ORIGINAL ARTICLE

Radiographic Location of Mental Foramen in Dentate Adults Visiting Dental Hospitals of Peshawar

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OBJECTIVES: To determine the location of mental foramen in panoramic radiographs of dentate adults in local population of Khyber Pakhtunkhwa visiting the Peshawar dental hospital, Khyber college of dentistry and Sardar begum dental hospital, Peshawar.
METHODOLOGY: A cross-sectional study was conducted in outpatient department of three dental hospitals of Peshawar from November 2018 to April 2019. A total of 280 subjects (140 males, 140 females) were included that fulfilled the inclusion criteria. Subjects underwent the standard OPG procedure. JPEG file format of OPG images were analyzed by Adobe Photoshop software 2008 version to analyze the location of mental foramen.
RESULTS: The mental foramen was located in class I, 0 cases (0%), class II, 11 cases (2%), class III, 295 cases (53%), class IV, 245 cases (44%) and class V, 9 cases (1%).
CONCLUSION: The most common location of mental foramen in local population of Khyber Pakhtunkhwa was between mandibular 1st and 2nd premolar (Class III).
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INTRODUCTION

Mandible is the largest and strongest bone in the human skull. It contains the teeth which is called as mandibular teeth. It consists of different part i.e., the curved part known as angle of the mandible, the horizontal part is the body of the mandible and the two perpendicular portions are the rami of the mandible. The ramus is united with the end of the body by nearly at right angle.[1]

The mandibular osteogenesis exists in the fibrous membrane which extent over the superior surface of the Meckel's cartilage. With this cartilage, two cartilaginous bars of both right and left side of the mandibular arch are developed.[2]

For the development of the mandible, Meckel's cartilage has a main role and at the intersection between proximal and middle third it is closely related with the mandibular nerve also. The lingual and inferior dental nerve are the branches of the mandibular nerve. It branches off at the junction between proximal and middle third.[3] On the inner surface of the cartilage, a nerve i.e., lingual nerve moves anteriorly, although the inferior alveolar nerve is present laterally to its superior margins and it passes parallel anteriorly and terminates into two branches i.e., the mental branch and incisive branch.[4]

Information about the location of the mental foramen is important for many reasons. In the information aids in the administration of local anesthetic and also for any surgical procedures in this region like implant placement, mandibular osteotomies, management of mandibular fractures, management of mental neuralgia, forensic analysis, surgical

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extractions of mandibular premolars, endodontic treatments & for periapical surgery etc.[5]

For clinical and diagnostic procedures, the accurate identification of mental foramen is important. The location of the mental foramen can be predicted visually[6], by palpation[7], topography[8], and via both conventional and digital radiographic.[9,10,11,12,13,14] Panoramic radiograph is widely used for dental procedures, which helps in the initial evaluation, diagnosis, treatment planning and monitoring the efficacy of treatment.[15]

The most common position of mental foramen in Pakistani subjects according to study by Shah et al., 2017 in Rawalpindi and Punjabi et al., 2010 in Karachi was directly inferior to long axis of 2nd premolar.[16,17] They used digital panoramic radiographs for location of mental foramen. There was no significant difference between genders of different ages according to their study.

The limitations of this study are the limited age group and findings of the study are not evenly generalized to our population of Peshawar. Therefore, it is suggested that large cohort/ case control study should be done in our population. The aim of the study was to determine the location of mental foramen in three dental hospitals of Peshawar. The data from this study will be useful in location of mental foramen for administrating the local anesthesia for mental block, for implant placement, in endodontic treatment, and for any surgical procedures in mandibular premolar region.

METHODOLOGY

The cross-sectional study was conducted in Out Patient Department (OPD) of Peshawar Dental Hospital, Khyber College of Dentistry and Sardar Begum Dental Hospital. Sample size was calculated with the help of Currie et al, 2015 by using G power v.3.1.9.2. The study group comprised of 280 patients. Both male and female gender were included, out of which 140 were males and 140 were females who required panoramic radiographs for their various dental treatments. The age range was 21-40 years. This age group was selected because premolars are fully erupted, the anatomy is preserved in this age; there is no or little attrition. As premolars erupt in 10-12 years but some time there is variation in eruption of teeth. Root completion is about 14-15 years but as there is variation in eruption, if there is delayed eruption then there will be delayed root completion, so that's why 21-40 years of age group was selected.

