

Morphometric analysis of mental foramen in adult human mandible of Nepalese population

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Abstract

Introduction: Mental foramen (MF) is front opening of the mandibular canal on the body of mandible alongside and above the tubercle of chin. Normally, MF is located below the interval between two premolars but position of MF varies in different populations. It may lie between apices of premolars, below the apex of second premolars. Any foramina in addition to MF found in body of mandible is known as accessory mental foramen (AMF).

Method: This is a descriptive cross-sectional study conducted in 197 dry human mandible which was collected from different medical colleges of Nepal. Study was conducted to determine morphology and variations in the position of the MF and AMF.

Result: The present study revealed that mental foramen was present in all observed mandibles and it was bilateral. Most common position was below second premolar, followed by below apex of first premolar then between first and second premolar, and

rarely below the apex of first molar. Shape of MF was predominantly round while in few percentage it was oval. AMF was observed in 11.68% of mandible and its average size was 1.00 mm.

Conclusion: MF and AMF have been found to vary in position in different ethnic groups. Injury of the mental nerve is one of the complications of surgery of mandibular canal and mental foramen region. Therefore, its identification is important for dental surgeons in nerve block and surgical procedures to avoid injury to neurovascular bundle.

Keyword: Accessory mental foramen, mandible, mental foramen, mental nerve, Premolar

Introduction

Mental foramen (MF) is the front opening of the mandibular canal on the body of mandible alongside and above tubercle of chin. Normally, MF is located below the interval between two premolars.^{1,2}

Any foramina in addition to the MF found in body of mandible are known as accessory mental foramen (AMF).¹ Mental nerve, a branch of inferior alveolar nerve passes through MF and supplies the chin, lower lip, buccal mucosa of incisors, canines and premolars.³ Preoperative study of MF is important to prevent damage to mental nerve which will cause paresthesia of lip, chin, oral mucosa.⁴ There are three nerve branches exit through mental foramen, approximately 1 mm thickness each.⁵ Occasionally, it innervates incisor teeth.⁵ But, studies have shown that there are variations in the position of MF in different populations but there is almost no data available for location, incidence, shape, size of mental foramen and accessory mental foramina of Nepalese mandibles. Hence, considering the importance of MF, this study was undertaken to determine morphology and variations in position of MF and AMF.

Methodology

This is a descriptive study conducted to determine morphology and variations in the position of the MF and AMF by the morphometric assessment of the relation of MF to mandibular symphysis, base of the mandible and alveolar border of the body of the mandible. This study was conducted in the Department of Anatomy of Kathmandu University School of Medical Sciences (Chaukot), Institute of Medicine (Teaching Hospital, Maharajgunj) Nepal Medical College (Jorpati, Attarkhel), Kathmandu Institute of Science and Technology (Imadole). A 197 dry human mandibles were obtained from the above mentioned medical colleges. Normal adult mandibles were included in this study while deformed, broken and young ones were excluded. Digital Vernier Caliper, Scale and Protector are used for the measurement procedure.



Fig. 1: Measuring distance from center of mental foramen to lower border.



Fig. 2: Measuring distance from mental foramen to symphysis menti



Fig. 3: Measuring horizontal distance of mental foramen



Fig. 4: Measuring distance from central of mental foramen to upper border

Results: The present study finds that the location of MF on the right side of the mandible is below the apex of first premolar (PM1) in 80 (40.6%), second premolar (PM2) in 101 (51.4%), first molar (M1) in 6 (3.0%); and between first and second premolar (PM1PM2) in 10 (5.0%). Similarly, location of MF on the left side is below the apex of PM1 in 81 (41.1%), PM2 in 106 (53.81%), M1 in 3 (1.52%); and PM1PM2 in 7 (3.55%) on the left side of the mandibles.

