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Assessment of the mental foramen location in a sample of Saudi Al Hasa, population using cone-beam computed tomography technology: A retrospective study.

Evaluación de la ubicación del foramen mental en una muestra de población de Arabia Al Hasa, utilizando tecnología de tomografía computarizada de haz cónico: Un estudio retrospectivo.

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Abstract: Background: It is essential that the dentist understand the positional variations of the mental foramen to perform different types of dental procedures. This study was conducted to identify the position of the mental foramen among the Saudi population of Al Hasa. **Material and Methods:** According to the selection criteria of 200 CBCT images, 101 images were selected. The selected images were categorized into five groups with respect to patient age. Each image was evaluated from both sides of the mandible and then recorded in six classes (position I-VI) according to the horizontal position and three classes in the vertical position. **Results:** In the Saudi Al Hasa population, Type 4 (at the level of 2nd premolar) was the most common location for mental foramen in the horizontal direction, on the right side (n= 41; 40.6%) and on the left side (n=44; 43.6%). Mental foramen was found in the vertical location, Type 3 (below the apex of 1st and 2nd premolars) was found in the right side (n= 54; 53.5%) and left side (n=56; 55.4%). The position of mental foramen is not constant and changes according to gender and ethnicity. This warrants dentists to evaluate patients individually. **Conclusion:** Even though the present study was done with a small sample of patients it provides a picture about approximate location of mental foramen among the target group of a population.

Keywords: *mental foramen; dentistry; dental implants; cone-beam computed tomography; Saudi Arabia; retrospective studies.*

Resumen: Antecedentes: Es esencial que el dentista comprenda las variaciones posicionales del agujero mentoniano para realizar diferentes tipos de procedimientos dentales. Este estudio se realizó para identificar la posición del foramen mental entre la población saudita de Alhasa. **Material y Métodos:** De acuerdo con los criterios de selección de 200 imágenes CBCT, se seleccionaron 101 imágenes. Las imágenes seleccionadas se categorizaron en cinco grupos con respecto a la edad del paciente. Cada imagen se evaluó desde ambos lados de la mandíbula y luego se registró en seis clases (posición I-VI) según

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la posición horizontal y tres clases en la posición vertical. **Resultados:** En la población saudita de Al Hasa, el tipo 4 (al nivel del segundo premolar) fue la ubicación más común para el foramen mental en la dirección horizontal, en el lado derecho (n = 41; 40,6%) y en el lado izquierdo (n = 44; 43,6%). El foramen mental se encontró en la ubicación vertical, el Tipo 3 (debajo del ápice del 1er y 2do premolares) se encontró en el lado derecho (n = 54; 53,5%) y el lado izquierdo (n = 56; 55,4%). La posición del foramen mental no es constante y cambia según el género y la etnia. Esto justifica que los dentistas evalúen a los pacientes individualmente. **Conclusión:** Aunque el presente estudio se realizó con una pequeña muestra de pacientes, proporciona una imagen sobre la ubicación aproximada del foramen mental entre el grupo objetivo de una población.

Palabra Clave: *foramen mental; odontología; implantes dentales; tomografía computarizada de haz cónico; Arabia saudita; estudios retrospectivos.*

INTRODUCTION.

The mental foramen (MF) is a bilateral exit passage for blood vessels and mental nerve from the inferior alveolar nerve and artery to supply the anterior part of the lower jaw. The mental foramen is located on both buccal sides of the mandible and is located near the apices of the premolars. This makes it an essential anatomical landmark in the region for local anesthetic injection, surgical incisions, implantation, and periapical surgery.[1]

Good knowledge about the precise location, shape, size, and number of MFs is important for different dental procedures. Depending on the anatomical knowledge of a dentist, successful and uncomplicated dental procedures will occur. Without having the proper anatomical details about the MF, performing any invasive procedure in this region can damage the neurovascular bundles.[2]

