

STUDY ON VARIATIONS OF SHAPE, SIZE, LOCATION AND POSITION OF MENTAL FORAMEN AND INCIDENCE OF ACCESSORY MENTAL FORAMEN IN HUMAN MANDIBLES

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ABSTRACT

AIM AND OBJECTIVE

The present study was conducted with an objective to determine the size, shape, location, position and number of Mental Foramen (MF) and Accessory Mental Foramen (AMF) on both sides of mandible and incidence of MF and AMF with respect to the surgically encountered important anatomical landmarks and compare with the findings of available literatures.

METHODS AND MATERIALS

The study was conducted on 50 dry adult human mandibles of unknown sex and age obtained from the Department of Anatomy of Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India. The shape, size, location and position of MF were measured on both sides of mandible by using Digital Vernier Caliper.

RESULTS

Mental foramen was present in all 50 mandibles and it was bilateral and the incidence of AMF was observed in only four mandibles (8%). In the present study, the round shape MF was observed in 17.05% and the oval shape of MF in 82.95%. Average size of AMF was 1.50 mm ranging from 1.00 mm to 2.00 mm. The location of the MF was found mostly below the apex of second premolar in 74.50 %, while it was 25.50% between the first and second premolars.

CONCLUSION

The knowledge about variations in size, shape, location and position of MF and presence of AMF will help the Dental Surgeons to determine accurate site of local anaesthesia and in avoiding injury to mental nerve and prevent unwanted spread of infections while performing periodontal or endodontic surgery.

KEYWORDS

Mental Foramen, Accessory Mental Foramen, Mandible, Mental Nerve, Premolar.

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INTRODUCTION

The Mental Foramen (MF) is a small foramen which is located in the antero-lateral aspect of the body of the mandible. It is situated midway between the upper and the lower border of the mandible and it transmits mental nerve, artery and vein.^[1,2] MF is an important anatomical landmark to facilitate diagnostic, surgical, local anesthetic and other invasive procedures for Dental Surgeons performing periapical surgery in the mental region of mandible. Normally, MF is located below the interval between the two premolars.^[3,4] The mental nerve and vessels emerges through the MF and supply sensory innervation and blood supply to the soft tissues of the chin, lower lip and gingiva.^[5,6] Variations of MF are often encountered ranging from difference in shape and positions to presence of Accessory Mental Foramen (AMF) or even complete absence in some cases.^[3,7-12]

Studying the position and its morphological variations of MF is very important, because it will be helpful to localize the important maxillofacial neurovascular bundle passing through the MF, but the position of MF vary among racial groups and genders.^[3,13-17]

The most common position of MF is in line with the longitudinal axis of the 2nd pre-molar tooth followed by a location between the 1st and second pre-molar tooth.^[13,18] Most of MF are oriented postero-superiorly. Variations in the position of MF have been reported by many authors in different ethnic groups and various shapes have also been noticed. Normally data from various ethnic groups e.g. Tanzanian, Thai, Chinese, British, Saudi Arabian vary regarding the location of MF. Knowing the variation of MF location is important for locational blockage of the incisor nerve in periapical surgeries involving molars and premolars and bucco-maxillofacial surgical procedures.^[1,17-22]

Any foramen which is in addition to MF is considered as an Accessory Mental Foramen (AMF) and it is usually located below the 1st molar tooth.^[17,23,24,25] Ethnic variations in relation to AMF have also been reported by Sawyer et al.^[9] This AMF may transmit the branches of the mental nerve. AMF is due to the branching of mental nerve before passing through MF. The study of the incidence of AMF will help to localize the important neuromuscular bundle passing through MF.^[26]

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Hence, the location, size, shape, position and incidence of MF and AMF would facilitate the Dental Surgeons to apply nerve block in different surgical procedures involving lower jaw and to achieve complete anaesthesia and also helpful to avoid injury during periapical surgery.^[27]

Gary Greenstein et al.^[28] in their study reported that injuries to mental nerve during implant placement can be avoided if MF is located and evaluated and this information is used to help guide surgical procedures. Precise knowledge on variations in the position, shape and the size of MF and the presence of AMF would be of great use for Dental Surgeons while performing surgical procedures on the mandible, such as curettage of premolars, filling procedures, dental implants, root canal treatments, orthognathic surgeries etc.^[4,20]

Despite the fact that many studies have been conducted on the subject matter by various workers, the relevant data and findings available are still considered inadequate. Hence, this present study was conducted with an objective to investigate the shape, size, location and position of MF and incidence of AMF with respect to the surgically encountered important anatomical landmarks and compare with the findings of available literatures.

