ORIGINAL ARTICLE

LOCALIZATION OF THE MANDIBULAR FORAMEN ON THE PANORAMIC RADIOGRAPHS

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Background: The mandibular foramen is of particular importance to the dentist and dental specialist as it marks the beginning of the mandibular canal, which transmits inferior alveolar nerve and vessels. The aim of this study was the localization of anteroposterior and superioinferior position of the mandibular foramen on the panoramic radiographs in adolescent and young adult in a selected sample of Pakistani population. **Methods:** This cross Sectional study was conducted in the Orthodontic department of Dr Ishrat ul ebad khan institute of oral health science, Dow University Karachi. Material comprised 150 panoramic radiographs. The radiographs were traced on a cellophane sheet. Landmarks were marked and measurements from the centre of the mandibular foramen to other landmarks were recorded. All measurements were recorded to the nearest millimetre. **Results:** The mandibular foramen occupies the posterior portion of middle third on antero-posterior width of mandible. A ratio between the sides of one or almost one indicated bilateral symmetry. **Conclusion**: The locations of the mandibular foramen occupy the middle third of ramus maintains bilateral symmetry in human mandibles.

Keywords: Mandibular foramen, panoramic radiography, anteroposterior distance.

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INTRODUCTION

The Mandibular foramen is proximal aperture on the medial surface of the ramus that occupies posterior, perpendicularly directed part of the mandible.[1] The foramen is guarded by bony protrusion called lingula.[2] The mandibular foramen is of particular importance to the dentist and dental specialist as it marks the beginning of the mandibular canal, which transmits inferior alveolar nerve and vessels.[3] The inferior alveolar nerve (IAN) is a mixed nerve that provides sensory innervation to the lower teeth, lower lip and buccal mucosa located between the premolars and lower central incisor through the mental nerve. The motor innervation of the inferior alveolar nerve is addressed to the mylohyoid muscle and anterior belly of the digastric muscle through the mylohyoid nerve.[4]

Knowledge of the position of the mandibular foramen and its exact localization is important for both diagnostic and clinical purposes. The radiographic appearance of the mandibular foramen may result in the misdiagnosis of a radiolucent lesion. Clinically, the inferior alveolar nerve could be injured during routine block injection application during tooth extraction and surgical procedures like sagittal split osteotomy.[5,6]

Although it is often possible to identify the mandibular foramen radio-graphically and by palpating the position of lingula, knowledge of its normal range of possible locations is essential. This position was analysed in several populations and panoramic radiography has been used for this analysis. In different populations, this foramen occupies different position. But its most frequent position on the mandible found is found to be in the mid of ramus.[7–9] Panoramic radiography is considered equally efficient than other digital methods.[10]

The previous knowledge of the anteroposterior position of the mandibular foramen is an important reference point for the preservation of inferior alveolar nerve during the surgical procedures in this area.

The morphometric analyses by panoramic radiography with the purpose of determining the possible alterations in the localization of the mandibular foramen are important for planning the dental, clinical and surgical procedures. Therefore, the purpose of this study was to investigate the anteroposterior position of the mandibular foramen on the panoramic radiographs in adolescent and young adult in a selected sample of Pakistani population.

MATERIAL AND METHODS

This cross-sectional study was conducted in Orthodontic department of Dr Ishrat ul Ebad Khan Institute of Oral Health Science, Dow University. The sample size was calculated using open epi statistics calculator which was composed of 152 panoramic radiographs from both male and female

individuals with the mean age 20.77±1.7 years. The radiographs belong to the Orthodontics Department archives at the Institute.

All panoramic radiographs were taken by same radiographic equipment (Rodograph Eva Villa-Italy). Images that are magnified and distorted or lighter were not included. The images that had good quality with respect to angulations and contrast at the sites of the structures to be evaluated were included in the study.

