

Morphological and Morphometric Analysis of Mental Foramen in Dry, Human Mandibles of South India

Mangala S¹, Shruthi B N²

¹Associate Professor, ²Professor and Head,
Department of Anatomy, Raja Rajeswari Medical College and Hospital, Bangalore, Karnataka, India

Corresponding Author: Mangala. S

ABSTRACT

Background: Mental foramen is a key factor in many of the surgical as well as clinical procedures in routine clinical practice.

The variations of mental foramen with respect to position, size and number does significantly alter the clinical implications of various intraoral treatments.

In this light, the present study on the position and morphological variants of mental foramen holds significance.

Aims and Objectives: To study morphological and morphometric analysis of mental foramen in dry human mandibles of South India

Materials and Methods: 50 dried adult Human mandibles of unknown sex with complete dentition and intact alveolar margin were studied

The morphometric analysis was done using vernier calipers

Results: In the present study, the most common position of mental foramen was of type 4 (in line with the 2nd premolar) 62% cases on Right and 66% cases on Left side

The next common position was Type 3(Between the premolars) 24% cases on Right side and 18% cases on the left side

The mean distance between Symphysis menti and anterior margin of mental foramen was 23.4mm and 23.2mm on Right and left side respectively and the mean distance between posterior margin of mental foramen and posterior border of ramus was 62.2 mm and 61.5 mm on Right and left sides respectively

Conclusion: The present study has thrown light on the common position and morphometric

variations of mental foramen in a given South Indian population.

This information will be valuable to the dental surgeons for localization of Neurovascular bundle emerging through mental foramen and for delivering local anesthesia effectively for placement of dentures/implants and other invasive procedures

Key Words: Mental foramen, Human mandible, Morphology, Morphometry

INTRODUCTION

The mental foramen is an oval/circular opening on the anterior surface of the mandible, located below or between the premolars, approximately midway between the alveolar crest and lower border of the mandible¹

The mental foramen marks the termination of mandibular canal in the mandible, through which the inferior alveolar nerves and vessels pass

At this point, the mandibular canal bifurcates and forms the mental and incisive canals.

The mental bundle passes through the mental foramen and supplies sensory innervations and blood supply to the soft tissues of the chin, lower lip and gingiva on the ipsilateral side of the mandible². Mental foramen is a strategically important anatomical landmark to facilitate surgical, local anesthetic and other invasive procedures for dental surgeons, performing periapical surgery in the mental region of

the mandible. Its Anatomy is important for evaluating the morphometric symmetry of mental triangle, microscopic and macroscopic morphology, maturity of the Human mandible and is an excellent point to study bone remodelling¹

Studying the position and morphological variation of the mental foramen is very important as it will be helpful to localize the important maxillofacial neurovascular bundle passing through mental foramen.

Need for the study

The position of mental foramen varies among racial groups and genders.

Despite the significance of mental foramen, little attention has been given to the study of morphology, most common location of foramen and associated anatomical characteristics in Mandibles of South India.

Hence, considering the importance of mental foramen, the present study shall be undertaken to investigate the morphology and variations in the position of mental foramen by the morphometric assessment with respect to the surgically encountered anatomical landmarks.

Objectives of the study

The aims of the present study are:

- 1) To determine the most common position of mental foramen in South Indian population in relation to the lower teeth and compare the results with those reported for other population
- 2) To determine the position of the mental foramen in relation to the mandibular symphysis, the posterior border of ramus of mandible, the lower border of the mandible and the alveolar crest on dry adult mandibles

MATERIALS AND METHODS

The present study was conducted in the Department of Anatomy, Rajarajeswari Medical College and Hospital, Bangalore.

Fifty dried adult human mandibles with complete dentition and intact alveolar

margin of unknown sex were used for the study

The mandibles for the study was procured from the Department of Anatomy of the Institution as well as from the 1st year medical students

The following parameters were observed in the mandibles during the study

- 1) shape and number of mental foramen
- 2) absence/presence of accessory mental foramen
- 3) The morphometric measurements were recorded using vernier calipers as follows:

- a) The relation of mental foramen with lower teeth-The position of the mental foramen was recorded as lying in line with the long axis of a tooth/interdental space in one of the six relations:

Type 1-Anterior to 1st premolar

Type 2-Below the 1st premolar

Type 3-Between the premolars

Type 4-Below the 2nd premolar

Type 5-Posterior to 2nd premolar

Type 6-Below the 1st molar

- b) Location of mental foramen was identified by using following parameters:

- 1) Distance between anterior margin of mental foramen and symphysis menti
- 2) Distance between posterior margin of mental foramen and posterior border of ramus
- 3) Distance between superior margin of mental foramen and alveolar crest
- 4) Distance between inferior margin of mental foramen and lower border of body of mandible

For measuring the parameters, a standard horizontal plane as defined by Marrant was utilized which states that the mandible when placed on a horizontal surface, the lower border of the mandible comes into greatest contact when vertical pressure is applied to the 2nd molar teeth

The measurements were recorded independently by 2 observers and the mean of the values recorded.

