
Occurrence of Accessory Mental Foramen

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Abstract: The mental foramen is an oval or circular opening on the anterior surface of the mandible. Mental foramen is the determinant of the mental triangle and forms an important landmark of the human mandible. Mental nerves and vessels pass through it and supply the area from canine to first molar. The mental nerve is the neurosensory nerve. Mental Foramen it's important landmark and orientation which serves surgical, local anaesthetic and other invasive procedures for oral and maxillofacial surgery. Understanding the anatomy of this region is important for effective nerve block and to avoid neurovascular bundles. It is also important to identify the ideal location of mental foramen for periodontal surgery, flap operation of lower tooth and for orthodontic surgery. Even so, in order to avoid neurovascular complications, particular attention should be paid to the possible occurrence of one or more accessory mental foramen during surgical procedures involving the mandible. The mental foramen is an important structure that needs to be considered in the surgery.

Keywords: Mental foramen, accessory foramen, Mental nerve, orthognathic surgery, anatomic variation

INTRODUCTION

Mental foramen is placed in an anterolateral aspect of the body of the mandible which transmits mental nerve, artery and vein. Accessory mental foramen is a rare anatomical variation. Mental Foramen it's important landmark and orientation which serves surgical, local anaesthetic and other invasive procedures for oral and maxillofacial surgery. Understanding the anatomy of this region is important for effective nerve block and to avoid neurovascular bundles. It is also important to identify the ideal location of mental foramen for periodontal surgery, flap operation of lower tooth and for orthodontic surgery. Even so, in order to avoid neurovascular complications, particular attention should be paid to the possible occurrence of one or more accessory mental foramen during surgical procedures involving the mandible. The mental foramen is located on the anterolateral aspect of the mandible, 13-15 mm superior to the inferior border of the mandibular body (Balcioglu and Kocaelli, 2009). The mental foramen [MF] is situated on the anterolateral aspect of the body of the mandible. It gives a path to the mental nerve and vessels. As the mental foramen is an important anatomical landmark to facilitate surgical, local anaesthetic, and other invasive procedures, the present study is aimed at assessing morphological and morphometric features of mental foramen with reference to surrounding landmarks (Budhiraja *et al.*, 2013). Mental foramen is usually situated in between lower two premolars. The current Up to the 12 gestation week, the MF remains incomplete. When the mental nerves ramify into various fascicules before the formation of MF, an accessory foramen is formed to provide an exit to these fascicules (Verma *et al.*, 2013). Knowledge of this mental foramen gives us information regarding mental nerve block and surgeries. Besides that, it also brings us knowledge regarding the mental foramen and the nerve passing through it. The position of MF may be present between the apex of lower premolars or below the apex of the second premolar. According to Tebo and Telford, (Güven *et al.*, 2009) location of MF is present below the apex of the second mandibular premolar which was similar to the findings of Suresh *et al.* Numerous data on the position of MF varies in different ethnic groups like British, Chinese, Indian, Saudi Arabian population and racial difference in the position of MF was reported by Green. In view of these discrepancies among the various investigations, it is no surprise that there are repeated failures to locate the MF for injections and other operative surgeries (Warwick *et al.*, 1985). Knowledge of the most common position of the MF of a local population gives additional information in the mental nerve blocks and related mandibular surgeries. Previously our university had conducted numerous clinical trials (Venugopalan *et al.*, 2014; Ganapathy *et al.*, 2016; Jyothi *et al.*, 2017) and in-vitro studies (Ajay *et al.*, 2017; Duraisamy *et al.*, 2019) and case reports (Ashok *et al.*, 2014; Ranganathan, Ganapathy and Jain, 2017) and systemic review (Selvan and Ganapathy, 2016; Subasree, Murthykumar and Others, 2016; Vijayalakshmi and Ganapathy, 2016; Ganapathy, Kannan and Venugopalan, 2017; Jain *et al.*, 2018; Kannan and Venugopalan, 2018) and surveys (Ashok and Suvitha, 2016; Basha, Ganapathy and

Venugopalan, 2018) over the past 5 years. Now we are focussing on epidemiological surveys. Therefore the present study was taken in to provide information on variation of anatomical landmark of opening of mental foramen that is obtained from Anatomy Department of Saveetha Dental College. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