The radiographs were traced in a darkened room with a light-box with variable light intensity. The limits of the mandibular ramus and the mandibular foramen were drawn on 60g, 10×7 cm cellophane paper, attached to the radiograph with pieces of tape, using a 0.5 mm HB pencil. The drawing was made on the limit of the most external radiopaque portion of the mandibular foramen.[8]

The standardization of measurements was made by taking these reference marks:

a-point: the deepest portion of the anterior border of the mandibular ramus.

b-point: the deepest portion of the posterior border of the mandibular ramus.

c-point: the deepest point on mandibular notch.

d-point :point on the mandibular base in the line .

f-point: central point of the radiolucent area representing mandibular foramen.

a-b line: anteroposterior width of the mandibular ramus.

f-a distance: distance of mandibular foramen and anterior border of ramus.

Figure-1 shows the marked landmarks on panoramic radiograph tracing. The "a" and "b" points were established after the lines tangent to the anterior and posterior border of the ramus were traced.

The data regarding the frequency of mandibular foramen's anteroposterior (AP) and supero-inferior (SI) position was collected by measuring the AP distance on a-b line and SI distance on c-d line in millimetres. A descriptive analysis was performed on SPSS-16. Continuous variables were presented as mean and standard deviation.

RESULTS

Table-1 shows the results obtained from this study. The mean distance of MF from various landmarks on panoramic radiographs tracings is shown in figure-1. The mean AP distance is found to be 30.27 mm. The MF is positioned at a mean distance of 17.62 mm from the anterior border of the ramus. It was found in this study that the location of MF is not at the centre of ramus in the horizontal plane. It is situated at a mean distance of 2.69 mm posterior to the midpoint of anteroposterior width of ramus. Superio-inferiorly the MF is situated 3.4mm inferior to the midpoint in a vertical plane. Figures-2 and 3 showed the mean value of MF location on right and left of mandible according to gender.

Table-1: Results of the study

Anterior to posterior width of ramus								
	Female				**Male**			
	Minimum	Maximum	Mean	SD	Minimum	Maximum	Mean	SD
Right	28	33	29.64	1.2	28	34	30.9	1.40
Left	28	32	28.97	2.6	28.7	33	30.04	1.19
Anterior border to mandibular foramen:								
	Female				**Male**			
	Minimum	Maximum	Means	SD	Minimum	Maximum	Mean	SD
Right	16.6	19.00	17.69	0.61	16.20	19.20	17.55	0.68
Left	16.3	18.70	17.65	0.63	15	19.10	17.56	0.81
Posterior border to mandibular foramen:								
	Female				**Male**			
	Minimum	Maximum	Means	SD	Minimum	Maximum	Mean	SD
Right	10.90	15.50	12.03	1.02	10.90	17.0	12.66	1.23
Left	10.10	13.30	11.84	0.7	11	17.0	12.50	1.04
Mandibular notch to mid of foramen:								
	Female				**Male**			
	Minimum	Maximum	Means	SD	Minimum	Maximum	Mean	SD
Right	15	21	20.51	0.92	18	21.0	20.45	1.02
Left	14.8	22	21.03	0.90	20	22.0	21.28	0.85
Base to mandibular foramen:								
	Female				**Male**			
	Minimum	Maximum	Means	SD	Minimum	Maximum	Mean	SD
Right	21.20	29.0	25.88	2.43	23.0	32.5	26.71	2.03
Left	24.10	27	26.86	1.2	24.10	28.10	26.63	1.11

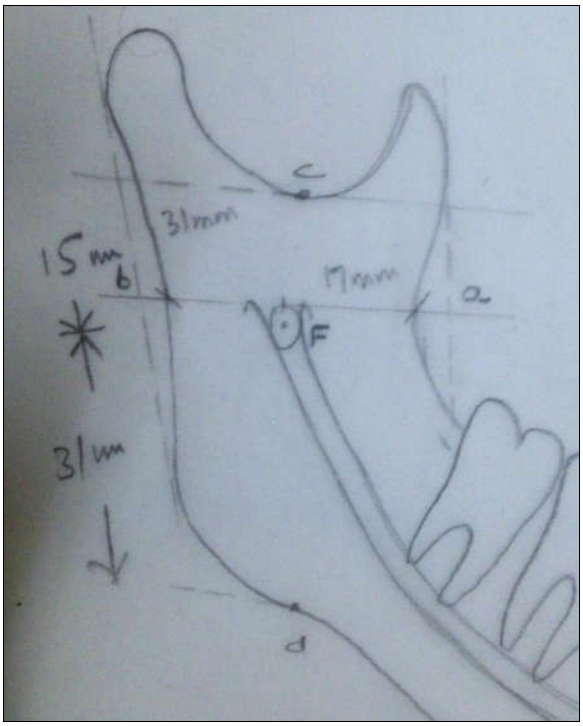

Figure-1: Mean distance of MF from various landmarks on panoramic radiographs tracings