Previous studies reported temporary and permanent loss of perioral soft tissue sensation after mandibular implant placement.[3,4] Therefore, it is necessary to determine the exact location of the MF before performing surgical procedures to avoid injury to the MF. However, many studies have reported the ambiguity of the anatomical location of the MF in different racial groups.[5] The position of MF varies by ethnicity, age, sex, due to alveolar bone resorption, and tooth loss. These studies emphasize that dentists must be aware of the variability of MF location among different groups of people.[5,6]

Variability of the location of the mental foramen has been reported for a long time. Recently this topic has become the focus of interest due to the need for surgical planning for the placement of mandibular implants.[7]

The location and number of MF can be assessed with the help of different methods such as on dry skulls, radiographs, computed tomography (CT) images and cone-beam computed tomography (CBCT).[4] Diagnostically, MF can be misdiagnosed as a periapical radiolucent lesion below the apices of mandibular premolars.[8]

The use of CBCT technology offers a high quality image and helps to obtain detailed information on the maxillofacial structures and allows an accurate assessment of anatomical variations.[9,10] Furthermore, CBCT is more cost-effective than classical CT and requires a lower dose of radiation exposure.

There are some publications available on the position of the MF in the Saudi population by using CBCT, therefore the present study was carried out to assess the position of the mental foramen by evaluating the archived CBCT images of patients at the Dental clinical complex, College of Dentistry, King Faisal University, KSA.

MATERIALS AND METHODS.

This retrospective study was conducted by using CBCT images of patients who attended the Dental Clinical Complex, King Faisal University for dental treatment. After obtaining the ethical approval from the institutional ethical committee (KFU/CoD/R/0022/2019), a sample of 200 CBCT scans were taken for a preliminary study and out of these 99 were excluded due to not fulfilling the study selection criteria. Consent of the patients was

obtained after being informed that their images might be anonymously used for research purposes at any later stage.

Inclusion criteria:

- Ethnic Saudi individuals.
- Patient age above 14 years.
- Presence of only permanent dentition (teeth should be present adjacent to MF, from canine to first molar, on both sides).

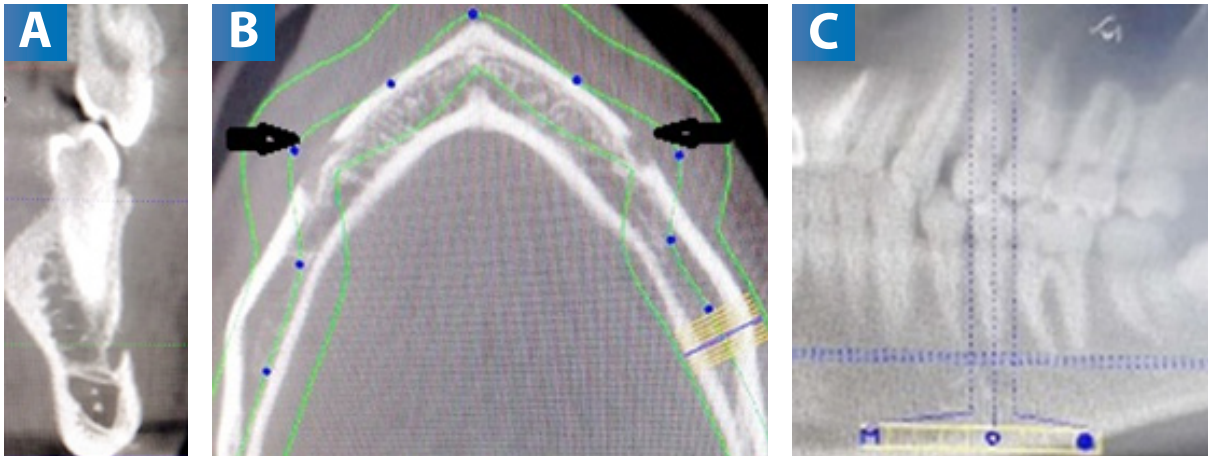
Exclusion criteria:

- Missing tooth adjacent to MF (from canine to first molar).
- Presence of any pathological lesion near the MF region.
- History of trauma or surgical procedures near the MF region.

