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Location of mental foramen on Panaromic radiograph: A Delima for oral radiologists

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Abstract
Objective: The purpose of this study was to determine the most common location of the mental foramen (MF), its gender differences and bilateral symmetry in a selected Kashmiri population and to compare the results with those reported for other populations.
Materials and Methods: 160 digital panoramic radiographs (DPR) of randomly selected Kashmiri population were retrospectively studied.
Results: There were 160 (320 sides) patients with panaromic radiographs with age range of 18 -72 years and a mean age of 34.5±17.46 in males and 31.6±12.66 in females. The most common position of mental foramen was position IV (foramen along the longitudinal axis of second premolar) in 45% cases followed by position III (foramen lying on the longitudinal axis passing between first premolar and second premolar) in 29% cases. The least common location of mental foramen is position VI (foramen lying on longitudinal axis of first molar) in 1.8% cases.
Conclusions: Mental foramen were usually symmetrically located either mesial to or in line with second premolar but in some (small percentage) cases it can be found asymmetrical and at other positions. Therefore, our reasoning for the difference in the positioning and symmetrical location of the MF in different populations might be influenced mainly by the genetics, environmental and local factors influencing growth and development of the mandible.

Keywords: digital panoramic radiograph, mental foramen, mental nerve

Introduction

Mental foramen (MF) is one of the important anatomical landmark for giving local anesthesia to mental nerve which is one of the terminal branches of the mandibular nerve. Generally, it is difficult to locate the mental foramen due to lack of consistent anatomical landmarks for reference and the mental foramen cannot be clinically visualized or palpated [1]. Inferior alveolar nerve, a branch of mandibular nerve passes through the mandibular canal and reaches to mental foramen where it branches into two terminal branches mental and incisive nerves. The mental nerve passes through the mental foramen and innervates the lower lip, the buccal vestibule, and the gingiva up to the mesial surface of the first mandibular molar of same side. The exact location of the mental foramen should be identified for nerve blocks [2, 3]. Injury to mental nerve lead to temporary or permanent changes in thermal and tactile sensations, and during surgical procedures locating the mental foramen helps to prevent such injuries [4]. According to Moiseiwitsch, there is individual variation in location of the MF anywhere from below the canine to between the roots of the first molar [5]. According to Yosue and Brooks, the location of mental foramen on panoramic radiograph has been classified into four types: in the first mental canal is continuous with the mandibular canal; the second is the separated type, where the foramen is distinctly separated from the mandibular canal, a third is said to be diffuse with a distinct border of the foramen, while the fourth group is so called unidentified type [6, 7].

The purpose of this study was to determine the most common location of the mental foramen (MF), its gender differences and bilateral symmetry in a selected Kashmiri population and to compare the results with those reported for other populations.

Materials and methods

This cross-sectional descriptive study was done in the Department of Oral Medicine and Maxillofacial Radiology, Government Dental College Srinagar. One hundred and sixty panoramic radiographs (320 sides) were selected from the patients who reported in our department for treatment. Standardized Digital Panoramic Radiograps were taken by Kodak Dicom 8000 system (tube potential: 60-90 KV, tube current: 2-15 mA, and time: 14 s). The magnification factor reported by the manufacturers was 1.2.

Inclusion criteria include

- Images with minimal technical errors,
- Acceptable density and contrast,
- Minimal structural super impositions, and
- The presence of at least 22 teeth (which must include mandibular canines, premolars, and first molars).

The exclusion criteria were

- Pathologic lesions in the mandible,
- Unerupted or the presence of supernumerary teeth or gross crowding in the mandibular premolar area,
- The presence of periodontal lesions in the mandibular premolar area,
- Fractures of mandible,
- Patients with intraosseous lesions,
- Orthognathic surgery, orthodontic treatment and
- Periapical pathologies.

The study included 80 females and 80 males, with age range of 18 – 72 years.
The position of the image of the mental foramen was recorded as follows:
Position I: Situated anterior to the first premolar
Position II: In line with the first premolar
Position III: Between the first and second premolars
Position IV: In line with second premolar
Position V: Between the second premolar and mesiobuccal root of first molar
Position VI: In line with the mesio-buccal root of first molar
According to Kjaer, [8] the location of the mental foramen could change during the development of the jaws, therefore the subjects over 18 years of the age were chosen for the study. The following measurements were taken as shown in fig.1