METHODS AND MATERIALS

Our study was conducted on 50 dry adult human mandibles of unknown sex and age obtained from the Department of Anatomy of Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India and the study was carried out to determine the size, shape, location, position and number of MF and AMF on both sides of mandible. The shape, size, location, position and number of MF were measured on both sides of mandible by using Digital Vernier Caliper. Mean horizontal and vertical diameters were measured by using Digital Vernier Caliper. The shape of MF observed was either oval or round. Position of MF was identified by measuring the distance from (a) Symphysis menti, (b) Inferior border of the mandible, (c) Posterior border of the ramus and (d) Superior border of the body of the mandible to MF. The position of MF was noted in relation to mandibular teeth.

RESULTS AND DISCUSSION

Mental foramen was present in all 50 (fifty) mandibles under study and it was bilateral. In the present study, AMF was noted in four mandibles, two on the left side (4%) and another two (4%) on the right side. That is, the incidence of occurrence of AMF was 8%. None of the mandibles presented with bilateral AMF. In our present study, we observed that the round shape MF was observed in 17.05% and the oval shape of MF in 82.95%. MF was located mostly below the 2nd premolar followed by the location between 1st and 2nd premolar. Mesbahul H et al.^[17] reported that no MF was found between 2nd premolar and 1st molar. In conformity with this finding, Hasan T reported that MF was found under the root of the second premolar in most mandibles.^[11] The most common location of MF at the root of the 2nd premolar teeth might be due to racial variations and researchers' observational error.^[17]

As pointed out above, only 4(Four) mandibles were found to have AMF out of 50 mandibles studied. Average size of AMF was 1.50mm ranging from 1.00mm to 2.00mm, thereby showing that AMF was smaller in size than the regular MF. In the present study, the location of MF was found mostly below

the apex of second premolar in 74.50%, while it was 25.50% between the first and second premolars. However, no mandibles was found having its location between second premolar and first molar.

Whereas, in one study conducted by Vimala V et al.^[27] it was observed that the most frequent position of MF was in line with apex of 2nd premolar (61.4%) and the second common position was between 2nd premolar and 1st molar (28.2%), the finding of which was found slightly different from our study. According to standard text books, MF is most commonly situated between the apices of the first and second lower premolar.^[3,5] In the present study, it was found mostly below second premolar (74.50%), which is not in conformity with that of Sinnthamby.^[5] Racial variation in the position of MF is clearly demonstrated. The modal position of MF in Chinese was in line with the second premolar, whereas in Britishers it was between the first and second premolars.^[7]

Some samples of the mandibles showing the location, size, shape and position of MF and AMF studied in the present study are shown below



Fig. 1: Mandible showing the location of Mental Foramen (MF) of oval shape below the 2nd premolar and presence of Accessory Mental Foramen (AMF) as well below MF



Fig. 2: Mandible showing the location of Mental Foramen (MF) of oval shape lying between the 1st and 2nd premolar



Fig. 3: Mandible showing the presence of both Mental Foramen (MF) of round shape as well as Accessory Mental Foramen (AMF) on the right side

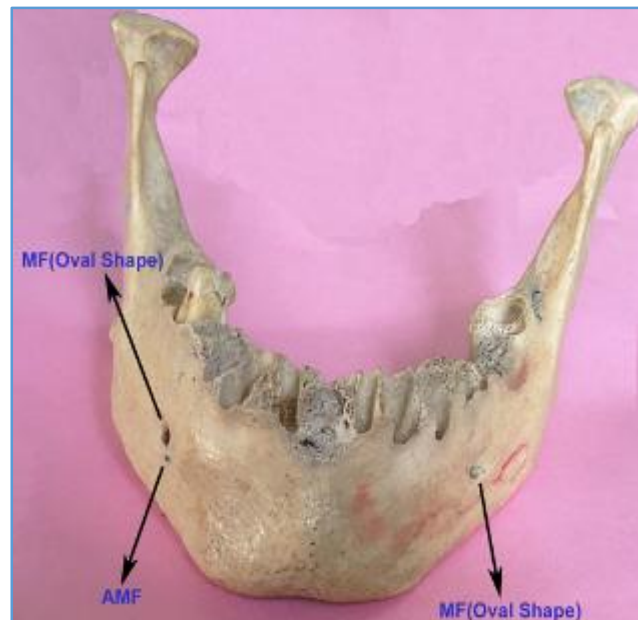


Fig. 4: Mandible showing the presence of Mental Foramen (MF) of oval shape on both the right and left sides as well as presence of Accessory Mental Foramen (AMF) on the right side