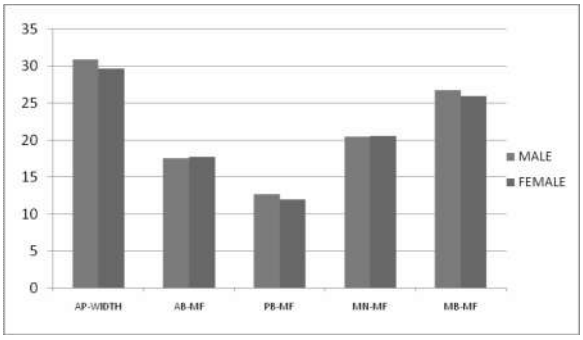

Figure-2: Mean value right side of mandible

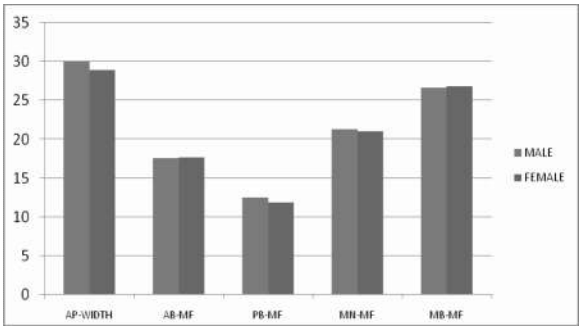

Figure-3: Mean value left side of mandible

DISCUSSION

It has been previously accepted that the position of mandibular foramen is affected by growth and remodelling,[11] which means the position of this foramen is not constant. For performing clinical procedure, accurate localization of this foramen is very important with respect to advancing age.[12]

The position of mandibular foramen and its importance for an efficacious inferior alveolar anaesthesia has been well accepted. The aim of this study was to locate the position of mandibular foramen in relation to anteroposterior and superior-inferior location on the mandibular ramus on the panoramic radiographs.

Different researcher adapted different means to study its position and used references to mark the location of Mandibular foramen. Some used radiographs.[13, 14] While other used dry mandibles for foramen localization.[15,16] Previous studies suggest panoramic radiographs as a better tool for studying changes of mandibular foramen.[10,14]

This study has been performed on panoramic radiographs, with a sample of 150 radiographs traced for localization of mandibular foramen. To compare the difference between right and left sides for its position, both sides were included in the study.

The mean and the standard deviations values of the anteroposterior and superioinferior length of the mandibular ramus determines that most frequent location of the MF is in posterior of the middle portion of the middle third on the mandibular ramus. These results were in agreement with the position of MF of other studies.[8,9,15,16] While other studies showed that the MF is predominantly located at the centre of the mandibular ramus in anteroposterior relation [17,18]

Results of this study indicate that the location of the MF maintains bilateral symmetry in human mandibles, in the measurement of both right and left side the MF laid on the same position.

In this study, centre of the MF was used as the reference point from which the measurements were taken. This referencing escaped any chance of bias in measurements due to altered shape of the foramen or the lingula. The data available to date suggest that there is little or no difference between the sides in terms of the position of the MF.

Although it was impossible to establish absolute values to describe the position of MF, its most frequent location was in the middle third quadrant in both anteroposterior and supero-inferior directions, in accordance with previously described results.[19]

The result gives no significant difference between right and left sides, showing absolute bilateral symmetry, which is parallel to other studies.[9,16] In regards to gender, although there is significant difference observed in the anteroposterior length of ramus, but it does not affect the positional symmetry of the foramen. The age difference cannot

be appreciated as all the radiograph belongs to same age group.