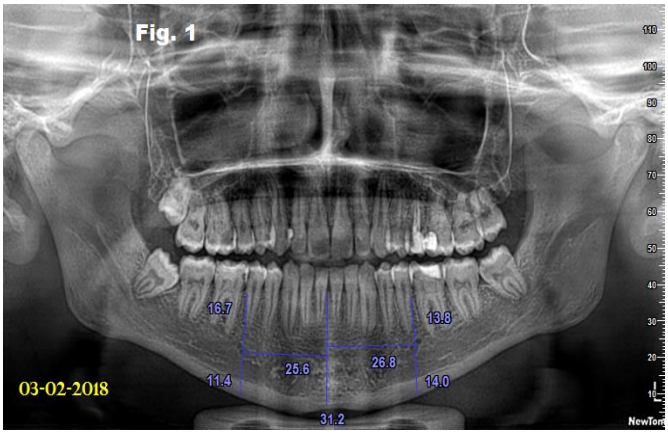

Fig 1

MR1=distance from mental foramen to superior alveolar border on right side
MR2=distance from mental foramen to inferior alveolar border on right side
MR3=distance from mental foramen to midline on right side
ML1= distance from mental foramen to superior alveolar border on left side
ML2= distance from mental foramen to inferior alveolar border on left side
ML3= distance from mental foramen to midline on left side
FR1-FL1=distance between right and left foramen.

Statistical Methods: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Data were expressed as Mean±SD. Student's independent t-test was employed for comparison of various parameters between males and females. A p-value of less than 0.05 was considered statistically significant.

Results: In this study 160 patients with panaromic radiographs were assessed having age range of 18 -72 years with a mean age of 34.5±17.46 in males and 31.6±12.66 in females. Table 1 shows the age wise distribution of mental foramen with no difference between males and females statistically.

Table 1: Age distribution

Age (years)	Males		Females		P-value
	No.	%age	No.	%age	
< 20	18	22.5	21	26.3	0.231
20-29	26	32.5	28	35.0	
30-39	11	13.8	14	17.5	
40-49	9	11.3	7	8.8	
50-59	5	6.3	2	2.5	
≥ 60	11	13.8	8	10.0	
Total	80	100	80	100	
Mean±SD	34.5±17.46		31.6±12.66		

Table-2 showing comparison of various parameters with stastically significant difference between males and females in parameters MR2, ML2, ML3 and FR1-FL1.

Table 2: Showing comparison of various parameters between males and females

Parameter	Males		Females		P-value
	Mean	SD	Mean	SD	
MR1	16.79	2.60	16.45	2.79	0.423
MR2	11.61	1.47	10.79	1.85	0.002*
MR3	26.33	3.98	26.32	3.45	0.985
ML1	16.54	2.67	16.11	2.33	0.275
ML2	11.95	1.79	10.55	2.28	<0.001*
ML3	25.72	4.28	27.48	4.83	0.016*
FR1-FL1	51.90	5.90	54.05	7.46	0.045*

*Statistically Significant Difference (P-value<0.05)

Graphic representation of various parameters in males and

females with stastically significant difference in parameters MR2, ML2, ML3 and FR1-FL1.

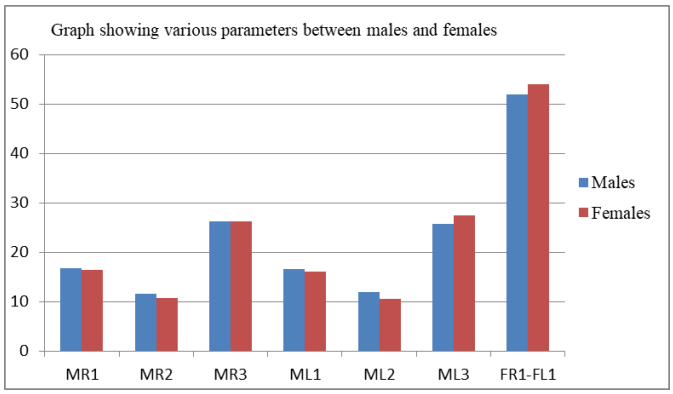

Fig 2

Table-3 showing distribution of position of mental foramen in males and females with position IV being most common location of mental foramen and least common location is position VI.

Table 3: Showing distribution of position of mental foramen in males and females

	Position-I	Position-II	Position-III	Position-IV	Position-V	Position-VI
Males (n=80)	1	10	24	36	8	1
Females(n=80)	4	9	23	36	6	2
Total(160)	5	19	47	72	14	3