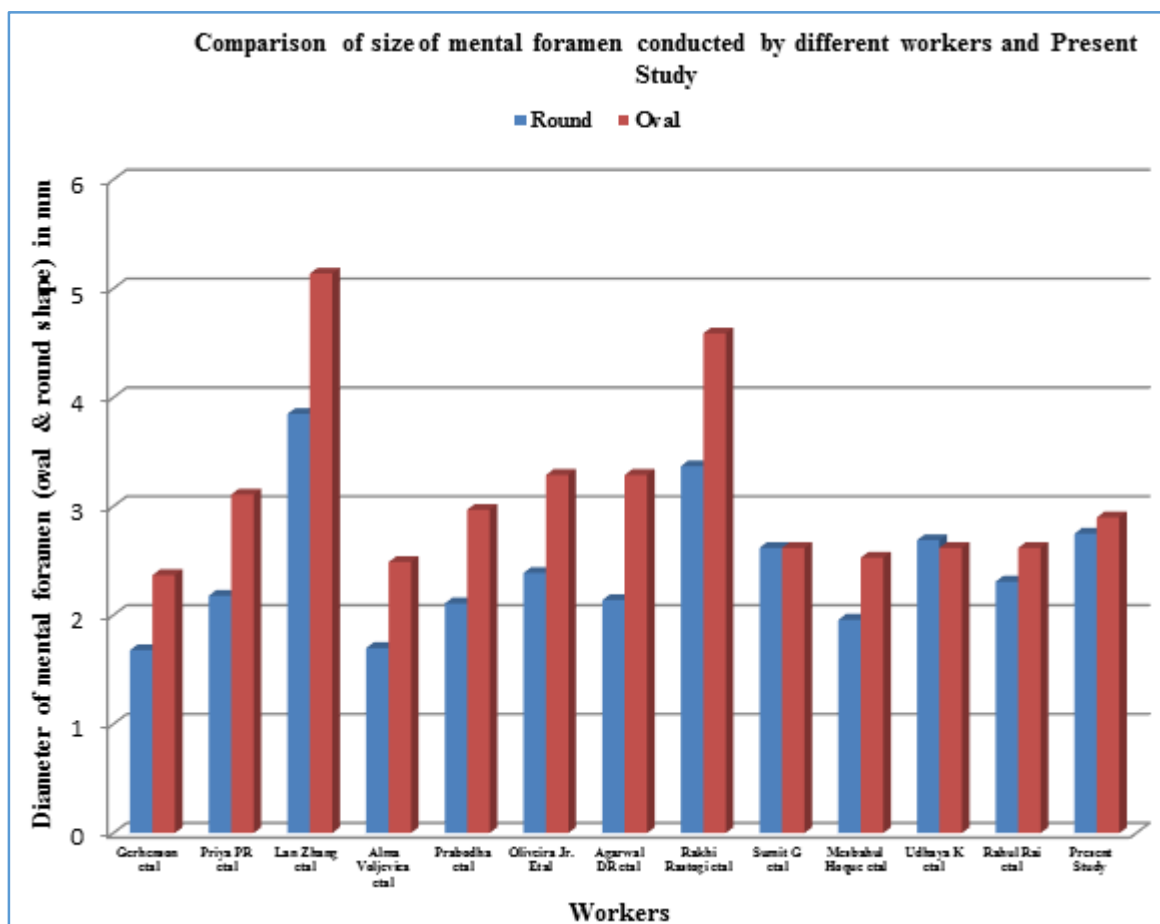


Fig.5: Bar Diagram showing the comparison of size of Mental Foramen of Mandibles conducted by different workers with that of the present study

As can be seen from Fig. 5, it could be observed that the mean diameter size of oval shape MF of our study was found almost similar to the findings of Prabodha et al.^[13] and Priya PR et al.^[29] and very close to that of Rahul Rai et al.^[30] Udhaya K et al.^[1], Mesbahul H et al.^[17], Sumit G et al.^[31] Alma Voljevic et al.^[20] and Gerhenson A et al.^[32] whereas in the case of round shape it was found closer to the findings of Udhaya K et al.^[1] Sumit G et al.^[31] and Oliveira Junior et al.^[19]