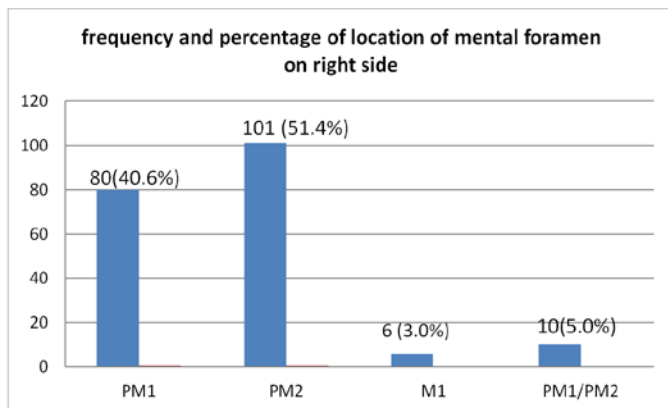


Fig 5: Bar chart shows the frequency and percentage of location of mental foramen in right side of mandible

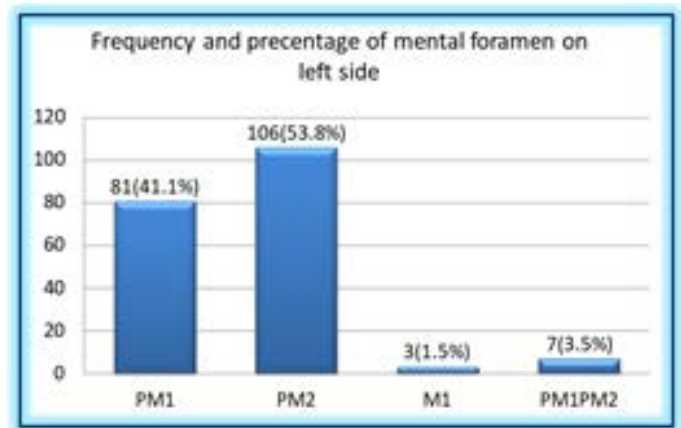


Fig. 6: Bar chart shows the frequency and percentage of location of mental foramen in left side of mandible.

The distance from MF to symphysis menti varies from 2.09 to 37.94 mm with the mean value of 26.29 ± 3.017 mm on the right side. The distance from MF to symphysis menti varies from 1.82 to 38.49 mm with the mean value of 26.06 ± 3.30 mm on the left side of the mandibles.

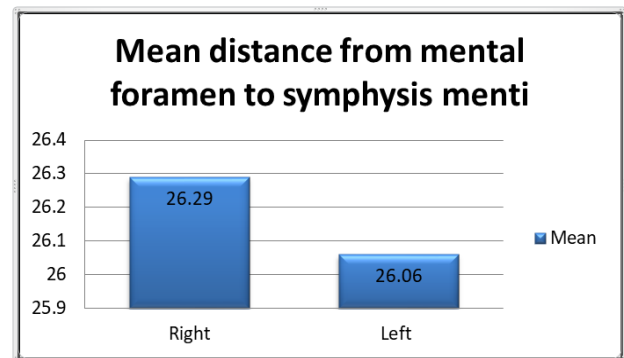


Fig 7: Bar chart shows that the distance from mental foramen to symphysis menti

The distance from MF to alveolar margin varies from 7.47 to 26.65 mm with the mean value of 13.56 ± 2.22 mm on the right side and the distance from MF to alveolar margin varies from 0.44 to 39.55 mm with the mean value of 13.15 ± 2.86 mm on the left side of the mandibles.

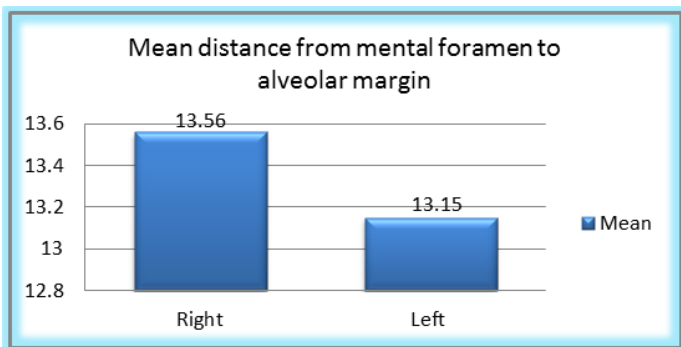


Fig. 8: Bar chart shows that the distance from mental foramen to alveolar margin

The distance from MF to inferior border (base) of mandible varies from 0.51 to 31.00 mm with the mean value of 13.65 ± 2.19 mm on the right side and on the left side of the mandible varies from 0.13 to 31.32 mm with the mean value of 13.44 ± 2.42 mm.