Discussion

Panoramic radiography (PR) shows maxilla as well as mandible of both right and left sides, thus allowing for a more accurate localization of both mental foramina in both vertical and horizontal dimensions. On other hand, the drawback of periapical radiograph is that it may not reveal the position of the mental foramen if it is below the edge of the film. [9] The position of the MF in relation to the mandibular body is probably more precise, and is not affected by factors such as malocclusion, mesiodistal width of the tooth, race, nutrition, and age [10]. However, in most studies, the position of this foramen is assessed in relation to the teeth, in order to make its use simpler in clinical applications [11]. According to the most authors the mental foramen is frequently situated along the long axis of the second premolars in the fully developed mandible, while some reported that it lies between first and second premolars but occasionally individual variations can also occur [12, 13, 14, 15, 16-31]. In our analysis of 160 panoramic radiographs we found the mental foramen can be present anywhere between the canine to the mesiobuccal root of first molar. However, in many other studies it was found in between the long axis of first premolar to the mesial of first molar but the location below the canine or first molar was either absent or very rarely present. In our study the most common position of mental foramen was position IV (foramen along the longitudinal axis of second premolar) in 45% cases followed by position III (foramen lying on the longitudinal axis passing between first premolar and second premolar) in 29% cases. The least common location of mental foramen was position VI (foramen lying on longitudinal axis of first molar) in 1.8% cases. Both these location of MF were also found most common in almost all of our reviewed literature. These two positions were making an overall prevalence of 74.3%. Another study on Indian population also showed that these two positions were most common and seen in 81.1% of population [32]. According to study by Sina Haghanifer *et al.* on Iranian population, position III and IV were found in 93.2% [33]. There is considerable debate regarding the normal position of the mental foramen in different populations. Studies done by Moiseiwtsch [5] in a North American white population, by Rupesh *et al.* [4] in a Asian Indians, by S. Haghanifar *et al.* [33] in an Iranian population, by Taseir AL-khateeb *et al.* [34] in a northern regional Jordanian population and Olasoji *et al.* [35] in Northern Nigerian adults showed that the most common location of the mental foramen was between first and second premolars. But according to our study the most common location is, foramen lying along the longitudinal axis of second premolar. However some studies done on similar or different populations such as Asian Indians by Shankland [13], Central regional Indians by S Gangotri, [15] Malays by Ngeow and Yuzawati [16], black Zimbabweans by Mbajiorgu [21], Kenyan Africans by Mwaniki and Hassanali, [22] Iraqis by Muhsen [23], Saudis by Al-Jasser and Nwoku [14] and Koreans by Kim [36] have indicated that MF was most commonly positioned in line with the second premolar. Their findings were consistent with our results.

No significant differences were seen between males and females either in positioning or symmetry of the mental foramen in our study. It would therefore appear that, the location of the MF is not gender-dependent. Ngeow and Yuzawati *et al.* [16] stated that this location of the mental foramen in relation to the first and second premolars is influenced by genetics of population and that other positions could be due to a lag in the development during prenatal stage. Most studies indicated that MFs were usually symmetrically located at either position III or IV but in some (small percentage) cases it can be found asymmetrical and at other positions. Therefore, our reasoning for the difference in the positioning and symmetrical location of the MF in different populations might be influenced mainly by the genetics, environmental and local factors influencing growth and development of the mandible.

Conclusions

Mental foramen were usually symmetrically located either mesial to or in line with second premolar but in some (small percentage) cases it can be found asymmetrical and at other positions. Therefore, our reasoning for the difference in the positioning and symmetrical location of the MF in different populations might be influenced mainly by the genetics, environmental and local factors influencing growth and development of the mandible.