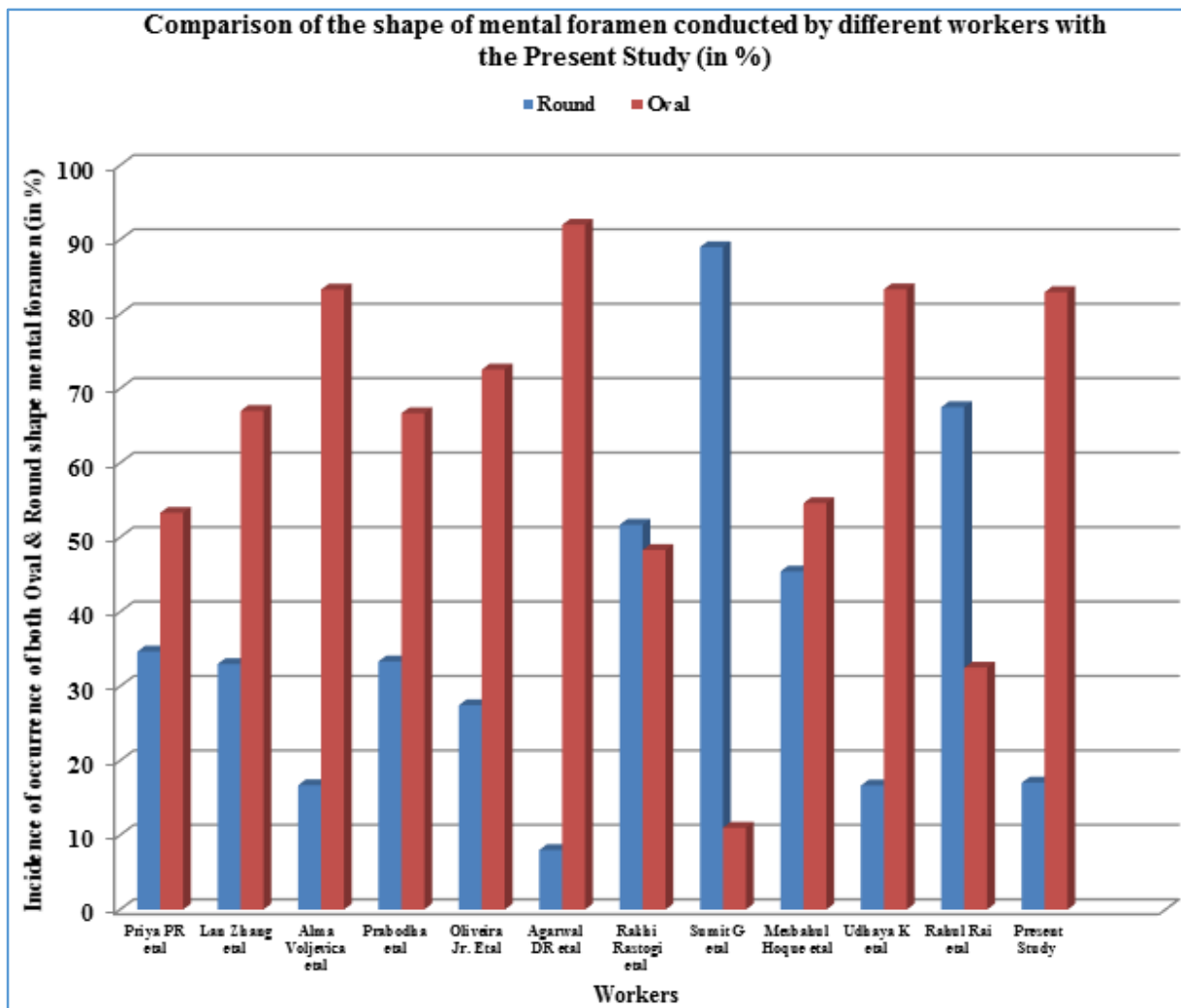


Fig.6: Bar Diagram showing the comparison of shape of Mental Foramen of Mandibles conducted by different workers with that of the present study

As regards the shapes of MF reported by different workers, the above Bar Diagram showed that the occurrence of both oval and round shape MF in our study was found

almost in conformity with the findings of Udhaya K et al.^[1] and Alma Voljevica et al.^[20]

Sl. No.	Authors	No. of Mandibles	No. of AMF	% of Occurrence
1	Prabodha LBL et al. (2006). ^[13]	24	2	8.33
2	Naitoh M et al. (2009). ^[33]	157	11	7.00
3	Sumit G et al. (Mar, 2012). ^[31]	120	8	6.67
4	Udhaya K et al. (Aug, 2013). ^[1]	90	5	5.56
5	Virendra B et al. (2013). ^[6]	105	7	6.60
6	Vimala V et al. (Sept, 2015). ^[27]	35	2	5.71
7	Alma Voljevica et al. (2015). ^[20]	150	4	2.67
8	Shukla RK et al. (2015). ^[34]	70	5	7.20
9	Zhang L et al. (2015). ^[35]	172	10	5.81
10	Present Study	50	4	8.00