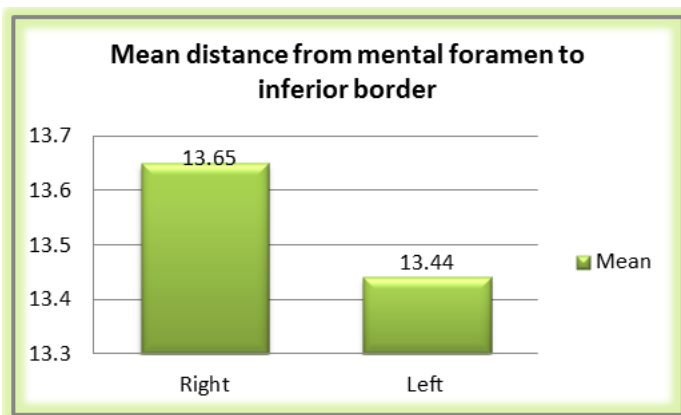


Fig. 9: Bar chart shows that the distance from mental foramen to inferior border

M1 tooth in 16 mandibles, PM1PM2 in 17 mandibles. Average distance between MF and AMF is 0.66mm lateral to MF. The shape of mental foramen is round in 165(84%), oval shape in 32(16%) on the right side of mandible. The shape of mental foramen is round in 167(85%) and oval shape in 30(15%) on the left side of the mandible.

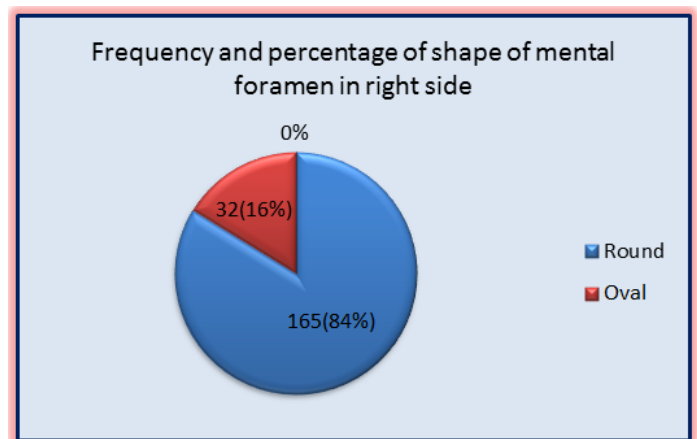


Fig. 10: Frequency and percentage of mental foramen shape in right side

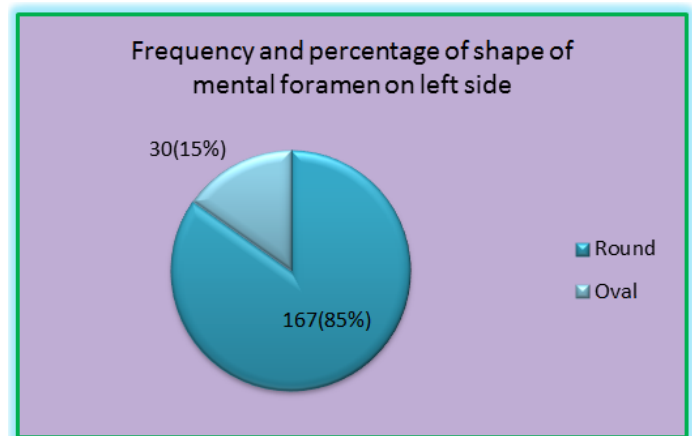


Fig. 11: Frequency and percentage of mental foramen shape in left side

The vertical diameter of MF varies from 0.16 to 2.74 mm with the mean value of 1.41 ± 0.47 mm on the right side and on the left side it varies from 0.09 to 6.63 mm with the mean value of 1.43 ± 0.61 mm. The horizontal diameters vary from 0.53 to 4.45 mm with the mean value of 1.72 ± 0.62 mm on the right side and on the left side it varies from 0.05 to 5.80 mm with the mean value of 1.64 ± 0.62 mm. Hence, the average size of MF is 1.57 mm on the right side and 1.53 mm on the left side with an average diameter of MF of 1.55 mm.