ICAT vision software (Q version 1.8.1.10, Imaging Science International, Hatfield, PA, USA) was used to study the position of MF and its relationship with adjacent structures. The CBCT images were evaluated in axial, coronal and panoramic views (Figure 1). Vision i-CAT software program was used to identify the location of the foramen.

About 200 stored CBCT images were thoroughly examined by two examiners who were initially calibrated by an experienced examiner (a radiologist with 16 years of experience). To assess variability

Figure 1. CBCT images were evaluated.



A: Coronal view. **B:** Sagittal view. **C:** Panoramic view.

Table 1. Frequency and percentage of horizontal and vertical location of the mental foramen at the right and left.

Horizontal location	Right side Frequency	Left side Percent	Frequency	Percent
Type I	2	2.0	2	2.0
Type II	17	16.8	13	12.9
Type III	38	37.6	36	35.6
Type IV	41	40.6	44	43.6
Type V	3	3.0	5	5.0
Type VI	0	0.0	1	1.0
Total	**101**	**100.0**	**101**	**100.0**
Vertical Location	**Right side Frequency**	**Left side Percent**	**Frequency**	**Percent**
Type I	1	1.0	1	1.0
Type II	46	45.5	44	43.6
Type III	54	53.5	56	55.4
Total	**101**	**100.0**	**101**	**100.0**

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between examiners, an inter examiner reliability test was done with Cohen's KAPPA variability test and scored at 0.8.

A total of 101 CBCT images were included in the study, 54 from males and 47 from females. The mean age was 34.9 years (age range 15–58 years). Selected images were categorized into five groups with regards to age (Group A: 14-23 years; Group B: 24-33 years, Group C: 34-43years; Group D: 44-53 years; Group E: above 54 years). Each image was evaluated from both sides of the mandible according to Tebo *et al*.,[11] the horizontal position of the mental foramen was recorded as follows:

Position 1: Situated anterior to the first premolar.
Position 2: In line with the first premolar.
Position 3: Between the first and second premolar.
Position 4: In line with second premolar.
Position 5: Between second premolar and 1st molar.
Position 6: In line with first molar.

Vertical relationships between MF and root apices of the lower premolars were classified into three types, as follows.[12]

(1) MF was located above the level of the apices of the first and second mandibular premolar teeth;

(2) MF was located at the level of the apices of the first and second mandibular premolar teeth;

Table 2. Correlation of horizontal location of the mental foramen with gender.

Side	Male	Female	*p*-value
Left	Type 4	Type 3	0.297
	27 (61.4%)	21 (58.3%)	
Right	Type 4	Type 3	0.621
	23 (56.1%)	20 (52.6%)	

Table 3. Correlation of vertical location of the mental foramen with gender.

Side	Male	Female	*p*-value
Left	Type 3	Type 3	0.426
	31 (57.4%)	23 (48.9%)	
Right	Type 3	Type 2	0.177
	34 (60.7%)	24 (54.5%)	

Table 4. Correlation of horizontal location of the mental foramen with age.