Inferior Alveolar Nerve and Vessels

Trigeminal nerves are a part of the mandibular division which enters the mandibular foramen (Verma *et al.*, 2013). After it enters the mandibular foramen, the inferior alveolar nerve proceeds anteriorly in the mandibular canal from lingual to the buccal side. In the molar region, the inferior alveolar nerve divides into mental and incisive nerves (Verma *et al.*, 2013). The mental canal, the mental nerve continues upward and emerges from the mental foramen in conjunction with blood vessels. There also will be three nerve branches which will come out of the mental foramen . One innervates the skin of the mental area, and the other two proceed to the skin of the lower lip, mucous membranes, and the gingiva as far posteriorly as the second premolar ('Characteristics Of The Mental Foramen In Different Populations', 2011). The mental nerve may provide innervation to tissues adjacent to the canine and incisor areas. Medial to the mental foramen, studies confirmed the existence of a true incisive canal, which is a continuation of the mandibular canal . The incisive canal may also appear to be ill-defined, and neurovascular bundles may run through a labyrinth of intertrabecular spaces . In about 1% of patients, the mandibular canal bifurcates in the inferior superior or medial lateral plane. Thus, a bifurcated mandibular canal will manifest more than one mental foramen. This may or may not be seen on panoramic or periapical films . Accordingly, Dario10 suggested that clinicians should consider obtaining a preoperative tomogram to avoid nerve injury prior to implant placement above the inferior alveolar canal (Gada, 2014).

Location of Mental Foramen

Mental foramen is usually found coronally then the mandibular canal. Other authors have commented that the foramen are usually found halfway between the crest of the bone and the inferior border of the mandible . It is usually located at the apex of the second premolars but it also depends on the face related . Example a Chinese subjects, the mental foramen is usually located at the apical of second premolars . Another example is Caucasian subjects are usually found between premolars (Sankar, Susan and Bhanu, 2011). This shows that the location of mental foramen varies according to the shape of the individual face . The finding that it may be coronal to the apex of the root needs to be considered when performing immediate placement of dental implants in sockets . After extraction has occurred, the alveolar bone will reabsorb and the mental foramen will get closer to the alveolar crest . Radiograph can be taken to identify the correct location of the mental foramen (Greenstein and Tarnow, 2006).

Guidelines to Avoid Nerve Injuries

Mental Foraminal Region Observe the position of the inferior alveolar nerve and mental foramen on a panoramic radiograph and periapical films . It is desired to place an implant leaving a 2-mm safety zone above the nerve (Balcioglu *et al.*, 2014). If the nerve canal, after adjusting for radiographic distortion, is close to the anticipated osteotomy depth, a CT scan would be helpful in determining the exact position of the neurovascular structures . If an anterior loop is detected radiographically [panoramic or periapical film], corroborate its presence surgically . If there are doubts regarding the amount of bone available for an implant in the foraminal region, surgically locate the mental foramen and establish the safety zone in millimetres . As previously described, verify the presence of the anterior loop using a curved accessory foramina and canals of mandible are some of the important anatomical variations which lead to surgical complications, if it's not identified properly (Methathrathip *et al.*, 2005). Haemorrhage, impairing the surgeon's visibility are some and increase of fibrous tissue formation at the site of contact with an implant are some of the complications caused by these anatomical structures during surgical intrusion . Dysesthesia is also experienced by the patient. 33 Large variations exist in the size of mandibular accessory foramina . They may be as small as 0.1 mm or reach a width of more than 1.5 mm 5 and often resemble the original foramina in size .6 Smaller foramina are rarely measured because they are indistinguishable from the normal porous appearance probe (Ekinci and Eroğlu, 2019). The proximity of the nerve to the alveolar crest needs to be considered when designing initial incisions. Implants can be placed over the mental foramen, anterior to it, and posterior to the foramen up to the mesial half of the first molar using the length of the safety-zone measurement which was defined radiographically [adjust for radiographic distortions