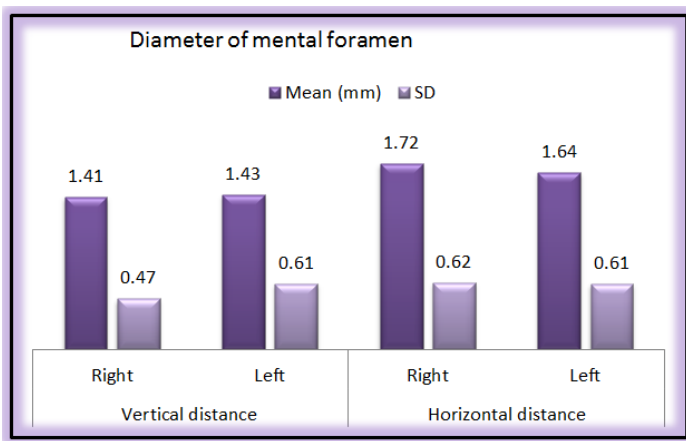


Fig. 12: Bar chart showing vertical and horizontal diameter of mental foramen of both side of mandible.



Fig 13: Showing mental and accessory mental foramen

The average size of AMF is 1 mm ranging from 0.6 mm to 1.5 mm. AMF is observed in 23 (11.68%) mandibles out of 197 mandibles. AMF is present in 10 (5.08%) mandibles on right side and in 13 (6.60%) in left side.

Discussion

The most common position of MF was below the apex of second premolar tooth in 52.54% of Nepalese mandibles. This commonest position has been described in 52.94% of mandibles in Sri Lankan population,⁶ 44.08% on the right side and 46.23% on the left side in western India,⁷ 55.7% on the right side and 61.4% on the left side in Turkish mandibles,⁸ 45% in Tanzanian studies,⁹ 64.3% in Koreans¹⁰ and 69.2% in Malay populations.² Siddiqui et al.⁷ found that MF below the apex of second premolar tooth in 44.08% on right and 46.23% on left side; 49% by

Tebo and Telford¹¹, 58.98% by Wang et al in Chinese population¹² and 52.9% by Santini and Land in Chinese and British population¹³ while Agrawal et al. reported 81.55% on right side and 81.5% on left side in Indian population.¹⁴

The second common position was below the apex of first premolar (40.86%) in opposition to Phillips et al¹⁵, Ngeow and Yuzawati² and Apinhasmit et al.¹⁶ the most common position was below the apex of first premolar. Haghanifar and Rokouei¹⁷ reported that the most common position of the MF was between the two premolars being 47.2%. Another study from Turkey has shown that the most common position of the MF was between the two premolars in 71.5%.¹⁸ A similar trend also noticed by Aktebin et al.¹⁹ According to Olasoji et al.²⁰ most frequent position of MF was between 1st and 2nd premolars, followed by the apical position of 2nd premolar in North Nigerians.

The distance between mental foramen and symphysis menti was 26.29 ±3.017 mm on right side with range of 2.09 to 37.94 mm and 26.06 ±3.30 mm on left side with range of 1.82 to 38.49 mm. Nimje et al.²¹ reported 25.81±2.25 mm on right side with range of 15.7-30 mm and 25.81±2.11 mm on left side with range of 15.2-30 mm; Sankar et al.²² published 27.2 mm and 27.7 mm on left side and Wang et al.¹² measurement was 28.06 mm.