			Right side				*p*-value
Age group	Type 1(%)	Type 2(%)	Type 3(%)	Type 4(%)	Type 5(%)	Total	
14-23	0 (0)	4 (23.5)	19 (48.7)	16 (39.0)	0 (0)	39	0.023
24-33	2(6.9)	3 (10.3)	16 (55.2)	6 (20.7)	2 (6.9)	29	
34-43	0	2 (16.6)	5 (41.7)	4 (33.3)	1 (8.3)	12	
44-53	0	3 (30)	6 (60)	1 (10)	0	10	
>54	0	1 (9.1)	8 (72.7)	2 (18.2)	0	11	
Total	**2**	**13**	**54**	**29**	**3**	**101**	
			Left side				***p*-value**
Age group	**Type 1(%)**	**Type 2(%)**	**Type 3(%)**	**Type 4(%)**	**Type 5(%)**	**Type 6(%)**	**Total**
14-23	0	4 (10.3)	19 (48.7)	15 (38.5)	1 (2.6)	0	39	0.632
24-33	2 (6.9)	2 (6.9)	17 (58.6)	5 (17.24)	1 (3.4)	1 (3.4)	29	
34-43	0	2 (16.7)	5 (41.7)	4 (33.3)	1 (8.3)	0	12	
44-53	0	2 (20)	6 (60)	2 (20)	0	0	10	
>54	0	1 (9.1)	7 (63.6)	3 (27.3)	0	0	11	
Total	**2**	**11**	**54**	**29**	**3**	**1**	**101**	

Table 5. Correlation of vertical location of the mental foramen with age.

Age	Left side				
	Type I (%)	Type II (%)	Type III (%)	Total	*p*-value
14-23 years	0	20	19	39	
	0.0	45.5	33.9	38.6	
24-33 years	1	12	16	29	
	100.0	27.3	28.6	28.7	
34-43 years	0	7	5	12	0.839
	0.0	15.9	8.9	11.9	
44-53 years	0	2	8	10	
	0.0	4.5	14.3	9.9	
>=54	0	3	8	11	
	0.0	6.8	14.3	10.9	
Total	**1**	**44**	**56**	**101**	
	100.0	**100.0**	**100.0**	**100.0**	

Age	Left side				
	Type I (%)	Type II (%)	Type III (%)	Total	*p*-value
14-23 years	0	20	19	39	
	0.0	43.5	35.2	38.6	
24-33 years	1	15	13	29	
	100.0	32.6	24.1	28.7	
34-43 years	0	5	7	12	0.554
	0.0	10.9	13.0	11.9	
44-53 years	0	2	8	10	
	0.0	4.3	14.8	9.9	
>53	0	4	7	11	
	0.0	8.7	13.0	10.9	
Total	**1**	**46**	**54**	**101**	
	100.0	**100.0**	**100.0**	**100.0**	

(3) MF was located below the level of the apices of the first and second mandibular premolar teeth.

Statistical Analysis

Data were analyzed using the SPSS-21.0 software package (IBM, Chicago, USA). The correlation of position of mental foramen with regards to gender and age was also evaluated by applying Pearson chi- square test and *p*-value was fixed at <0.05 as statistically significant.

RESULTS.

Out of 200 randomly selected archived CBCT images, 99 were excluded due to non-fulfillment of inclusion criteria. Of 101 included CBCT images, 54 were male 47 were female. Minimum age was above 14 years, maximum age was 58 years, and mean age of study sample was 30.48 years. At horizontal location, Type 4 (at the level of 2nd premolar) was the most common location for MF on right side n= 41 (40.6%) and left side n= 44 (43.6%).

This was followed by Type 3, on the right side n= 41 (40.6%) and left side n= 44 (43.6%) (Table 1). The comparison between the genders revealed that in males type 4 was the most common, but in females type 3 (between premolars) was the commonest (Table 2).

At vertical location, Type 3 (below the apex of 1st and 2nd premolars) was the most common on the right side n= 54 (53.5%) and left side n= 56 (55.4%), followed by Type 2 (at the level of apices of premolars), it on the

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right side n= 54 (53.5%) and left side n= 56 (55.4%) (Table 3). Based on gender, in females on the right side type 2 was higher, n= 24 (54.5%). (Table 2 and Table 3). Based on age, the most common position of MF in horizontal and vertical directions on both the sides of the mandible was type 3 (Table 4 and Table 5).

DISCUSSION.

MF is one of the important anatomical landmarks of the mandible. The dentist must have sufficient knowledge of the location, shape, size and distance of the MF from the other anatomical landmarks for dental treatments and the safety of surgical procedures such as implant placement, genioplasty and osteotomy. The dentist must have a clear awareness of the precise distance between the MF and the roots to avoid damaging the neurovascular bundle of the MF.