and severe crestal bone loss] or with surgical exposure of the mental foramen (Juodzbaly, Wang and Sabalys, 2010). Before placing an implant anterior to the mental foramen, which is longer than the safety-zone measurement, probe the mental foramen to determine whether there is an anterior loop. If the loop is present, place implants no longer than the safety-zone measurement. If there is no loop, clinicians can place an implant anterior to the foramen beyond the length of the safety zone. However, for safety, place an implant so that its distal aspect is ± 2 mm mesial to the mental foramen to allow for surgical error. An important link or connection has also been found between location of accessory foramina and area of insertion of the muscles of mastication. The discussion on symmetry of accessory canals and foramina hasn't come into a conclusion yet (Mirbeigi *et al.*, 2016). While most authors believe that bilateral symmetry exists others do not. Racial differences may affect the prevalence of accessory foramina. Some races, e.g., the native population of North America, may have more foramina than others. However, no gender differences have been discovered. Apparently, prevalence is affected by age with a marked peak in adolescence which may reflect increased neurovascular requirements related to the adolescent growth-spurt. A question also exists regarding the contents of the accessory foramina and canals. Obviously, it can only be resolved by dissection. Myelinated nerves, neurovascular bundles, one or more arterioles and one or more venules have been found to occupy these canals and foramina (Naitoh *et al.*, 2009).

METHODS AND MATERIAL

70 dry adult human mandible of unknown sex obtained from the Anatomy Department of Saveetha Dental College formed the material for study. We have observed the shape and the position of the opening of mental foramen. Before we observe the mandibles, it is placed on a standard horizontal plane where it is easier to observe and collect the data. Various parameters were taken to observe the opening of the mental foramen. Uses of a syringe indicate the various openings in mental foramen. It is also noted that various numbers open in the mental foramen.

RESULTS AND DISCUSSION

The opening of the mental foramen in each mandible is different. Based on our observation, 6 mandibles have 2 openings of mental foramen on either the both side or the specific side [Figure 1]. Even the sizes of the foramen vary. Below are some pictures that we have come across.

Based on the first author, they have studied 200 mandibles, in their study it shows that only 15 mandibles show multiple openings in mental foramen. In those 15 mandibles, only 8 shows multiple openings on left sides and 7 on the right sides and 2 on both sides of the mandible. Based on the second article, a total of 124 mandibles were studied and in that only 8 had multiple foramen. In those found mental foramen, only 2 were on the left side and 5 were on the right side and 2 on both sides. Based on our study of mental foramen, a total of 70 mandibles were studied and only 6 were found with multiple foramen. That is 3 on the left side and 4 on the right side and 3 on both sides. Besides that, this investigation has also shown that there are more openings in our studies despite the lower number of total mandible count.

Mandible variants like any other variant may be of considerable clinical, racial and regional significance. As a variation from normal, especially in foramina may result, into the unusual course of nerves and vessels of that region and clinical procedures adopted by clinicians should be accordingly adjusted and modified. Several workers have studied the significance of mandibular accessory foramina, a variant studied by present study. Based on the first author, they have studied 200 mandibles, in their study it shows that only 15 mandibles show multiple openings in mental foramen. In those 15 mandibles, only 8 shows multiple openings on left sides and 7 on the right sides and 2 on both sides of the mandible. Based on the second article, a total of 124 mandibles were studied and in that only 8 had multiple foramen. In those found mental foramen, only 2 were on the left side and 5 were on the right side and 2 on both sides. Based on our study of mental foramen, a total of 70 mandibles were studied and only 6 were found with multiple foramen. That is 3 on the left side and 4 on the right side and 3 on both sides. Besides that, this investigation has also shown that there are more opening in our studies despite the lower number of total mandible count Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

CONCLUSION

To sum up, the six mandibles showed an extra opening compared with the other mandible. It is essential to be aware of the possibility of these anatomical variations already when planning surgery and when viewing the preoperative radio-logical examination. Thus, we consider that it is important during surgery in order to avoid nerve damage. The reason for the difference in location could be due to the shape of the foramen itself. As this study was conducted in dry dentulous mandibles, the instances of premortem tooth loss mandibles were

excluded due to the reason for its alveolar resorption which may also alter the position of mental foramen. Thus, size, shape, number of foramen and location may vary with population.

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CONFLICT OF INTEREST

The authors declare that there was no conflict of interest.

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Table

Author	Total mandible	Found mental foramen	Left	Right	Both sides
1]Huseyin Avni Balcioglu and Hümeýra Kocaelli	200	15	8	7	2
2]Ahmet Ercan Sekerci, Yildiray Sisman	124	8	2	5	2
Based on our investigation	70	6	3	4	3