The inclusion criteria are as follows: 1) Mental foramen clearly visible on both side of the mandible as seen in OPG. 2) Presence of fully erupted mandibular teeth between right mandibular 2nd premolar to left mandibular 2nd premolar. The exclusion criteria are as follows: 1) Cyst or tumor in the mandibular region. 2) History of fracture in mandible. 3) History of an orthodontic treatment. 4) Pregnant women, physical/ mental handicapped, prisoners and other vulnerable population. 5) Missing Premolars. 6) Crowding of premolars.

Informed consent was taken from all the patients included in the study. The data of the patients were recorded on a specially designed Proforma. The standardization of the radiographs was ensured so that image parameters were set to 64-70 kv and 8-10 mA and exposure time 10-12 sec. ALARA (As Low as Reasonably Achievable) principle was applied for reducing radiation exposure.

The analysis of the soft copy of the images of OPG was done in Adobe Photoshop 8 CS Software version 2008 by drawing a longitudinal line joining the cusp tip and root apex of mandibular 1st and 2nd premolar. After evaluation of each panoramic radiograph, the location of mental foramen were reported on the basis of gender and symmetry (or) asymmetry. The data of the mental foramen location was recorded in the data sheets and observations was entered and analyzed using the computer program (SPSS, version 22, SPSS Corp, Chicago IL, USA). Descriptive statistics in the form of mean and standard deviation for the age and percentage relating to location of mental foramen were done.

RESULTS

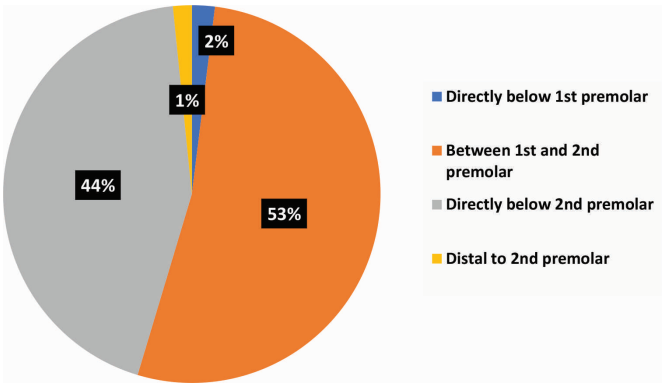
Two hundred eighty panoramic radiographs taken for the diagnostic purposes and full filling the inclusion criteria were obtained from the OPD of three dental colleges i.e., Peshawar Dental Hospital, Khyber College of Dentistry and Sardar Begum Dental Hospital. The sample consists of equal numbers of males and females i.e., 140 males and 140 females. The mean age was 30.61 ± 5.933 (SD) (range of 21-40 years). On the basis of whole study group, the most common location of mental foramen was Class III (between the cusp tip and root apex of mandibular 1st and 2nd premolar) in 53% of cases and 2nd most common location was Class IV (directly below the cusp tip and root apex of 2nd premolar) i.e., in 44% of cases. No number of cases were found in Class I (mesial to cusp tip and root apex of mandibular 1st premolar) (Table 1) (Fig: 1).

In relation to the gender, the most frequent location in males was Class IV (directly below the cusp tip and root apex of 2nd premolar) on right side in 51.4% cases and on left side it was Class III (between the cusp tip and root apex of 1st and 2nd premolar in 53.6% of cases. The 2nd most common location of mental foramen in males on right side was Class III (between the mandibular 1st and 2nd premolar) i.e., 45.7% and on left side, it was Class IV (directly inferior to cusp tip and root apex of mandibular 2nd premolar)

Table 1: Mental foramen locations with respect to whole study group

Location of mental foramen	Class I N (%)	Class II N (%)	Class III N (%)	Class IV N (%)	Class V N (%)
Total	0 (0.0%)	11 (2%)	295 (53%)	245 (44%)	9 (1%)

Figure 1: Location of mental foramen with respect to study group



(38.6%). The least common location of mental foramen was Class V (distal to the cusp tip and root apex of mandibular 2nd premolar) on both right and left side (2.9% & 1.4%). Only 6.4% cases were found in Class II (directly inferior to cusp tip and root apex of mandibular 1st premolar) on left side (Table 2) (Fig: 2).

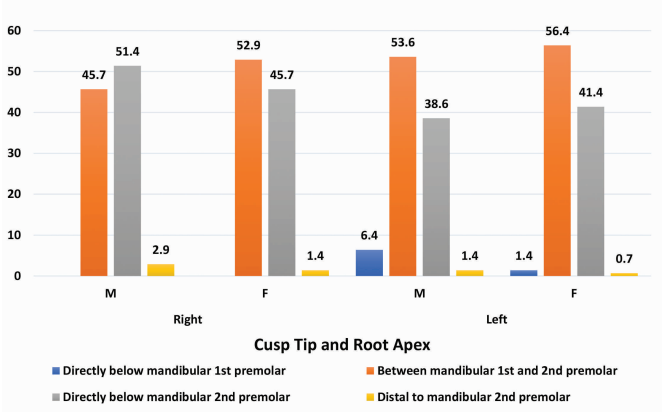
In females, the most frequent location of mental foramen was Class III (between the cusp tip and root apex of 1st and 2nd premolar) on both right (52.9%) and left (56.4%) side. The 2nd most common location of mental foramen was Class IV (directly inferior to cusp tip and root apex of mandibular 2nd premolar) on both right and left side (45.7% and 41.1%).

