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MORPHOMETRIC AND OSTEOMETRIC STUDY OF MENTAL FORAMEN

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ABSTRACT

Objective: Mental nerve is sensory nerve of lower lip, gingiva and vestibule. Mental nerve emerges through the mental foramen, a foramen on the antero lateral aspect of body of mandible. To anesthetise the mental nerve local anesthetic must be injected at the point where it emerges out from mental foramen. Hence it was decided to study the mental foramen.

Methods: Sixty human dry mandibles were studied to measure the distance of mental foramen from symphysis menti, alveolar ridge, base of mandible and posterior border of ramus of mandible. The shape, direction of mental foramen were recorded. Location of mental foramen in relation to the lower teeth was also recorded and all the parameters were tabulated and analysed. **Results and Conclusion:** According to the present study mental foramen was located 1.3cm below the alveolar ridge, 1.25 cm above the base of mandible, 2.5 cm postero-lateral to symphysis menti, 6.4 cm anterior to the posterior border of ramus and was most commonly in line with 2nd lower premolar tooth. The shape was round and direction was postero-superior in most of the cases.

Keywords: Mental foramen, mental nerve, alveolar ridge, implant, orthognathic surgery.

INTRODUCTION

The mental foramen (MF) is situated on the anterolateral aspect of the body of mandible on either side. The mental nerve and vessels which appear through the MF provide sensory nerve supply and blood supply to the soft tissues of the chin, lower lip and gingiva.¹ Since the location of MF differ among various racial and ethnic groups, in the present study it was decided to locate MF in relation to the neighbouring bony landmarks.

MATERIALS AND METHODS

A total of 60 dry human mandibles were studied. Only the mandibles with the teeth or intact alveolar ridge were studied. Mandibles of children and mandibles with reabsorption of the alveolar ridge were excluded from the study.

I. Following parameters were studied using vernier caliper on both sides to locate the MF:

- (1) Distance from MF to symphysis menti(SM) - (MF-SM)
- (2) Distance from MF to alveolar ridge - (MF-AR)
- (3) Distance from MF to inferior border of the mandible - (MF-MB)
- (4) Distance from MF to posterior border of ramus of mandible - (MF-PB) (Figure 1).

II. The position of MF was noted in relation to mandibular teeth and was documented as:

- a) In line with the 1st premolar (1st PM)
- b) Between the 1st and 2nd premolar (1st & 2nd PM)
- c) In line with second premolar (2nd PM).
- d) Between second premolar and 1st molar (2nd PM & 1st M)
- e) In line with 1st molar (1st M).

III. The direction of opening of MF was recorded as:

Postero-superior (PS), superior (U), lateral (L), posterior (P) or anterior (A).

A comparison of the mean values between sides was performed using the t-test, p-value < 0.05 was considered to be statistically significant.

RESULTS

The present study revealed that average (AVG) distance of MF from SM was 2.49 cm and 2.53 cm on the right and left side respectively which was a statistically significant difference (Table 1). AVG distance of MF to the alveolar ridge was found to be 1.32 cm on the right side and 1.36 cm on the left side. AVG distance of MF to the inferior border of mandible was 1.25 cm and 1.26 cm on right and left sides. AVG distance of MF to the posterior border of ramus on right and left side was 6.46 cm and 6.41 cm respectively. None of these parameters showed a significant difference in the values on right and left side (Table 1).

Table 2 reveals that according to present study on an average MF was 2.51 cm postero-lateral to the SM with a SD of 0.178601, was 1.34 cm below the AR with a SD of 0.229425, was 1.25 cm above the inferior border of mandible with a SD of 0.1378 and was 6.44 cm anterior to the posterior border of ramus with a SD of 0.421013.

In the present study it was found that MF was located most commonly in line with the 2nd PM (81 sides or 67.5%) and the next common position was in between 2nd PM & 1st M (32 sides or 26.67%) (Table 3).