The incidence of occurrence of AMF reported by various other workers are shown in Table-I

The incidence of AMF varies in the literature.^[6] Singh R and Srivastav AK observed AMF in 13% mandibles.^[4] However, the incidence of AMF was reported to be only 2.70% by Serman.^[36] In the study conducted by Virendra B et al.^[6] the incidence of AMF was found 6.6%. AMF was found in 5.81% in the study conducted by Zhang L et al.^[35] As can be seen from the above Table-I, it could be ascertained that the incidence of occurrence of AMF as reported by various workers was found ranging from 2.67% to 8.33%, with the finding in the present study (8%) very close to the findings of Prabodha et al.^[13]

Sl. No.	Authors	No. of Mandibles	Size of MF (Mean diameter in mm)		Shape of Mental Foramen (%)	
			Round	Oval	Round	Oval
1	Gerhenson A et al. (1986). ^[32]	575	1.68	2.37	34.50	65.50
2	Priya PR et al. (2014). ^[29]	75	2.18	3.11	34.67	53.30
3	Zhang L et al. (2015). ^[35]	172	3.85	5.14	33.00	67.00
4	Alma Voljevica et al. (2015). ^[20]	150	1.70	2.49	16.70	83.30
5	Prabodha LBL et al. (2006). ^[13]	24	2.11	2.97	33.33	66.67
6	Oliveira Jr. et al. (2009). ^[19]	80	2.39	3.29	27.45	72.55
7	Agarwal DR et al. (Jan 2011). ^[3]	100	2.14	3.29	8.00	92.00
8	Rakhi R et al. (2012). ^[37]	87	3.37	4.59	51.70	48.30
9	Sumit G et al. (2012). ^[31]	120	2.62 (Av. Size)	2.62 (Av. Size)	89.00	11.00
10	Mesbahul H et al. (Jan, 2013). ^[17]	185	1.96	2.53	45.41	54.59
11	Udhaya K et al. (Aug 2013). ^[1]	90	2.69	2.62	16.67	83.33
12	Rahul Rai et al. (Jul 2014). ^[30]	40	2.31	2.62	67.50	32.50
13	Present study)	50	2.75	2.90	17.05	82.95

Table-II Shows the comparison of the shape and size of Mental Foramen of various studies conducted by different workers with reference to the findings of the present study

Sl. No.	Mean distance from (in mm)	Authors								Present Study
		Wang TM et al. (1986) ^[23]	Prabodha et al. (2006) ^[13]	Sumit G et al. (2012) ^[31]	Vimala V et al. (2015) ^[27]	Singh R et al. (2010) ^[4]	Apinhasmit W et al. (2006) ^[38]	Alma Voljevica et al. (2015) ^[20]	Agarwal DR et al. (2011) ^[3]	
1	Symphysis menti	28.06	26.52	29.12	26.67	29.95	28.83	25.63	25.30	25.90
2	Posterior border of the ramus	74.14	65.58	74.16	62.35	78.25	68.85	59.01	-	62.50
3	Inferior border of the body	14.70	12.25	14.45	11.25	15.50	14.88	12.70	12.14	12.95
4	Alveolar crest	-	-	-	-	17.80	-	14.37	13.94	13.13

Table III: Position of Mental Foramen from various parameters of various studies conducted by different workers with reference to the findings of the present study

In the present study, the position of MF from various parameters i.e. mean distance from symphysis menti, posterior border of the ramus, inferior border of the body and Alveolar crest was observed at 25.90mm, 62.50mm, 12.95mm and 13.13mm respectively, as can be seen from the Table-III shown above. The findings of the present study was found almost similar and in close conformity with the findings of the studies conducted by Prabodha et al.^[13] Vimala V et al.^[27] Alma Voljevica et al.^[20] and Agarwal DR et al.^[3]

The limitation of the present study is that there is every possibility that the workers might have committed some inadvertent mistakes while measuring various parameters, despite maximum care and precaution taken by the authors, even though the measurement was carried out using Digital Vernier Calipers. Another limitation is the limited availability of dry human mandibles (50 numbers only).

CONCLUSION

The present study revealed variations in shape, size, location and position of MF and incidence of occurrence of AMF. Prior knowledge about variations in size, shape, location and position of MF and presence of AMF will help the Dental Surgeons and Anatomists alike to achieve full anaesthesia after nerve block. The findings of our study will be of great help to Dental Surgeons for determining accurate site of local anaesthesia and in avoiding injury to mental nerve and

prevent unwanted spread of infections while performing periodontal or endodontic surgery. Further research in the field with significantly larger numbers of mandibles will definitely bring interesting and useful findings.

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