Assessment of variations in the location of Mental Foramen by means of Cone Beam Computed Tomography

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ABSTRACT

Objective: To determine variations in the location of mental foramen by means of Cone Beam Computed Tomography.
Study Design: Descriptive Cross-sectional Study.
Place and Duration: Rehman College of Dentistry, Peshawar from 1st Jan 2018 to 30th June, 2019.
Methodology: The Cone Beam Computerized Scans were evaluated and Mental foramen positions were categorized into Type I (beneath apex of 2nd premolar) type-II (between 1st and 2nd premolar) type- III (between 2nd premolar and 1st molar) and type-IV(distal to 1st molar root apex). Mental foramen position was stratified among left and right side of mandible.
Results: On evaluation of 264Cone Beam Computerized Scans, the most common location of Mental foramen was type-I (56.44%), followed by type-II (39.20%). Type-III and type-IV were having the prevalence of 3.98% and 0.37% respectively.
Conclusion: Type-I is the most common location of mental foramen followed by type-II in the studied population.
Keywords: Mandible**,** Mental foramen, Mental nerve, Cone beam computed tomography, Ionizing radiation, Bicuspid

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INTRODUCTION

An oval, round, bilateral opening located apical to mandibular bicuspids, is termed as mental foramen (MF). Mental nerve passes through MF and supplies teeth, lower lip, gingival and buccal mucosa of the bicuspids and the related mandibular regions with sensory innervations[1,2]. The location of MF has been described by early researchers who agree that mental foramen location is not a constant entity but can vary among different races[3]. Apical area of the second premolar and the space between the apices of the first and second premolars is the most common horizontal location of MF[4]. Variable methods used for determining accurate location of MF before surgical procedures to avoid iatrogenic injuries to MF include; manual palpation, direct visualization during surgical procedures, cadaveric dissection, peri-apical and panoramic radiographs, MRI, CT scans and Cone-Beam Computed Tomography (CBCT).

Hasan et al described the position of MF in the area from sub-canine to sub-molar region and its location is right away affected by age, gender, racial group, tooth loss and alveolar bone resorption[5]. Similar studies were conducted in Saudi Arabia by Al-Mahalaway et al (52.8%) and by Amorim et al in Brazil[6,7].

The MF is a vital anatomic landmark for different dental procedures. Error in locating mental foramen may damage its contents which can induce sensory disturbances[8]. Mental foramen is a common site for iatrogenic injuries to Mental nerve. Therefore, knowledge regarding variations in MF position can play important role in different procedures to avoid temporary or permanent nerve injury[9]. Location of MF may also help in forensic identification of various races, determination of age and gender of an individual[10]. Most techniques used for determination of MF are not cost effective, have exposure to radiations and magnification issues[11]. Therefore the rationale of this study is that CBCT is the most precise method available to assess MF location in terms of accuracy and this study will provide valuable information regarding MF position to Dentals surgeons as well as to forensic odontologists and anthropologists. So, this study was conducted with an objective to determine variations in the location of mental foramen by means of Cone Beam Computed Tomography.

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METHODOLOGY

In this Descriptive Cross-sectional study, the Cone-Beam Computed Tomography (CBCT) scans of mandible performed from1st January, 2018 till 30th June, 2019 were analyzed. The data was recruited from Oral Medicine Department, Rehman College of Dentistry, Peshawar, KPK. The sample size of 264 CBCT scans was determined by using WHO calculator and non-probability, consecutive sampling technique was used for sample collection. The images were taken by "Carestream Germany, model no. 90003D" with 74 kv (male patients), 70kv (female patients), 10mA. All CBCT scans were having standard resolution of 0.3mm voxel and 10.8 s. The CBCT images taken covered the area of interest and matched with exclusion and inclusion criteria. Patients aged 18 years or above with canine to first permanent mandibular molar teeth present on both sides of the mandible were included. Patients having mixed dentition, malocclusion or history of any pathology or surgery in mandible were excluded from this study. In the total sample of 264 CBCT scans,the location of MF was observed for both right and left side of the mandible.

The postero-anterior position (location) of MF was recorded as categorized by Pyun et al. 2013[12] (Figure 1). MF position was categorized into following four types i.e.

Type I: Beneath the apex of the second premolar
Type II: Amid the apices of the 2nd and 1stpremolar
Type III: Amid the apices of the 1st molar and 2nd premolar
Type IV: Distal to the root tips of first molar

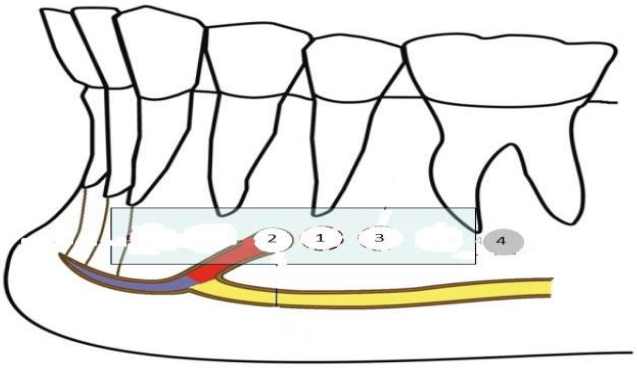

Figure-1: Posteroanterior position of Mental foramen

Data Analysis: The frequency of MF location was calculated by descriptive statistics. Pearson chi square test was used to compare 4 types of location. Data was analyzed using SPSS (version 20). Differences were considered to be significant at a p value < 0.05.