The findings were charted, analyzed and compared with findings of other

workers and studies on different geographical locations and ethnic groups.

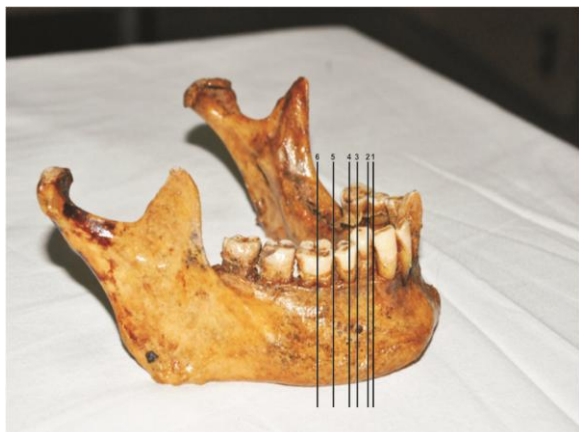


Figure 1: 1/2/3/4/5/6 – the lines showing relation of mental foramen to the lower teeth / interdental space (Types 1 to 6 as mentioned earlier)



Figure 2: S- Symphysis menti, MF-mental foramen, PB-posterior border of ramus of Mandible, X-alveolar crest, Y-lower border of body of Mandible, 1- Distance between S and MF, 2- Distance between MF and PB, 3- Distance between X and MF and 4- Distance between MF and Y.

RESULTS

The mental foramen was present in all mandibles.

It was predominantly present as an oval opening in 62% of the cases

Rounded openings were observed in 38% of the cases

There was one mandible with accessory mental foramen on Right side (Figure 3)



Figure -3 -Accessory Mental foramen

TABLE-1:Shape of the Mental Foramen(MF)-Comparison with other studies

Shape	Present study 2021, South India (n=50)	Ajay Parmar ² 2012,Eastern India(n=50)	Siddiqui ⁸ 2010,Western India(n=93)	Ilayperuma ⁹ 2009,Srilanka (n=51)	Fabian ¹⁰ 2007,Tanzania (n=100)	Prabodha ¹¹ 2006,Srilanka (n=24)
oval	62(62%)	69(69%)	65(70%)	30(59%)	54(54%)	16(66.7%)
Rounded	38(38%)	31(31%)	28(30%)	21(41%)	46(46%)	8(33.33%)

The most commonly present position of mandibular foramen in relation to the lower set of teeth was in line with the 2nd premolar –Type 4

This position was present in 62% cases on the right side and 66% cases on the left side

TABLE-2:Position of the Mental foramen in relation to Lower teeth/Interdental space(comparison with other studies)

study	location	year	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Present study(n=50)	Southern India	2021	-	-	R12(24%) L10(20%)	31(62%) 33(66%)	5(10%) 4(8%)	2(4%) 3(6%)
Ajay parmar ² et al(n=50)	Eastern India	2012	-	-	R11(21.6%) L10(19.6%)	33(64.7%) 34(66.7%)	4(7.8%) 5(9.8%)	2(3.9%) 1(2%)
Siddiqui ⁸ (n=93)	Western India	2010	R(1.07%) L(1.07%)	6(6.45%) 8(8.60%)	39(41.93%) 33(35.48%)	41(44.08%) 43(46.23%)	6(6.45%) 8(8.60%)	-
Ilayperuma ⁹ (n=51)	Srilanka	2009	-	-	26.47%	52.94%	-	-
Yesilurt ⁷ (n=70)	Turkey	2008	-	-	34.3% 25.7%	-	-	-
Fabian ¹⁰ (n=100)	Tanzania	2007	-	-	-	45%	35%	-
Kim et al ¹² (n=72)	Korea	2006	-	-	26.8%	64.3%	-	-
Ngeow ¹³ (n=169)	Malaysia	2003	-	-	19.6%	69.2%	-	-
Gingori ¹⁴ (n=361)	Turkey	2006	-	-	71.5%	22.4%	-	-

The mean distance between anterior margin of mental foramen and symphysis menti was 23.4 mm and 23.2 mm on Right and Left sides respectively.