CONCLUSION

It is concluded from the result that the MF is located in the middle third of the ramus both anterio-posteriorly and superior-inferiorly which maintain bilateral symmetry. The knowledge of MF location would be helpful for a dentist and surgeon to introduce new technical modification to create more successful anaesthesia and to perform safer surgeries in the ramus of mandible.

AUTHOR'S CONTRIBUTION

ASA: Carried out the research, literature search and wrote the manuscript, IA: Supervised and reviewed the article.

REFERENCES

1. Peter Williams L. Grays Anatomy, 38 edition. Churchill Livingstone; pp.567, 1995.
2. Fabian FM. Observation of the position of the lingula in relation to the mandibular foramen and the mylohyoid groove. Ital J Anat Embryol 2006; 111(3):151–8.
3. Singh SK, Prabhu RV, Mamatha GP, Gupta A, Jain M. Morphological variations in the mandibular canal: a retrospective study of panoramic radiograph. J Oral Health res 2010;1(3):106–12.
4. Sandoval MC, López FB, Suazo GI. An unusual relationship between the inferior alveolar nerve, lingual nerve and maxillary artery. Int J Odontostomat 2009;3(1):51–3.
5. Hillerup S, Jensen R, Nerve injury caused by mandibular block analgesia. Int J Oral Maxillofac Surg 2006;35(5):437–43.
6. Yip L, Korczak P. Clinical audit on the incidence of inferior alveolar nerve dysfunction following mandibular sagittal split osteotomies at the Derby Royal Infirmary, England. Int J Adult Orthodon Orthognath Surg 2001;16(4) 266–71.
7. Varma CL, Haq I, Rajeshwari T. Position of Mandibular Foramen in South Indian Mandibles. Anatomica Karnataka 2011;5(1):53–6.
8. Ono E, Medici Filho E, Moraes LC, Castilho JCM, Moraes MEL. Anteroposterior location of the mandibular foramen of 7 to 12 year-old children in panoramic radiographs. Cienc Odontol Bras 2005;8(2):6–12.
9. Ennes JP. Medeiros RM. Localization of mandibular foramen and clinical implications. Int J Morphol 2009;27(4):1305–11.
10. Peker I, Gungor K, Semiz M, Tekdemir I. Localization of Mental and Mandibular Foramens on the Conventional and Digital Panoramic Images. Coll Antropol 2009;33(3):857–62.
11. Tsai HH. Eruption process of the second molar. ASDC J Dent Child 2000;67(4):275–81.
12. Tsai HH. Panoramic radiographic findings of the mandibular growth from deciduous dentition to early permanent dentition. J Clin Pediatr Dent 2004;28(3):215–9.
13. Mbajiorgu EF. A study of the position of mandibular foramen in adult black Zimbabwean mandibles. Cent Afr J Med 2000;46(7):184–90.
14. Ashkenazi M, TaubmanL, Gavish A. Age-associated changes of the mandibular foramen position in anteroposterior dimension and of the mandibular angle in dry human mandibles. Anat Rec (Hoboken) 2011;294(8):1319–25.
15. Trost O, Kazemi A, Cheynel N, Benkhadra M, Soichot P, Malka G, *et al*. Spatial relationships between lingual nerve and mandibular ramus: original study method, clinical and educational applications. Surg Radiol Anat 2009;31(6):447–52.
16. Kilarkaje N, Nayak SR, Narayan P, Prabhu LV. The location of the mandibular foramen maintains bilateral symmetry in mandibles of different age groups. Hong Kong Dent J 2005;2(1):35–7.
17. Nicholson ML. A study of the position of the mandibular foramen in the adult human mandible. Anat Rec 1985;212(1):110–2.
18. Shenoy V, Shmi SV, Swathi PS. Osteometric Analysis Of The Mandibular Foramen In Dry Human Mandibles. J Clin Diagn Res 2012; 6(4):557–60.
19. Oguz O, Bozkir MG. Evaluation of location of mandibular and mental foramina in dry, young, adult human male, dentulous mandibles. West Indian Med J 2002;51(1):14–6.

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