In our study MF was present in both sides of the mandible in all evaluated cases. However, few previous studies reported absence of De Freitas *et al.*,[13] investigated the absence of the MF in 1435 dry human mandibles (total of 2870 hemi-mandibles) and reported that the absence of MF in the right side (0.06%) was twice as much as the left side (0.03%). Recently, Hasan *et al.*,[14] also reported a case of bilateral absence of MF during routine sections on dry human mandibles.

The position of MF varies among different ethnicities and genders. Some previous studies show that MF was most commonly located between 1st and 2nd premolars.[15-18] The study carried out by Al-Khateeb *et al.*,[19] in 1993 by using panoramic radiography in Saudi population showed that in females, the mental foramen was located more frequently apical to the mandibular 2nd premolar, whereas, in males it was most often located between the 1st and 2nd premolar. Our results differ from this study, as in males Type 4 (at the level of 2nd premolar) was the most common location, but in females it was Type 3 (between premolars). (Table 2).

The variations in position of the mental foramen between males and females may be due to the hormonal changes at the time of growth spurts. In 1927, Hellman identified gender based variations in the timing, extent, velocity, and intensity of facial growth and recognized that these changes result in alterations in size and proportions of the face.[20] The pubertal growth spurt is a marked adolescent acceleration in the rate of growth. This spurt in the peak of incremental growth has been found to occur approximately 2 years earlier in females than males, at mean ages of 12 years and 14 years, respectively.[21]

According to the study conducted by Ochoa et al. the females had the greatest skeletal growth between 10 years and 14 years of age. The males had the greatest changes between the age of 12 to 16 years and even up to 18 years of age.[21]

In our study, Type 4 at the level of 2nd premolar was the most common location for MF in the horizontal location. This is similar to other studies, conducted in different populations in countries such as Kenya, India, Malaysia and Brazil, that have shown that the mental foramen is most commonly positioned in line with the second premolar tooth.[22-28] However, studies done in a group of North American white population, Northern Nigerian adults, and in Iranian population showed that the most common position of the MF was between the first and second premolars, followed by in line with the second premolar.[29-32]

Our study indicates that the most common position of MF was below the apex of 2nd premolar (52.8%) both in male and female patients, in agreement with a similar study carried out by Al Jasser *et al.*,[25] in 1998 in a selected Saudi population using panoramic radiographs.Ngeow *et al.*,[26] stated that the location of the mental foramen below the first and second premolars is influenced by genes but other positions might be due to disturbance in prenatal development.[33] An anthropometric study conducted on the position of the MF based on the evaluation of 76 Chinese, 46 European and 33 Indian skulls by Santini *et al.*,[24] reported that the position of the MF in the Chinese samples was in line with the long axis of the second premolar, while among Europeans and Indians skulls it was between the first and second premolar. They concluded that the position of the MF differs between ethnic populations.

The slight differences among the same population could be explained by using different imaging modalities. Panoramic radiography produces a flat image of a curved structure. It is not as accurate as

CBCT in horizontal localization of objects leading to image distortion in the premolar region. In our study sample, MF was mostly located below the apex of the mandibular second premolar and our results appear to be similar to those of studies conducted on different populations in several countries.[35-37]

Considering all these facts, the determination of the location of the MF in each group of population is very important for numerous dental procedures in the mandible. Thus, the results hereby presented could be helpful for clinicians.

CONCLUSION.

The position of the mental foramen is not constant and changes with age. There are also variations related to gender and ethnicity, warranting dentists to evaluate patients individually, on a case-by-case basis. Although the present study was conducted with a small sample of patients, it provides a picture of the approximate location of the mental foramen among an Al Hasa Saudi population group. To get more precise information on the location of the mental foramen, studies using a larger sample size are needed.

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REFERENCES.

