

A Morphological Study of Mental Foramen in Human Mandibles

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Abstract: Introduction: The mental foramen is a funnel like opening located bilaterally on the anterolateral surface of the body of the mandible which transmits mental nerve and vessels. Any foramen which is in addition to MF is considered as an Accessory Mental Foramen (AMF). This accessory mental foramen may transmit the branches of the mental nerve. Materials and Methods: The 150 dry human mandibles of unknown age and sex were used for this study and examined for shape and position of mental foramen in relation to the mandibular teeth. Incidence of accessory mental foramen was also studied. Results: In present study we observed that the oval shape of mental foramen was 77.3% on right side and 79.3% on left. The location of mental foramen was found 58.6% in the line with the longitudinal axis of the second molar teeth on right side, on left side 57.3%. Incidence of accessory mental foramen is found on right side in 9 mandibles 6% and on left side in 2 mandibles 1.33%. Conclusion: The precise knowledge on the variations in the shape, position of the mental foramen and the presence of the accessory mental foramen would be of much use for dental surgeons while they do surgical procedures on the mandible, such as the curettage of the premolars, filling procedures, dental implants, root canal treatments, orthognathic surgeries.

Keywords: Mental Foramen, Accessory Mental foramen, Position of Mental Foramen

1. Introduction

The mental foramen is a funnel like opening located bilaterally on the antero lateral surface of the body of the mandible which is 11-15 mm superior to the inferior border of mandible, which transmits mental nerve and vessels¹. Mental nerve is a branch of inferior alveolar nerve, which provides sensory innervation to lower lip, vestibule and gingival mucosa up to 1st premolar tooth².

The average size of the foramen is 4.6 mm horizontally and 3.4 mm vertically³. The shape of mental foramen varies from oval in most of the cases to round in fewer cases⁴. Most of the mental foramina are oriented postero superiorly and they are in line with the longitudinal axis of the 2nd premolar tooth followed by a location between the 1st and 2nd premolar teeth¹.

Position of Mental foramen varies among racial groups¹. In Mongoloid population, the mental foramen is in line with the longitudinal axis of 2nd premolar, whereas in Black populations it was found posterior to the second premolar⁵. The presence and variations of accessory mental foramen is also reported by different researchers⁶.

The precise knowledge on the variation in shape, position, presence of accessory mental foramen helps in providing an effective and successful anesthesia during nerve blocks, prior to the surgical procedure. The presence of nerve fibers in accessory foramina may be significant in the effectiveness of local anesthesia following a routine inferior alveolar nerve block. Blood vessels present in accessory foramina can be a cause of intra osseous hemorrhages during implant procedures⁷.

The possible role of accessory foramina and their

neurovascular contents in the spread of tumors of this region has also been recognized⁶. The knowledge of the additional foramina may be important for the radiotherapists while planning radiation therapy⁷.

2. Materials and Methods

150 human mandibles of unknown age and sex are collected from department of anatomy, Osmania Medical College, Hyderabad and various other medical colleges in Hyderabad. Random selection of mandibles was done, labelled. Data collected entered in Microsoft excel sheets, tables and graphs are generated by statistical software XLSAT2017.

The different parameters recorded were:

- 1) The shape of mental foramen.
 - 2) The position of mental foramen.
 - 3) Presence of accessory mental foramen.
- These were recorded by naked eye examination.



Figure 1: Showing oval shaped mental foramen



Figure 2: Showing round shaped mental foramen

Positioning relation to the roots of mandibular teeth is may vary. According to Tebo and Telford positions divided as 6 types¹⁰

- 1) Between the canine and the first premolar.
- 2) Beneath the first premolar
- 3) Between the premolars
- 4) Beneath the second premolar
- 5) Between the second premolar and first molar
- 6) Beneath the root of the first molar

