

Evaluation of mental foramen using cone beam computed tomography in Pakistani population

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Abstract

Introduction: Mental foramen is an important landmark in the mandible. Its anatomical location varies between persons as well as in different populations. Knowing the location of mental foramen can help in surgical, endodontic and implant placement procedures in the mandible. This study was done to establish the location of mental foramen in Pakistani population.

Material and Methods: 200 CBCT's were evaluated for the number, position and distance of mental foramen from lower border of mandible using built in software. The study was carried out in Armed Forces Institute of Dentistry, Rawalpindi.

Results: Out of the total sample assessed, 4.5% had accessory mental foramen and the most common position being in line with second premolar. The average distance of the lower border of mental foramen from lower border of mandible was $11.97\text{mm} \pm 1.359$ for left side and $12.00\text{mm} \pm 1.764$ for right side.

Conclusions: The anatomy of mental foramen is different in various populations and knowing the location in Pakistani population can help in treatment planning for various dental procedures planned for the mandibular premolar region.

Keywords: Mandibular nerve; mental nerve; computed tomography; radiation exposure

Introduction

The mental foramen (MF) is a funnel like opening and an important reference on the external surface of the mandible in the region below the premolars.¹ It is an important landmark, the location of which may vary in the vertical and horizontal plane. Inferior alveolar nerve and vessel passes through the foramen which on leaving the foramen branches to innervate the skin of the chin, lower lip and the mucosa of the lower lip.²

Its important to establish the position and location of mental foramen accurately because any invasive procedure in this region may damage the neurovascular bundle and cause sensory dysfunction.³ Establishing this location helps in pre-operative planning for placement of plates for reduction of

mandibular fracture, placement of osseointegrated dental implants and peri apical surgery in premolar region.⁴

The region between two MF is termed as safe area for surgical procedures such as bone graft removal and placement of implants for implant retained over-denture in a completely edentulous patient since this region is free of large nerves and vessels.⁵

Panoramic radiograph has been used to determine the location of mental foramen. Albeit its advantages, it only provides a two dimensional picture. The cone beam computerized tomography (CBCT) is a relatively newer technology that provides 3D view of the head and neck region. 2D panoramic radiographs are the most common radiograph used in preoperative planning in any invasive dental and surgical procedure but provide limited information about the dimension, location and relationship of mental foramen with the adjacent structures. CBCT provides accurate imaging of the MF and adjacent structure and confers a low radiation dose as compared to conventional CT.^{6,7}

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Multiple studies have been conducted on different populations showing varied positions of mental foramen.^{8,10} This study was conducted to establish the frequency of number of foramina, distance from the lower border of mandible and the position with reference to mandibular teeth in a Pakistani population using CBCT.

Material and Methods

200 CBCT images were studied in this retrospective descriptive study. All images were taken with a New-Tom VGi CBCT machine (QR s.r.l, Italy) in Armed Forces Institute of Dentistry (AFID), Rawalpindi, Pakistan. Image parameters were set to 110 kV and 10 mA and an exposure time of 18s. Field of view was set to 15x15 cm and 250µm voxel size.

Although CBCTs were not done for the purpose of this study, however the areas of interest for this study were present in the scan. Patients above the age of eighteen years having teeth from canine to first molar on both sides in mandibular arch were included in the study. Patients with a history of orthodontic treatment, mandibular fracture, periapical radiolucency in premolar region and any other surgical procedure in mandible were excluded.

First, the number of mental foramina on both left and right sides were observed. If more than one foramen was found on either side, no further data was collected from that case. Distance of the mental foramen from the lower border of the mandible on both sides was recorded. For this measurement the lower border of mental foramen was used. The measurements were done using the built-in software. The position of the mental foramen relative to the teeth was also observed. Following criteria was used to describe the location of the foramen.⁴

Position 1: Situated anterior to the first premolar

Position 2: In line with the first premolar

Position 3: Between the first and second premolars

Position 4: In line with the second premolar

Position 5: Between the second premolar and first molar

Position 6: In line with the first molar

The data was analyzed using the statistical package for social sciences (SPSS, Version 20, SPSS inc., Chicago, IL, USA).

Results

Out of the total sample, 4.5% (n=9) had accessory mental foramina hence were excluded from further evaluation. The position of the foramen was observed for the remaining 191 cases for both left and right sides respectively. Of the 191 CBCTs examined, 50.7% (n=97) were male and 49.3% (n=94) were female. Frequency of the location of foramen was ascertained (Table 1). Chi-square test showed significant difference in the position of mental foramen between left and right side with the p-value of 0.002. In the cross section taken through the center of both mental foramina, the distance from the lower border of the foramen to the base of mandible was calculated (Table 2). There was no significant difference between the two sides as shown by Paired sample t-test (p=0.826). The relationship between the gender and the distances from mental foramen to the lower border of mandible was ascertained (Table 3).

Discussion

Generally, only one mental foramen is present on either side of the mandible but an accessory foramen can also be present. In the present study, 4.5% of the subjects were found to have an accessory foramen. This incidence of accessory foramina varies between different populations with 4.5% incidence in African population¹², 6.5% in Turkish population¹¹ and 5.81% in Chinese population.⁹ Knowing the position of mental foramen is very important for avoidance of damage to the nerve is important. The most common position of mental foramen was in line with the second premolar, followed by

position between first and second premolar. Our results are in accordance with previous studies which have shown the most frequent site to be in line with the second premolar.^{13,14} This helps in planning treatment for surgical procedures in mandibular premolar region.⁵

The distance of the lower border of the mental foramen to the lower border of mandible also varies amongst different populations.^{4,8,9} This study establishes the mean distance of the lower border of mental foramen to the lower border of mandible in Pakistani population to assist dentists in treatment planning involving this region. The variation in gender seen in this study might be due to difference in jaw sizes. Multiple researches have shown significant difference in distance of mental foramen between genders.¹⁵⁻¹⁷

Table I: Frequency of location of Foramen

Position	Left		Right		Total	
	%	n	%	N	%	n
1	0.5	1	1.5	3	1	4
2	7	13	6.8	13	6.8	26
3	38.7	74	37.3	71	37.9	145
4	46	88	43.5	83	44.7	171
5	6.3	12	9.4	18	7.9	30
6	1.5	3	1.5	3	1.7	6
Total	100	191	100	191	100	382

Table II: Mean and SD for distance of mental foramen from lower border of mandible

	Left (mean \pm SD)	Right (mean \pm SD)
MF-LBM*	11.97mm \pm 1.359	12.00mm \pm 1.764

*MF-LBM: distance of mental foramen from lower border of mandible

Table III: Independent Samples t-Test to determine the difference in distance of the mental foramen between genders

	Male (mean \pm SD in mm)		Female (mean \pm SD in mm)		Significance**	
	Left	Right	Left	Right	Left	Right
MF - LB M*	12.50 \pm 1.26	12.65 \pm 1.68	11.44 \pm 1.25	11.34 \pm 1.61	0.00	0.00

*MF-LBM: distance of mental foramen from lower border of mandible

**Independent sample t-test. p-value less than 0.005 was considered significant

Conclusions

The mental foramen is located most commonly in line with the second premolar with the average distance of 11.99 mm \pm 1.561mm from the lower border of the mandible. These findings can help in safe invasive procedures in the mandibular premolar region.

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