1. Al-Shayyab M H, Alsoleihat F, Dar-Odeh N S, Ryalat S, Baqain Z H . The Mental Foramen I: Radiographic Study of the Anterior Posterior Position and Shape in Iraqi Population. Int J Morphol 2015; 33:149-57.
2. Gupta S, Soni JS. Study of anatomical variations and incidence of mental foramen and accessory mental foramen in dry human mandibles. National J Med Res. 2012; 2:28-30.
3. Abed HH, Bakhsh AA, Hazzazi LW , Alzebiani NA , Nazer FW, Yamany I, Kayal RA, Bogari DF, Alhazzazi TY. Anatomical Variations and Biological Effects of Mental Foramen Position in Population of Saudi Arabia. Dentistry 2016;6: 1000373.
4. Rios HF, Borgnakke WS, Benavides E. The Use of Cone-Beam Computed Tomography in Management of Patients Requiring Dental Implants: An American Academy of Periodontology Best Evidence Review. J Periodontol. 2017; 88(10):946-959.
5. Sheikhi M, Kheir MK. CBCT Assessment of Mental Foramen Position Relative to Anatomical Landmarks. Int J Dent. 2016; 2016:5821048.
6. Greenstein G, Tarnow D. The mental foramen and nerve: clinical and anatomical factors related to dental implant placement: a literature review. J Periodontol. 2006;77(12):1933-43.
7. Thakare S, Mhapuskar A, Hiremutt D, Giroh VR, Kalyanpur K, Alpana KR. Evaluation of the Position of Mental Foramen for Clinical and Forensic Significance in terms of Gender in Dentate Subjects by Digital Panoramic Radiographs. J Contemp Dent Pract. 2016;17(9):762-768.
8. Vani C, Swapna LA, Voulligonda D, Nikitha G R, Madhuri K. Evaluation of Morphometric Variations in Mental Foramen and Prevalence of Anterior Loop in South Indian Population–A CBCT Study. JIAOMR 2019; 31: 131-9.
9. Aoun G, El-Outa A, Kafrouny N, Berberi A. Assessment of the Mental Foramen Location in a Sample of Fully Dentate Lebanese Adults Using Cone-beam Computed Tomography Technology. Acta Inform Med. 2017;25(4):259-262.
10. Alam MK, Alhabib S, Alzarea BK, Irshad M, Faruqi S, Sghaireen MG, Patil S, Basri R. 3D CBCT morphometric assessment of mental foramen in Arabic population and global comparison: imperative for invasive and non-invasive procedures in mandible. Acta Odontol Scand. 2018;76(2):98-104.
11. Tebo HG, Telford IR. An analysis of the variations in position of the mental foramen. Anat Rec. 1950;107(1):61-6.
12. Zmyslowska-Polakowska E, Radwanski M, Ledzion S, Leski M, Zmyslowska A, Lukomska-Szymanska M. Evaluation of Size and Location of a Mental Foramen in the Polish Population Using Cone-Beam Computed Tomography. Biomed Res Int. 2019; 2019:1659476.
13. De Freitas V, Madeira MC, Toledo Filho JL, Chagas CF. Absence of the mental foramen in dry human mandibles. Acta Ant. 1979;104 : 353-5.
14. Hasan T, Mahmood F, Hasan D. Bilateral absence of mental foramen – a rare variation. International Journal of Anatomical Variations. 2010. 3: 167–9.
15. Gungor K, Ozturk M, Semiz M, Lynn Brooks S. A radiographic study of location of mental foramen in a selected Turkish population on panoramic radiograph. Collegium Antropologicum 2006;30:801–5.
16. VonArx T, Friedli M, Sendi P, Lozanoff S, Bornstein M. Location and dimensions of the mental foramen: a radiographic analysis by using cone-beam computed tomography. J Endod. 2013;39:1522-8.