The distance from MF to alveolar margin was varied from 7.47 to 26.65 mm with the mean value of 13.56 ±2.22 mm on the right side and 0.44 to 39.55 mm with the mean value of 13.15 ±2.86 mm on the left side. Almost similar findings were also noticed by Nimje²¹ et al. that the distance was 12.42±2.13 mm on right side with range of 8-19.3 mm and on left side it was 12.51±2.0 mm with range of 8-18.5 mm; also by Sankar et al.²² noted the distance was 13.7 mm and 16.4 mm on left side while Singh and Srivastav¹, the distance on right side was 17

mm and on left side was 18.6 mm which was slightly higher than the findings of the present study.

The distance from MF to inferior border (base) of Mandible varied from 0.51 to 31.00 mm with the mean value of 13.65 ± 2.19 mm on the right and 0.13 to 31.32 mm with the mean value of 13.44 ± 2.42 mm on the left side of the Mandibles. Nimje et al.²¹ reported 12.39 ± 1.25 mm on right side with range of 9-19 mm and on left side was 12.27 ± 1.13 mm with range of 9-17 mm; Souaga et al.²³ reported 14.89 mm in males and 14.21 mm in the females.; Sankar et al.²² noted 16.5 mm on right side and 14.3 mm on left side; Singh and Srivastav¹ reported 17.3 mm on the right side and 13.7 mm on left side.

Cagirankaya and Kansu²⁴ reported that the position of AMF below the first molar was similar to the present study. According to Toh et al.²⁵ distance between the MF and AMF in three cadavers are 0.67 mm, 2.1 mm and 5.74 mm whereas the authors observed position of AMF from MF to be 0.67 mm.

The present study showed that the shape of MF was round in 84% and oval shape was in 16% on the right side and on the left side, round shape was in 85% and oval shape of MF was in 15% of the mandibles. A similar trend was also noticed by Singh and Srivastav¹ in their study, on right side it was oval in 6% of mandibles and round in 94%. In left side it was oval in 13% of mandibles whereas it was round in 87%. Mbajiorgu et al.²⁶ reported round MF in 43.8% and oval MF in 56.3%. Oliveira et al.¹⁰ reported that the shape was oval in 73.8% on right side and 71.3% on left side. Nimje et al.²¹ also found that the majority of mental foramen was oval in shape i.e. 62% and only 38% had round MF.

The vertical diameter of MF varied from 0.16 to 2.74 mm with the mean value of 1.41 ± 0.47 mm on the right side and the left side it was varied from 0.09 to 6.63 mm with the mean value of 1.43 ± 0.61 mm; Nimje et al.²¹ reported

the mean vertical diameter 2.53 mm on right side and 2.56 mm on left side with range of 1.5-3.7 mm on right side and 1.5-3.8 mm on left side. Oguz and Bozkir²⁷ measured 2.38 mm and 2.64 mm on right and left sides respectively; Ilayperuma et al.⁶ reported 2.45 mm on right side and 2.60mm on left side. Agrawal et al.¹⁴ 2.15 and 2.13mm on the right and left respectively.

The horizontal dimension of MF was 1.72 ± 0.62 mm on the right side and 1.64 ± 0.61 mm on left side with range of 0.53 to 4.45 mm on right side and 0.05 to 5.80 mm on left side. According to Chung et al.²⁸ measurement was 2.4 mm; Apinhasmit et al.¹⁶ reported 2.8mm; Oguz and Bozkir²⁷ found 2.93 mm on right side and 3.14 mm on left side amongst Turkish population; Singh and Srivastav¹ reported 2.79 mm on right side and 2.57 mm on the left side; Nimje et al.²¹ measured 3.11 mm on right side and 3.18 mm on left side with range of 1.7-5.1 mm on right side and 1.4-5.4 mm on left side; Ilayperuma et al.⁶ noted 3.26 mm and on left side 3.41 mm and Agrawal et al.¹⁴ measured on right side 3.33 mm and on left side 3.25 mm.