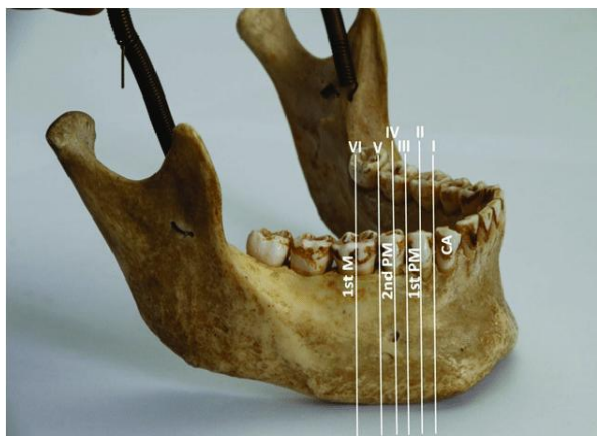


Figure 3: Diagram showing position of mental foramen in relation to the mandibular teeth

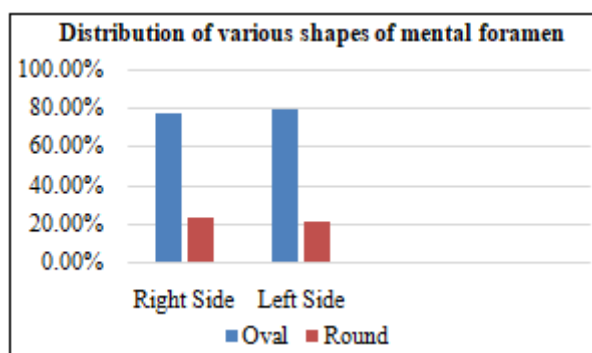
3. Results

1) Shape of Mental Foramen

The various shapes found in this study are oval shape, Round shape. Oval shape is the most common shape and round is the next common shape in this study. On right side oval shape is seen in 116 mandibles(77.3%), on left side oval shape is seen in 119 mandibles (79.3%). On right side round shape is seen in 34 mandibles(22.6%), on left side round shape is seen in 31 mandibles (20.6%). These findings are represented in Table :1 and Graph :1

Table 1: Percentage distribution of various shape of the mental foramen

Shape	Right Side	Left Side
Oval	116(77.3%)	119(79.3%)
Round	34(22.6%)	31(20.6%)
Total	150(100%)	150(100%)



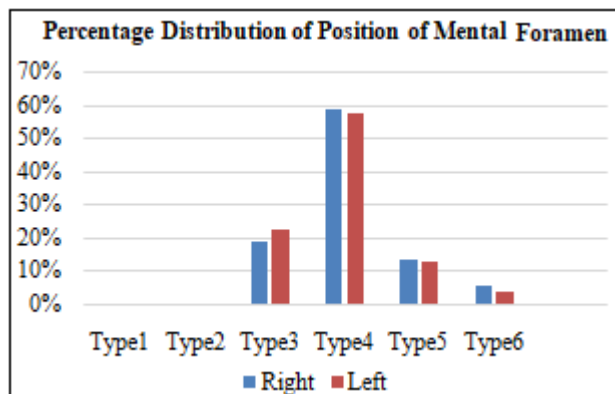
Graph 1: Percentage distribution of various shapes of mental foramen

2) Position of Mental Foramen

Most common position on right side is type4 seen in 88 mandibles(58.6%), followed by type3 seen in 28 mandibles (18.6%), type5 is seen in 20 mandibles (13.3%), type6 is seen in 8 mandibles(5.33%). On left side most, common position is type4 seen in 86 mandibles(57.3%), followed by type3 seen in 34 mandibles(22.6%), type5 is seen in 19 mandibles (12.6%), type6 is seen in 5 mandibles (3.33%). 6 mandibles are edentulous. Hence, unable to locate the position of mental foramen.