17. Verma P, Bansal N, Khosa R, Verma KG, Sachdev SK, Patwardhan N, Garg S. Correlation of Radiographic Mental Foramen Position and Occulusion in Three Different Indian Populations. West Indian Med J. 2015;64(3):269-74.
18. Currie CC, Meechan JG, Whitworth JM, Carr A, Corbett IP. Determination of the mental foramen position in dental radiographs in 18–30 year olds. Dento maxillo Radiol 2015;45:20150195.
19. al-Khateeb TL, Odukoya O, el-Hadidy MA. Panoramic radiographic study of mental foramen locations in Saudi Arabians. Afr Dent J. 1994;8:16-9.
20. Hellman M. Changes in the human face brought about by development. Int J Orthod Oral SurgRadiog. 1927;13:475-516.
21. Ochoa BK, Nanda RS. Comparison of maxillary and mandibular growth. Am J Orthod Dentofacial Orthop. 2004;125(2):148-59.
22. Hwang K, Lee WJ, Song YB, Chung IH. Vulnerability of the inferior alveolar nerve and mental nerve during genioplasty: an anatomic study. J Craniofac Surg. 2005;16(1):10-4.
23. Mwaniki DL, Hassanali J. The position of mandibular and mental foramina in Kenyan African mandibles. East Afr Med J. 1992;69(4):210-3
24. Shankland WE. The position of the mental foramen in Asian Indians. J Oral Implantol. 1994;20(2):118-23.
25. al Jasser NM, Nwoku AL. Radiographic study of the mental foramen in a selected Saudi population. Dentomaxillofac Radiol. 1998;27(6):341-3.
26. Ngeow WC, Yuzawati Y. The location of the mental foramen in a selected Malay population. J Oral Sci. 2003;45(3):171-5.
27. Al Ralabani, N., Gataa, I.S. and Jaff, K. Precise computer-based localization of the mental foramen on panoramic radiographs in a Kurdish population. Oral Radiol. 2008; 24:59-63.
289. Amorim, M. M. Prado, F. B.Borini, C. B.Bittar, T. O.Volpato, M. C. Groppo, F. C. , Caria, P. H. F. The mental foramen in dentate and edentulous Brazilian's mandible. Int. J. Morphol 2008;26:981-7.
29. Moiseiwitsch JR. Position of the mental foramen in a North American, white population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;85(4):457-60.
30. Olasoji H, Tahir A, Ekanem U, Abubakar A. A Radiographic and Anatomic Locations of Mental Foramen in Northern Nigerian Adults. Niger Postgrad Med J. 2004;11:230-3.
31. Gungor E, Aglarci OS, Unal M, Dogan M, Guven S. Evaluation of mental foramen location in the 10–70 years age range using cone-beam computed tomography. Nigerian J Clin Pract. 2017;20:88–92.

32. Haghanifar S, Rokouei M. Radiographic evaluation of the mental foramen in a selected Iranian population. Indian J Dent Res. 2009;20(2):150-2.
33. Ishii N, Makino Y, Fujita M, Sakuma A, Torimitsu S, Chiba F, Yajima D, Inokuchi G, Motomura A, Iwase NH, Saitoh H. Assessing age-related change in Japanese mental foramen opening direction using multidetector computed tomography. J Forensic Odontostomatol. 2016;34(2):11-20.
34. Santini A, Alayan I. A comparative anthropometric study of the position of the mental foramen in three populations. Br Dent J. 2012;212(4):E7.
36. Al-Mahalawy H, Al-Aithan H, Al-Kari B, Al-Jandan B, Shujaat S. Determination of the position of mental foramen and frequency of anterior loop in Saudi population. A retrospective CBCT study. Saudi Dent J. 2017;29(1):29-35.
37. Ilayperuma I, Nanayakkara G, Palahepitiya N. Morphometric Analysis of the Mental Foramen in Adult Sri Lankan Mandibles. Int. J. Morphol. 2009; 27(4): 1019-24.

ISSN Print 0719-2460 - **ISSN Online** 0719-2479.