In the present study, the average dimension of AMF is 1 mm. Published literature related to the size of AMF for common scholars is hardly available. In the observations under this study, MF was present in all the 197 mandibles (100%) and it was bilateral. Singh and Shrivastav¹ reported MF was present bilaterally in all the 100 mandibles (100%). Oliveira et al.¹⁰ analyzed 80 mandibles and established 100% presence of MF which were consistent with result of the present study however de Frietas et al.²⁹ reported 0.4% absence of MF. Singh and Shrivastav¹ noticed that 8% of AMF was left side and 5% on right side of the mandibles which was quite similar with the result of the present study. According to Gershenson et al.³⁰ AMF was present in 2.8% Israeli adults mandibles. It was 1.8% for American whites and

12.5% in Polinesians. Oliveira et al. reported 5% AMF in mandibles. The incidences of AMF did not differ significantly between right and left side of the mandibles.¹⁰

Conclusion

Mental foramen and accessory mental foramen have been found to vary in position in different ethnic groups. Injury of the mental nerve is one of the complications of surgery of the mandibular canal and mental foramen region. Therefore, its identification is important for dental surgeons in nerve block and surgical procedures to avoid injury to neurovascular bundle.

The present study revealed that mental foramen was present in all 197 observed mandibles and it was bilateral. Accessory mental foramen was present in 6.60% on left side and 5.08% in right. Study concluded that the most common position of mental foramen was below second premolar, followed by below apex of first premolar then between first and second premolar, and rarely below the apex of first molar. Shape was predominantly round while in few percentage it was oval. Average size of mental foramen was 1.57 mm on right side while 1.53 mm on left side. Average size of accessory mental foramen was 1.00 mm.

Identification and preservation of mental foramen is extremely important in periapical surgery, implant surgery, maxillofacial surgery and orthographic procedures. Moreover, it also aids in interpreting landmarks in oral pathology and forensics. To avoid nerve injury during surgery in the foraminal area, guidelines should be developed based on the literature with respect to verification of the position of the MF.

This study supplement data of MF and AMF of Nepalese population which may help the surgeons, anesthetists, neurosurgeons and dentists in carrying out surgical procedures successfully. This study will also be helpful to

anthropologist and forensic medicine for gender identifications.

References

1. Singh R, Srivastav AK. Evaluation of position, shape, size and incidence of mental foramen and accessory mental foramen in Indian adult human skulls. *Int J Exp Clin Anat* 2011;1-7
2. Ngeow WC, Yusof Y. The location of the mental foramen in selected Malay population. *Journal of oral sciences* 2003;45:171-175
3. Frederico S, Neves, Marianna GG, Torres. Lingual accessory mental foramen: a report of an extremely rare anatomical variation. *J Oral Sci* 2010;52:501-503
4. Gary Greenstein, Dennis Tarnow. The mental foramen and nerve: clinical and anatomical factors related to dental implant placement: A literature review. *J Periodontol* 2006;77:1933-1943.
5. Mraiwa N, Jacobs R, Moerman P. Presence and course of the incisive canal in the human mandibular interforamina region: Two-dimensional imaging versus anatomical observations. *Surg Radiol Anat* 2003; 25:416-423
6. Ilayperuma I, Nanayakkara G, Palahepitiya N. Morphometric analysis of the mental foramen in adult Sri Lankan mandibles. *Int J Morphol* 2009; 27(4): 1019-1024
7. Siddiqui AU, Daimi SR, Mishra PP, Doshi SS, Date JY, Khurana G. A Study On Morphological And Morphometric Analysis Of Mental Foramen Utilizing Various Assessment Parameters In Dry Human Mandibles. *International Journal Of Students' Research* 2011; 1(1): 19-22.
8. Yesilyurt H, Aydinlioglu A, Kavakli A, Ekinici N, Eroglu C, Hacialiogullari M, et al. Local differences