Table2: Percentage distribution of position of mental foramen

Position	Left	Righ
Type1	-	-
Type2	-	-
Type3	28(18.6%)	34(22.6%)
Type4	88(58.6%)	86(57.3%)
Type5	20(13.3%)	19(12.6%)
Type6	8(5.33%)	5(3.33%)



Graph 2: Percentage distribution of position of mental foramen

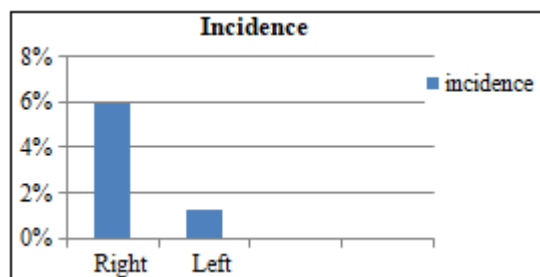
- 3) Incidence of Accessory mental foramen is found on right side in 9 mandibles (6%) and on left side in 2 mandibles (1.33%)



Figure 4: Diagram showing presence of accessory mental foramen

Table 3: Percentage distribution of presence of accessory mental foramen

Side	Right	Left
Number of Accessory Mental Foramen	9(6%)	2(1.33%)



Graph 3: Percentage distribution of accessory mental foramen

4. Discussion

Knowledge about orientation and position of the mental foramen and also about the accessory mental foramen is important for performing an aesthetic block prior to clinical procedures in lower anterior teeth and also for preserving the integrity of the mental nerve trunk in surgical interventions⁸. Thus, knowledge helps in obtaining effective nerve block and also avoids post-surgical neurovascular complications⁹. The mental nerve injury can cause transitory or permanent sensitive, thermal and tactile

changes. The situation of mental foramen is an important factor in enabling the surgeon to plan the extent of bone removal in cancer of the floor of the mouth encroaching on the jaw⁶.

1) Shape of the Mental Foramen

In the present study most, common shape was oval in the most of the mandibles

- As per **Alma voljevica et al (2006)** study most common shape of mental foramen is oval bilaterally in 83.3% mandibles and round in 16.7% mandibles bilaterally¹⁰.
- As per **Oliveira junior et al (2009)** study most common shape is oval on right side in 59 mandibles (73.8%), on left side in 57 mandibles (71.3%), next common shape is round seen on right side in 21 mandibles (26.2%), on left side in 23 mandibles (28.7%)¹¹.
- Ritika patel et al (2015)** study shows oval was most common shape (79.03%). All above studies matches with present study¹².

The shape of the mental foramen depends upon the direction of emergence of mental vessels and nerves. **Importance of shape of mental foramen** is, it is widely variable in different individuals, helpful in racial identification.⁵

Table 4: Comparison between different studies regarding shapes of mental foramen

Study	Year	Country	Material for Study	Shape of Mental Foramen (%)	
				Oval	Round
Gershenson	1986	Switzerland	Dry bones (n=525)	65.5	34.5
Mbarjiorgu	1998	Zimbabwe	Dry bones (n=32)	56.3	43.8
Oguz	2002	Turkish		92	8
Igbigbi	2005	Malawi	Dry bones (n=70)	70	30
Prabodra	2006	Srilanka	Dry bones (n=24)	66.7	33.3
Fabian	2007	Tanzania	Dry bones (n=100)	54	46
Oliveria J	2009	Japanese		72	27
Ilayperuma	2009	Srilanka		51	49
Siddiqui	2010	Western India		70	30
Singh, Srivastav	2010	India	Dry bones (n=100)	6(R), 13(L)	94(R), 87(L)
Agarwal, Gupta	2011	India (South Gujarat)	Dry bones (n=100)	92	8
Rastogi	2012	India (central)	Dry bones (n=87)	48.3	51.7
Gupta	2012	India	Dry bones (n=120)	11	89
Pirov	2012	Rome	Dry bones (n=37)	60.2	39.9
Udhaya	2013	South India	Dry bones (n=90)	83.3	16.7
Kasat	2016	India	Dry bones (n=100)	47	53
Present Study	2018	Telangana	Dry bones (n=150)	77.3(R), 79.3(L)	22.6(R), 20.6(L)

2) Position of Mental Foramen

In the present study most, common position of mental foramen in relation to the mandibular teeth is type4 seen in

88 mandibles (58.6%) on right side, on left side 86 mandibles (57.3%).