Mean distance between posterior margin of mental foramen and posterior border of ramus was 62.2mm and 61.5 mm on Right and left sides respectively

Mean distance between superior margin of mental foramen and alveolar crest was 10.6mm on right side and 10.3mm on left side.

Mean distance between inferior margin of mental foramen and lower border of body of the mandible was 10.1mm on right side and 9.9mm on the left side

TABLE-3:Situation of Mental foramen with respect to Mandibular parameters(comparison with other studies)

location	Southern India	Eastern India	Western India	Turkey	korea	Srilanka	Thailand	North India
year	2021	2012	2010	2008	2006	2006	2006	1992
Variable studied	Mean values	Mean values	Mean values	Mean values				
Distance between MF &S	R=23.4 L=23.2	R=23.3 L=22.5	R=18.8 L=19.6	R=19.18 L=19.37		26.52		23.6
Distance between MF&PB	R=62.2 L=61.5	R=61.3 L=62.5	R=48.8 L=47.9	R=48.58 L=19.37		68.85		76.2
Distance between MF &X	R=10.6 L=10.3	R=10.6 L=10.3	R=10.2 L=10	R=10.5 L=10.64				15.3
Distance between MF &Y	R=10.1 L=9.9	R=10.7 L=10.7	R=9.9 L=10.1	R=9.44 L=9.46	14.33	12.25	14.88	14.0

All values in mm S-Symphysis menti, MF – Mental foramen, PB -Posterior border of ramus, X- alveolar crest, Y - lower border of the body of the mandible

DISCUSSION

Knowledge of location of foramen in maxillofacial region especially mental foramen is necessary especially in a clinical situation where regional nerve blocks are required for open as well as endoscopic surgical procedures in order to avoid injury to corresponding nerves.

In the present study, the most commonly encountered shape of the mental foramen was oval (62%) followed by a round shape (38%) as per Table-1

This predominance of the oval shape has also been reported by other workers, the value of which vary in different population

Ajay Parmar et al(2012)² stated that the most common position of mental foramen in relation to the lower teeth in their study was Type 4i,e in line with second premolar. This fact correlates with the similar findings in the present study. The most common type was type 4 -62% and 66% on right and left sides respectively.

With reference to Table 2,the commonest position has been described in 52.94% cases in srilanka9.44.08%(R) and 46.23%(L) cases in Western India 8,55.7% (R) and 61.4%(L) cases in Turkish mandibles, 45% in Tanzanian studies10,

64.3% in Koreans and 69.2% in Malay populations¹³

Yesilyurt et al(2008)⁵ in their study have quoted that the most common position for the mental foramen were i) below the second premolar tooth (Type4) in Chinese, Kenyan Africans and Mongoloid populations ii)posterior to the second premolar (Type 5) in Caucasians and Zimbabweans iii) between the premolars (Type 3) in Negro, British, Central Anatolian and North American white populations

Haganifar and Rokouei(2009)¹⁷ in their radiological study of the mental foramen, reported that the most common position of the mental foramen was between the 2 premolars –Type 3 being 47.2%

Another study from Turkey has shown that the most common position of the mental foramen was between the 2nd premolars-Type 3(71.5% cases)¹⁴

As regards to the situation of the mental foramen with respect to mandibular parameters (Table 3) differences are seen amongst Western India⁸, Turkish⁵, Korean¹²,Srilankan¹¹,Thai¹⁵ and North Indian samples¹⁶

The review of available literature shows that the mental foramen shows racial and ethnic variation. Moreover the variation in the values indicate towards the variational mandibular dynamics of population under consideration

Many of the differences can be attributed to variability in chewing habits of different population leading to differential development of Mandible²

The restoration of form and function without violating important anatomic structures are the fundamental goal in surgical management of any patient, one of these is mental foramen, its identification and preservation in periapical surgery, implant surgery, maxillofacial surgery and orthographic procedure is of utmost importance.¹⁸

CONCLUSION

The knowledge gained from this study offers valuable insight on the morphology of mental foramen in South Indian population which hitherto was not recorded by other authors.

Knowledge of distances from surgically encountered anatomic landmarks may be of assistance in locating these important maxillofacial neurologic structures during many procedures

Therefore a detailed knowledge of mental foramen anatomy and its variations in different population is essential for dentists, orthopedicians and anatomists alike.

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