Table 2: Mental foramen locations with respect to sides of the jaw in relation to males

MF location in Males	Right	Left
	N (%)	N (%)
Mesial to mandibular 1st premolar buccal cusp tip and root apex (Class I)	0 (0.0)	0 (0.0)
Directly below mandibular 1st premolar buccal cusp tip and root apex (Class II)	0 (0.0)	9 (6.4)
Between mandibular 1st and 2nd premolar buccal cusp tip and root apex (Class III)	64 (45.7)	75 (53.6)
Directly below mandibular 2nd premolar buccal cusp tip and root apex (Class IV)	72 (51.4)	54 (38.6)
Distal to mandibular 2nd premolar buccal cusp tip and root apex (Class V)	4 (2.9)	2 (1.4)
Total	140	140

1.4% cases were found in Class II (directly inferior to cusp tip and root apex of mandibular 1st premolar) on left side of mandible in females. The least common location was

Figure 2: Location of mental foramen in relation with cusp tip and root apex in both gender



Class V (distal to the cusp tip and root apex of mandibular 2nd premolar) on both right and left side (1.4% & 0.7%). Only 1.4% cases were found in Class II (directly inferior to cusp tip and root apex of mandibular 1st premolar) on left side of mandible (Table 3) (Figure 3).

In both genders, no Class I (mesial to cusp tip and root apex of right mandibular 1st premolar) location was found. (Table 2, 3) (Fig: 2, 3).

Table 3: Mental foramen locations with respect to sides of the jaw in relation to females

MF location in Females	Right	Left
	N (%)	N (%)
Mesial to mandibular 1st premolar buccal cusp tip and root apex (Class I)	0 (0.0)	0 (0.0)
Directly below mandibular 1st premolar buccal cusp tip and root apex (Class II)	0 (0.0)	2 (1.4)
Between mandibular 1st and 2nd premolar buccal cusp tip and root apex (Class III)	74 (52.9)	79 (56.4)
Directly below mandibular 2nd premolar buccal cusp tip and root apex (Class IV)	64 (45.7)	58 (41.4)
Distal to mandibular 2nd premolar buccal cusp tip and root apex (Class V)	2 (1.4)	1 (0.7)
Total	140	140

Figure 3: Determination of Mental foramen location in panoramic radiograph

In relation to sides of the jaw, 49.1% of cases were found between the cusp tip and root apex of mandibular 1st and 2nd premolar (Class III) on right side and 55% cases on left side and 2nd most common location was directly inferior to cusp tip and root apex of mandibular 2nd premolar (Class IV) i.e., 48.6% on right side and 40% cases on left side. No number of cases were found on mesial to cusp tip and root apex of right and left mandibular 1st premolar (Class I) and also on right side of mandible 0% cases were found on directly inferior to cusp tip and root apex of mandibular 1st premolar (Class II). The least common location was distal to cusp tip and root apex of mandibular 2nd premolar (Class V) on both right and left side (2.1% & 1.1%) and 2nd most least common location was directly inferior to cusp tip and root apex of mandibular 1st premolar (Class II) on left side (3.9%) (Table: 4).

Table 4: Mental foramen locations with respect to sides of the mandible

Position of Mental Foramen	Mesial to mandibular 1st premolar buccal cusp tip and root apex (Class I)	Directly below mandibular 1st premolar buccal cusp tip and root apex (Class II)	Between mandibular 1st and 2nd premolar buccal cusp tip and root apex (Class III)	Directly below mandibular 2nd premolar buccal cusp tip and root apex (Class IV)	Distal to mandibular 2nd premolar buccal cusp tip and root apex (Class V)
	N (%)	N (%)	N (%)	N (%)	N (%)
Right Side	0 (0.0)	0 (0.0)	138 (49.1)	136 (48.6)	6 (2.1)
Left Side	0 (0.0)	11 (3.9)	154 (55.0)	112 (40.0)	3 (1.1)

DISCUSSION

This study determined if gender, age and side of the jaw was an important variable for the location of mental foramen. The adult dentate adults visiting Out-Patient Department of Peshawar Dental College, Khyber College of Dentistry and Sardar Begum Dental hospital. The age group of 21-40 years were selected. The time interval for the study was 6-12 months. The location of mental foramen was done using soft images of subjects OPGs using Adobe Photoshop 8 CS, version 2008.