- **Ritika Patel (2015)** study concluded that most common position of mental was type4 (40.32% on right side, 43.55% on left side)¹².
- **KasatPA(2016)** study shows that most common position was type 4(46.5%on both sides), least common was type 6(2% on both sides)⁷.
- **MunaKadel(2016)** study concluded that most common position was type 4(58% on right side,69% on left side), least common was type 6(2% on right side,3% on left

side)¹.All the above studies matches with present study.

Clinical importance of position of mental foramen:

MF is difficult to localize as there are no absolute anatomical landmarks for reference. The MF cannot be visualized or palpated clinically; hence it is localized in relation to the lower teeth. So, knowledge of the most common position of the mental foramen in relation to lower teeth is important for dental surgeon both while administering regional anaesthesia and performing periapical surgeries of mandible⁵.

Table 5: Comparison of the Position of the Mental Foramen with Other Studies

Study	Location	Year	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Ngeowl(n=169)	Malaysia	2003	-	-	19.6%	69.2%	-	-
Gingor(n=361)	Turkey	2006	-	-	71.5%	22.4%	-	-
Kim (n=72)	Korea	2006	-	-	26.8%	64.3%	-	-
Fabian(n=100)	Tanzania	2007	-	-	-	45%	35%	-
Yesilurt(n=100)	Turkey	2008	R	-	34.3%	-	-	-
			L	-	25.7%	-	-	-
Ilayperuma(n=51)	Srilanka	2009	-	-	26.47%	52.94%	-	-
Siddiqui(n=93)	Western India	2010	R	1(1.07%)	6(6.4%)	39(41.9%)	41(44.08%)	6(6.45%)
			L	1(.07%)	8(8.6%)	33(35.4%)	43(46.2%)	8(8.60%)
Ajay Parmar	Eastern India	2012	R	-	-	11(21.6%)	33(64.7%)	4(7.8%)
			L	-	-	10(19.6%)	34(66.7%)	5(9.8%)
Present study(n=150)	Telangana, India	2018	R	-	-	28(18.6%)	88(58.6%)	20(13.3%)
			L	-	-	34(22.6%)	86(57.3%)	19(12.6%)

3) Incidence of Accessory Mental Foramen

In present study accessory mental foramen on right side are present in 9 mandibles (6%), left side 2(1.33%) mandibles

- **K Udhaya (2013)** study showed that incidence of accessory mental foramen was 2.22%on right side,3.33% on left side¹³.
- **Ritika Patel(2015)** study showed that it was 6.45%on right side ,1.61% on left side¹². ***MunaKadel(2016)** study showed that it was 3%on right side,3% on left side¹.

Table 6: comparison of incidence of mental foramen with other studies

Study	Year	Results
Alma V	2006	2.7%
Rajani Singh	2010	5%on right side ,8% on left side
Devi K Sankar	2011	8.9%.
Virendra B	2012	6.6% on both sides
K Udhaya	2013	2.22%on right side ,3.33% on left side
Ronak Zarei	2014	2%on right side ,3% on left side
Vimala	2014	2.6%on right side,2.6% on left side
Ritika Patel	2015	6.45%on right side,1.61% on left side
MunaKadel	2016	3%on right side,3% on left side
Kasat	2016	1.5% on right side.
Raja Sekhar	2016	2% on right side
Present Study	2018	Right side 9(6%), left side 2(1.33%).

5. Conclusion

Mental foramen is an important landmark at the time of surgical intervention in mental region of mandible and during procedure of mental nerve block, to obtain effective nerve block and to avoid post-surgical neurovascular complications in mental regions. Hence, variability in shape, position of mental foramen and presence of accessory

mental foramen should alert the dental surgeons while performing periodontal or endodontic surgery.

Generally, the mental foramen is difficult to locate as it cannot be clinically visualized and palpated. So, the knowledge of mental foramen and accessory mental foramen are important to facilitate diagnostic, surgical, local anesthetic and other invasive procedures of the oral and maxillofacial region, and to prevent injury during surgical and anaesthetic procedures which may result in paranesthesia and complete loss of sensation.

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