References

1. Phillips JL, Weller RN, Kulid JC. The mental foramen: Part I. Size, orientation, and positional relation to the mandibular second premolar. J Endod. 1990; 16:221-223.
2. HwangK, Lee WJ, Song YB, Chung IH. Vulnerability of the inferior alveolarnerve and mental nerve during genioplasty: an anatomic study. J Craniofac Surg. 2005; 16(1):10-4. [PubMed: 15699638].
3. Quirynen M, Mraiwa N, van Steenberghe D, Jacobs R. Morphology anddimensions of the mandibular jawbone in the interforaminal regionin patients requiring implants in the distal areas. Clin Oral Implants Res. 2003; 14(3):280-5. [PubMed: 12755778].
4. Rupesh S, Winnier J, John SA, Joy T, Rao AP, Reddy V. Radiographic study of the location of mental foramen in a randomly selected Asian Indian population on digital panoramic radiographs. J Med Sci. 2011; 11(2):90-5.
5. Moiseiwitsch JR. Position of the mental foramen in a North American, white population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998; 85:457-46.
6. Yosue T, Brooks SL. The appearance of mental foramina on panoramic and periapical radiographs. II. Experimental evaluation. Oral Surg Oral Med Oral Pathol. 1989; 68:488-92.
7. Yosue T, Brooks SL. The appearance of mental foramina on panoramic radiographs. I. Evaluation of patients. Oral Surg. Oral Med. Oral Pathol. 1989; 68:360-364.
8. Kjaer I. Formation and early prenatal location of the human mental foramen. Scand. J. Dent Res. 1989; 97:1-7.
9. Philips JL, Weller RN, Kulild JC. The mental foramen: Part 2. Radiographic position in relation to the mandibular second premolar. J Endod. 1992; 18:271-274.
10. Al-Khateeb T, Al-Hadi Hamasha A, Ababneh KT. Position of the mental foramen in a northern regional Jordanian population. Surg Radiol Anat. 2007; 29(3):231-7. doi: 10.1007/s00276-007-0199-z. [PubMed: 17375258].
11. Green RM. The position of the mental foramen: a comparison between the southern (Hong Kong) Chinese and other ethnic and racial groups. Oral Surg Oral Med Oral Pathol. 1987; 63(3):287-90. [PubMed: 3473355].
12. Phillips JL, Weller RN, Kulid JC. The mental foramen: Part I. Size, orientation, and positional relation to the mandibular second premolar. J Endod. 1990; 16: 221-223.
13. Shankland WE. The position of the mental foramen in Asian Indians. J Oral Implantol. 1994; 20:118-123.
14. Al-Jasser, NM and. Nwoku AL. Radiographic study of the mental foramen in a selected Saudi population. Dentomaxillofacial Radiol. 1998; 27:341-343.
15. Shweta Gangotri, Patni VM, Sathwane RS. Radiographic Determination of Position and Symmetry of Mental Foramen in Central Indian Population. JIAOMR. 2011; 23(2):101-103.
16. Ngeow WC, Yuzawati Y. The location of the mental foramen in a selected Malay population. J Oral Sci. 2003; 45:171-5.
17. Philips JL, Weller RN, Kulild JC. The mental foramen: Part 2. Radiographic position in relation to the mandibular second premolar. J Endod. 1992; 18:271-274.
18. Atkinson ME, White FH. The skeletal system. Principles of Anatomy and Oral Anatomy forDental Students. 1 st ed. Edinburgh: Churchill Livingstone, 1992, 120.
19. Woelfel JB, Scheid RC. Structures that form the foundation for tooth function. Dental Anatomy: Its relevance to dentistry. 6 th ed. Newyork: Lippincott, Williams and Wilkins, 2002, 19.
20. Rajani Singh A, Srivastav K. Study of position, shape, size and incidence of mental foramen and accessory mental foramen in adult human skull. Int.j.morphol. 2010; 8(4):1141-1146.
21. Mbajiorgu EF, Mawera G, Asala SA, Zivanovic S. Position of the mental foramen in adult black Zimbabwean mandibles: a clinical anatomical study. Central African Journal of Medicine. 1998; 44:24-30.
22. Mwaniki DL, Hassanali J. position of mandibular and mental foramina in Kenyan African mandibles. East Afr Med J. 1992; 69(4):210.
23. Salah Muhsen J. Horizontal and vertical position of the mental foramen on panoramic views of a selected Iraqi population. J Bagh Coll Dentistry. 2011; 23(1):69-72.
24. Montagu MFA. The direction and position of the mental foramen in the great apes and men. Am J Phys Anthrop. 1954; 12:503-518.
25. Al Jasser NM, Nwoku AL. Radiographic study of the mental foramen in Saudi females. Saudi Med J. 1996; 17:471-474.
26. Matsuda Y. Location of the dental foramina in human skulls from statistical observations. Am J Orthod. 1927; 13:299-305.
27. Philips JL, Weller RN, Kulild JC. The mental foramen: Part 3. Size and position on panoramic radiographs. J Endo. 1992; 18:383-386.
28. Tebo HG, Telford IB. An analysis of the variations in position of the mental foramen. Anat Rec. 1950; 107:61-66.
29. White SC, Pharoah MJ. Normal radiographic anatomy. Oral Radiology: Principles and interpretations. 5th ed. St. Louis: Mosby, 2004, 183.
30. Liebgott B. The skull. The anatomical basis of Dentistry. 2nd ed. St. Louis: Mosby, 2001, 189.
31. Berkovitz BKB, Holland GR, Moxham BJ. Dento-osseous structures. Oral anatomy, Histology and Embryology. 3rd ed. London: Mosby, 2002, 11.
32. Rupesh S, Winnier JJ, Jhon SA, *et al*. Radiographic Study of the Location of Mental Foramen in a Randomly Selected Asian Indian Population on Digital Panoramic Radiographs. J med Scies. 2011; 11(2):90-95.
33. Sina Haghanifer, Mehrak Rokouel. Radiographic evaluation of the mental foramen in a selected Iranian population. Indian j dent Res. 2009; 20(2):150-52.
34. Taseir AL-khateeb, Abed AL-Hadi Hamesha, Khansa taha Ababneh. Position of mental foramen in northern regional

Jordanian population. surgical and radiologic anatomy, 29, 3, 231-237.
35. Olasoji HO, Tahir A, Ekanem AU, Abubakar AA. Radiographic and anatomic locations of mental foramen in northen Nigerian adults. Niger Postgard Med J. 2004; 11:230-3.
36. Kim IS, Kim SG, Kim YK, Kim JD. Position of the Mental Foramen in a Korean Population: A Clinical and Radiographic Study. Implant Dent. 2006; 15:404-411.