RESULTS

Out of 264 scans, 51.14%(n=135) scans were of male patients and 48.86%(n=129) belonged to female patients.

The location of right MF varied among four types with the highest incidence of type-I,(56.82%, n=150), followed by type-II (37.50%,n=99). Type-III, had a prevalance of 5.31%(n=14) and type-IV was 0.37%(n=1) (Table-I).

Table-I: Right mental foramen location in context to adjacent teeth in the mandible (N=264)

Mental foramen Location (right side)	Frequency, n(%)
type 1: Beneath the apex of the 2nd premolar	150 (56.82%)
type 2: Amid the apices of the 2nd and 1st premolar	99 (37.50%)
type 3: Amid the apices of the 1st molar and 2nd premolar.	14 (5.31%)
type 4: Distal to root tips of 1st molar	1 (0.37%)
Total	264 (100%)

Frequency of location of left MF was 56.06%(n=148) in type-I followed by 40.92%(n=108) for type-II, 2.65%(n=7) for type-III and 0.37%(n=1) for type- IV as shown in table-II.

Table-II: Left mental foramen location in context to adjacent teeth in the mandible.(N=264)

Left mental foramen location	Frequency, n(%)
type 1: Beneath2nd premolar apex	148 (56.06%)
type 2: amid the apices of the 2nd and 1st premolar	108 (40.92%)
type 3: Between the apices of the 1st and 2nd premolar.	7 (2.65%)
type 4: Distal to apex of 1st molar	1 (0.37%)
Total	264 (100%)

Commulative frequency of MF location on both sides of mandible show most common location of MF was type-I (56.44%, n=298)), followed by type-II (39.20%, n=207). Type -III and type IV were having the prevalence of 3.98%(n=21) and 0.38%(n=1) respectively as shown in Table-III). The findings are not statistically significant(p >0.05)

Table-III: Location of Mental foramen in relation to adjacent teeth in the mandible on both sides (N=264)

Mental foramen location	Right mental foramen	Left mental foramen	Total
type 1	150(56.82%)	148(56.06%)	298 (56.44%)
type 2	99(37.5%)	108(40.915)	207(39.20%)
type 3	14(5.3%)	7(2.65%)	21 (3.98%)
type 4	1(0.37%)	1(0.37%)	2(0.38%)
p- value	0.23		

DISCUSSION

Mental Foramen is a morphological landmark that is significant in various dental procedures irrespective of the field. The precise position of the foramen is difficult to assess as it varies greatly from population to population. The present study was aimed to assess variations in location of MF by means of CBCT. Our results illustrate that type 1 is the most common location of MF followed by type 2 in our population.

A study conducted on Saudi population utilizing panoramic radiographs presented that in females the MF was located apical to mandibular 2nd premolar that is type 1 location[13]. Similarly, Al Mahalaway et al found 52.8% prevalence of type 1 MF location

in Saudi population[9].These results are in line with many epidemiological studies which show that the most common location is either type 1 or type 2[10].

Punjabi et al found 47.2% prevalence of type 1 location (below 2nd premolar apex) of MF followed by type 2 (40.4%)[14]. Another study done on dried human mandibles by Rehman et al indicated that 70% of the cases were having type 1 MF location in our community[15].These results are supported by research conducted using CBCT's by Shah et al.[16] in Pakistan.

In contrast, Muinelo-Lorenzo et al and Oliveira et al stated that type 2 is the most frequent location of MF[17]. This conclusion is similar to the study performed by Verma et al[18]. Their result is in contrast to our result. The reason can be due to demographic variations or difference in sample size. Location of MF varies among different populations e.g In Zimbabwean population type 3 was observed as common location of MF, while type 2 was common horizontal position of MF in Iranian and British according to some studies. Type 1 was found commonly in Chinese, Indians, mongoloid and Africans[19]

CONCLUSION

We conclude that type 1 is the most common location of mental foramen followed by type 2 in the studied population. However, variation in morphology and anatomy may occur, therefore, care should be taken to avoid damage to the vital contents of mental foramen.

Recommendations: Further studies are recommended with larger sample of representative population and to abate the differences produced by the resorption of alveolar bone.

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AUTHOR'S CONTRIBUTION

Jamil Y: Conceived idea, Literature Search, Manuscript writing.
Rehman AZU: Data Interpretation, Statistical Analysis.
Alam S: Designed Research Methodology.
Salam S: Data collection
Irshad M: Manuscript final reading.
Khattak MA: Literature review.

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