According to the current study, the overall frequency of position of mental foramen was class III (between the cusp tip and root apex of mandibular 1st and 2nd premolar) in the radiographs of the recruited patients. According to study group it was found to be 53% (295 out of 560 both sides of Mandibular premolars teeth of both genders). According to the sides of the jaw (right and left sides) i.e., 49.1% and 55% respectively. The location of mental foramen with respect to gender on both sides (Males= 45.7% on right side and 53.6% on left side, Females= 52.9% on right side and 56.4% on left side) (Table 5.1, 5.2, 5.3, 5.4) (Fig 5.1, 5.2, 5.3). These finding are in close proximity to Abed et al (2016) who observed a prevalence rate of mental foramen position in a hospital-based population of Jeddah, Saudi Arabia[18] was 57.89% of patients (total sample size of 950 panoramic radiographs). In 2015, another study conducted in 600 Iraqi patients' panoramic radiographs by Al-Shayyab[19] found out a frequency of 48.6% which in agreement to this study. In a study by Gungor et al (2006), the overall frequency of location of mental foramen was reported to be 71.5%.[20] He carried out the study on selected Turkish population with a sample size of 361 panoramic radiographs. Currie et al., conducted a study on UK based population in 2015 of patients with an age group between 18-30 years showed a higher frequency of mental foramen location in both premolars' crown (51%) and apex (76%) taking as reference point.[9]

Contrary to the results of this study, in 2003 by Ngeow in Malay population, 2010 by Singh in India and 2013 by Afkhami in Iranian population reported the most common location was Class IV i.e., directly inferior to mandibular 2nd premolar (69.2%, 68.8% and 67% respectively). According to this study, on the basis of whole sample size (44%), sides (R= 48.6% and L= 40%) and gender on both right and left side (Males = 51.4%, 38.6%, Females = 45.7%, 41.4%) (Table 5.1, 5.2, 5.3, 5.4) (Fig 5.1, 5.2, 5.3). The results of right side of males only agrees with Ngeow et al., 2003, Singh et al., 2010 and the Afkhami et al., 2013.[21,22,25]

In the current study the Class II (directly inferior to the apex of mandibular 1st premolar) position of mental foramen was 2% of the whole sample population, according to sides 0% on right side and 3.9% on left side and with respect to gender of both right and left side was (Males = 0%, 6.4% Females = 0%, 1.4%) respectively. Our studies agree with Punjabi et al.,2010 (4.5% out of 1000 patients), Al-Shayyab et al., 2015 (2.6% of whole sample population i.e., 518 panoramic radiographs, and according to gender on both right and left side males= 1.6%, 2.7% and females= 2.3% and 3.85% respectively) and Abed et al., 2016 (0.21% out of 950 radiographs).[17,18,19]

Similarly, in this study Class V (MF distal to 2nd premolar) is the least common position i.e., 1% of the whole sample population, 2.1% on right side and 1.1% on left side out of 280 panoramic radiographs and 2.9% on right side and 1.4% on left side of males and 1.4% on right side and 0.7% on left side of females. These findings are in concordance with those of Abed et al., (2016) (0.1%), Al-Shayyab et al., (2015) 4.9% out of 518 radiographs, 5.8% on right side and 6.6% on left side of males' mandible and 4.2% on right side and 2.7% on left side of females'

mandible.[18,19] These findings are in contradiction to the discoveries of study done in 1998 by Mbajiorgu et al., in Zimbabwean population who observed most of their cases in Class V.[24]

In this study no number of cases were found in Class I (anterior to mandibular 1st premolar) which is in agreement with the study done in Iraqi population by Al-Shayyab et al 2015, in Saudi Population by Abed et al.,2016, in Karachi by Punjabi et al.,2010, Ngeow et al., 2003 and in India by Singh et al., 2010.[17,18,19,22,25] (Table 5.1, 5.2, 5.3, 5.4) (Fig 5.1, 5.2, 5.3).

The variation in the frequencies of position of mental foramen among various studies may be because of the participation of different populations who displayed different frequency rates.

CONCLUSION

The most common location of mental foramen was found to be between mandibular 1st and 2nd premolar in relation to cusp tip and root apex (Class III) with respect to age, gender and side of the arch, closely followed by Class IV presence.

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CONFLICT OF INTEREST

None declared

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