In 79 out of 120 sides studied, the shape of MF was found to be rounded, out of which 41 were on right side and 38 were on left side. MF was found to be oval in shape in 41 sides, 19 on right side and 22 on left side (Table 4).

Almost 63.33% of the MF studied, the opening was directed postero-superiorly, 18.33% of MF opened posteriorly, 16.33% MF were directed upwards, 3.33% of the cases MF was directed anteriorly and only in 1.67% of the MF were directed laterally (Table 5).

DISCUSSION

Recently surgical procedures in the mental region have increased because of the advancements in orthognathic surgery.² Since the mental nerve is responsible for sensory innervations of soft tissues of the chin, lower lip and gingiva, during any surgical approach to these regions, mental nerve blockage is the anesthetic technique used. Hence exact localisation of MF, through which mental nerve emerges, becomes mandatory prior to the procedure. This will ensure an effective nerve block and also will help in prevention of post surgical neurovascular complications.^{2,3}

The present study revealed that MF was located 2.51 cm postero-lateral to the SM, 1.33 cm below the alveolar ridges, 1.25 cm above the inferior border of mandible and 6.43 cm in front of posterior border of ramus. Most commonly MF was in line with 2nd PM and PS direction of MF was the commonest finding. These findings are in accordance with the studies in the past.³⁻⁹ Whereas a radiographic study on MF in the Asian Indian population found that MF was most commonly located between the

two premolars and along the long axis of second premolar was the second common position.¹⁰

Another study conducted in South Gujarat found that the most frequent position of MF was in line with the 2nd premolar for both right (81.55%) and left (81.50%) sides. The direction of MF was PS in 92%. The shape of foramen was oval in 92% cases and rounded in 8% cases,³ whereas the present study found that MF was most commonly round in shape (in 65.8 percent of the cases studied).

A previous report on MF stated that the position of MF in the Mongoloid population was in line with axis of second lower premolar whereas in Caucasoid samples MF were just medial to those in Mongoloid, Melanesian, and African samples.⁸

Clinically MF cannot be visualised or palpated hence, it is localised in relation to the lower teeth.³ MF is an important bony landmark during osteotomy procedures, implant in the mental region, any surgical approach or biopsy of this region. Therefore its location and the possibility of an anterior loop of the mental nerve should be considered before any kind of procedure to avoid mental nerve injury. Since there are many reports regarding the variations of MF with respect to the size, shape, location and direction, MF region is considered to be one of the challenging areas for implants in the mandible.¹¹

A dissection study conducted in 1997 reported that in 15% of the specimens studied, mental nerve or its branches re-entered the labial plate. The same study concluded by stating that the finding of the mental nerve re-entering the labial plate to supply the lower incisors explains the crossover innervation from the contralateral mental nerve and also explains the anesthesia of lower incisors during the labial infiltration of anesthetic injection.¹²

Precise knowledge of the location of the foramen, in relation to anatomical or bony landmarks can be of great help in localising important neurovascular structures during various interventions in the region.^{9, 13} Such information must be used to develop newer minimally invasive surgical techniques in the region.¹³

CONCLUSION

Since mental nerve block is routinely practiced in common procedures like suturing, biopsy of vestibular region, of lower lip, localisation of MF is a clinically significant factor in such conditions. In general, altered lip sensations can be prevented if the MF is precisely located.¹⁴ According to the present study MF was located 1.3cm below the alveolar ridge, 1.25 cm above the base of mandible, 2.5 cm postero-lateral to SM, 6.4 cm anterior to the posterior border of ramus and was most commonly in line with 2nd lower premolar tooth.

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Table1: Table showing the various studied distances of Mental Foramen on both sides.

