessary. In these procedures the foramen must be probed to exclude the possibility that an anterior loop is present. From the variations in the position, shape, and relation of mental foramen in different races and geographical area, it can be concluded that variations may be related to feeding habits of different regions which may ultimately effects the development of mandibles. A prior CT scan can elucidate jaw structures and prevent morbidity. So it is essential to the dentists, orthopaedicians and surgeons to be aware of the anatomical variations while planning surgery in mental region to avoid nerve damage and also to enable effective mental nerve block. Further study in large number of mandibles in different geographical areas can give more information about these variations.

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