- in the position of the mental foramen. *Folia Morphol* 2008;67(1):32-35
9. Fabian FM. Position, shape and direction of opening of mental foramen in dry mandibles of Tanzanian adult black males. *Ital J Anat Embryol* 2007;112(3):169-77.
 10. Oliveria Junior EM, Araujo ALD, Da Silva CMF, Sousa- Rodrigues CF, Lima FJC. Morphological and morphometric study of the mental foramen on the M-CP-18. *Int J of Morphol* 2009; 27(1): 231-238
 11. Tebo HG, Telford IR. An analysis of the variations in position of the mental foramen. *Anat Rec* 1950; 107:61-6
 12. Wang TM, Shih C, Liu JC, Kuo KJ. A clinical and anatomical study of the location of the mental foramen in adult Chinese mandibles. *Acta Anat (Basel)* 1986; 126:29-33
 13. Santini A, Land MA. Comparison of the position of the mental foramen in Chinese and British mandibles. *Acta Anat* 1990; 137:208-212.
 14. Agarwal DR, Gupta SB. Morphometric analysis of mental foramen in human mandibles of south Gujarat. *People's J Sci Res* 2011; 4: 15-18.
 15. Phillips JL, Weller RN, Kulild JC. The mental foramen: Radiographic position in relation to the mandibular second premolar. *J Endod* 1992; 18:271-4.
 16. Apinhasmit W, Methathrathip D, Chompoonong S, Sangvichien S. Mental foramen in Thais: an anatomical variation related to gender and side. *Surg Radiol Anat* 2006;28(5):529-33.
 17. Haghanifar S, Rokouei M. Radiographic evaluation of the mental foramen in a selected Iranian population. *Indian J Dent Res* 2009;20(2):150-2.
 18. Gingor K, Ozturk M, Semiz M, Brooks SL. A radiographic study of location of mental foramen in a selected Turkish population on panoramic radiograph. *Coll Antropol* 2006;30(4):801-5.
 19. Aktekin M, Celik HM, Celik HH, Aldur MM, Aksit MD. Studies on the location of the mental foramen in Turkish mandibles. *Morphologie* 2003; 87:17-9.
 20. Olasoji HO, Tahir A, Ekanem AU, Abubakar AA. Radiographic and anatomic locations of mental foramen in northern Nigerian adults. *Niger Postgrad Med J* 2004;11:230-3.
 21. Nimje DA, Wankhede HA, Hosmani PB. Morphometric study of the mental foramen in dry human mandibles. *International Journal of Recent Trends in Science and Technology* 2014; 12(1): 47-49.
 22. Sankar DK, Bhanu SP, Susan PJ. Morphometrical and morphological study of mental foramen in dry dentulous mandibles of South Andhra population of India. *Indian J Dent Res* 2011; 22: 542-6
 23. Souaga K, Adou A, Angoh Y. Topographical and morphological study of the mandibular foramen in black Africans from the Ivory Coast. *Odontostomatol Trop* 2004; 27:17-21.
 24. Cag Irankaya LB, Kansu H. An accessory mental foramen: a case report. *J Contemp Dent Pract* 2008; 9: 98-104
 25. Toh H, Kodama J, Yanagisako M, Ohmori T. Anatomical study of the accessory mental foramen and the distribution of its nerve. *Okajimas Folia Anat Jpn* 1992; 69:85-8.
 26. Mbajiorgu EE, Mawera G, Asala SA, Zivanovic S. Position of the mental foramen in adult black Zimbabwean mandibles: a clinical anatomical study. *Cent Afr J Med* 1998; 44:24-30.
 27. Oguz O and Bozkir MG. Evaluation of location of mandibular and mental foramina in dry, young, adult

- human male, dentulous mandibles. West Indian Med J 2002; 51:14-
28. Chung MS, Kim HJ, Kang HS, Chung IH. Locational relationship of the supraorbital notch or foramen and infraorbital and mental foramina in Koreans. Acta Anat (Basel) 1995; 154:162-6
29. de Freitas V, Madeira MC, Pinto CT, Zorzetto NL. Direction of the mental canal in human mandibles. Aust Dent J 1976; 21:338-40
30. Gershenson A, Nathan H, Luchansky E. Mental foramen and mental nerve: changes with age. Acta Anat (Basel) 1986;126(1):21-8.