		AVG (cm)	MIN (cm)	MAX (cm)	SD	T test
MF- SM	Right N=60	2.491667	2	3	0.178783	0.038579
	Left N=60	2.53	2.1	3	0.17784	
MF-PB	Right N=60	6.456667	5.5	7.7	0.468451	0.179801
	Left N=60	6.413333	5.7	7.4	0.37028	
MF-AR	Right N=60	1.32	0.8	1.9	0.232014	0.097569
	Left N=60	1.356667	0.8	1.9	0.227266	
MF-MB	Right N=60	1.246667	0.8	1.5	0.14897	0.526962
	Left N=60	1.256667	1	1.5	0.126714	

Table 2: Average (AVG) and Standard Deviation (SD) of various distances from Mental Foramen (MF) of both the sides studied.

N=120	AVG (cm)	SD
MF- SM	2.510833	0.178601
MF-PB	6.435	0.421013
MF-AR	1.338333	0.229425
MF-MB	1.251667	0.1378

Table 3: Location of Mental Foramen

Location	Right	Left	B/L
1st & 2nd PM	1 (1.67%)	2 (3.33%)	03 (2.5%)
2nd PM	39 (65%)	42 (70%)	81 (67.5%)
2nd PM & 1stM	17 (28.33%)	15 (25%)	32 (26.67%)
1st M	3 (5%)	1 (1.67%)	04 (3.33%)

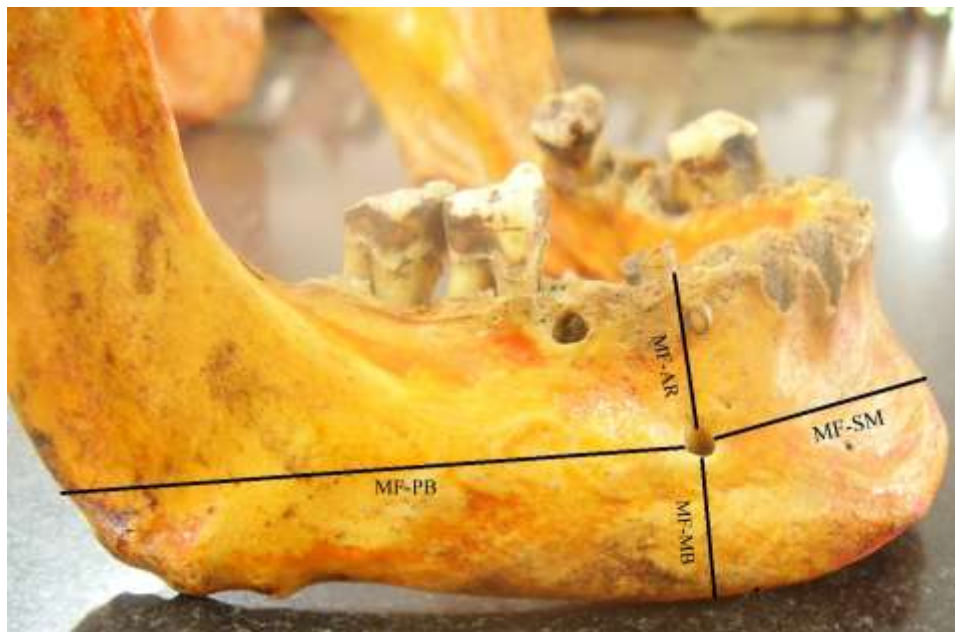
Table 4 : Shape of Mental Foramen

Shape of MF	Right	Left	B/L
Oval	19 (31.67%)	22 (36.67%)	41 (34.2%)
Round	41 (68.33%)	38 (63.33%)	79 (65.8%)

Table 5: Direction of Mental Foramen

Direction	Right	Left	B/L
PS	33 (55%)	43 (71.67%)	76 (63.33%)
U	11 (18.33%)	05 (8.33%)	16 (13.33%)
P	12 (20%)	10 (16.67%)	22 (18.33%)
A	02 (3.33%)	02 (3.33%)	04 (3.33%)
L	02 (3.33%)	00	02 (1.67%)

Figure 1: Photograph of Mandible showing the various parameters studied.



MF- Mental Foramen, SM- Symphysis Menti, MB- Base of mandible, AR- Alveolar ridge, PB- Posterior border of ramus