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Anatomical Position of Mental foramen: a Review

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ABSTRACT

Mental foramen is a key factor in many of the surgical as well as clinical procedures in routine clinical practice. The variations of mental foramen with respect to position, size and number dose significantly alter the clinical implications of various intraoral treatments. The accurate knowledge of the mental nerve and its position helps the clinician for delivering local anesthesia effectively also placement of implants and dentures intraorally to replace missing teeth is important in prosthetic point of view. While doing the surgical procedures in this region the position of mental nerve and its foramen is of importance to avoid intraoperative neurovascular damage and to avoid postoperative neurosensory disturbances. The ethnic and racial variations are seen in the position of mental foramen, although a gender variation in same population has not been seen. Thus the knowledge of the position of mental nerve is important for day to day clinical practice of dentistry.

Keywords: Mental Nerve, Variations, Clinical Implication

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Introduction

The mental foramen is an opening on the anterolateral surface of the mandible, which is generally seen to be oval or circular in shape. Through this foramen the mental neurovascular bundle exits. The inferior alveolar nerve and artery, after traveling through the mandibular foramen, exit at the mental foramen as the mental nerves and vessels which innervate the lower teeth, lip, gingiva and soft tissues of chin area. The foramen opens directed posteriorly, outward and upwards. Although there are variations in the position of mental foramen are seen the frequent position identified is in between and below the apices of first and second premolars.

Mental foramen's anatomical position is of significant importance in giving anesthesia, treatments of fractures related to parasymphysis area, osteotomies required for orthognathic and implant placement, giving complete denture in mandible etc. There can be neurosensory disturbances encountered if this important landmark is

ignored while doing any invasive treatment in this region. Thus it is important to have knowledge of the probable location the mental foramen on the basis of age gender and symmetry of the mental triangle.

VARIATIONS: Variations of the mental foramen are often encountered, ranging from difference in position of foramen on anterolateral surface of mandible or presence of accessory foramina or even complete absence in some rare cases. It has been suggested that separation of the mental nerve into several fasciculi earlier than the formation of the mental foramen until the 12th gestational week could be a reason for the formation of accessory mental foramen⁹. The incidence of accessory foramina varies between ethnic groups, while non-Caucasians may have a higher incidence than Caucasians; there are yet no reported gender differences¹⁰. The presence of nerve fibers in accessory foramina may be significant in the effectiveness of local anesthesia following a routine inferior alveolar nerve block and also heamorhages can be encountered due to

trauma and laceration of accessory neurovascular bundles during implant placement or incision in vestibule for performing open reduction and internal fixation of mandible in cases of fractures of parasymphyseal region^{11,12,13,14}. The multiple foramina are usually unequal in size: a single large foramen with smaller (satellite) foramina¹⁵. The position of mental foramen varies depending of various factors like, symmetry of mental triangle, microscopic and macroscopic morphology and maturity of the human mandible, bone remodeling activity and paleoanthropologic features of the facial skeleton in different populations. The modal direction of the mental foramen also shows variation that is directed anterosuperiorly, anteroinferiorly and posteroinferiorly than normal which is posterosuperiorly directed¹⁶. The variation in the number of openings in the mental foramen region also varies that is a single foramen usually, but can be double or triple foramina, single foramen with clusters of accessory foramina around it or at rare times it might be absent^{17,18,19}.

The location of mental foramen also changes along with the age changes. In children before tooth eruption, usually the Mental foramen is found to be closer to the alveolar ridge; as the teeth starts to erupt the Mental foramen starts descending to the midway between the upper margin and lower border and in adults with the teeth present for long time, the Mental foramen moves is somewhat closer to the inferior border comparatively. In old age eventually with the loss of teeth and bone resorption of the edentulous ridge the mental foramen moves relatively up towards the alveolar ridge. In extreme cases of resorption, the mental foramen and the adjacent part of the mandibular canal are open at the alveolar margin. According to the degree of resorption, in severe cases, the mental nerve and the final part of the inferior alveolar nerve may be found directly under the oral mucosa²⁰.

Mental foramen has also shown the changes in position of foramen than usual in different races and populations of people. The ethnic variations in the position of mental foramen are also of great significance for estimating its position during the invasive procedures and delivering dental anesthesia. In Tanzanians the mental foramen is seen to be on a posterior position than usual that is in between 2nd premolar and 1st molar with the anterior most position below the apex of 2nd premolar²¹. On contrary in zimbabwean, Caucasian and Jordanian races it is been observed to be located more medially that is in between 1st and 2nd premolars. In mongoloid and Japanese population it is been found to be in line of long axis of 2nd premolar^{22,23,24,25}. The average size of the mental foramen is seen to be approximately 5mm in diameter amongst Africans as

compared to that of Israelis to have approximate diameter of 2 mm. In Indians the mental foramen was seen to be oval in shape, oriented postero-superiorly, and located inferior to the second premolar tooth and bilaterally symmetrical in a majority of cases⁴.

CLINICAL SIGNIFICANCE OF ANATOMICAL POSITION OF MENTAL FORAMEN:

- 1) In local anesthesia delivery for mental nerve block the direction of needle is to be kept antero-infero-medially and in between 1st and 2nd premolar. The variation in the position and number of mental foramen the efficacy of mental nerve block may decrease²⁶. In some rare cases, absence of mental foramen may also be the reason for inefficacy of the mental nerve block. In such cases the lower lip and chin area may show history of neurosensory disturbances and may be a history of trauma or surgery. In such cases higher blocks like inferior alveolar blocks may have to be given²⁷. Local anesthesia of the terminal incisive branches of the inferior alveolar and mental nerves can be obtained effectively if the mental foramen is correctly identified. Identification of position of mental foramen clinically is not reliable and accurate as it cannot be clinically visualized or manually palpated. Instead the detection of mental foramen can be done much accurately by periapical radiographs and computed tomography. On routine radiographs the periapical radiolucent lesions of lower premolars should be differentiated from mental foramen²⁸.
- 2) Before emerging out of the mental foramen the nerve loops into the body of mandible anteriorly and then turns back to emerge out of the mental foramen. The extent of anterior looping of the nerve is maximum 2 mm anterior to the anterior border of mental foramen. Thus while doing the osteotomy for implant placement should be at least 8 mm anterior to the anterior border of mental foramen to avoid inadvertent damage to the mental nerve and blood vessels. Identification of extent of the loop of mental foramen on panoramic radiographs and considering the magnification factor of the radiographs we can assess the location of implant placement²⁹.
- 3) Orthognathic surgeries are also one of the important procedures carried out as esthetic surgery procedures. Orthognathic surgeries those related to the mental foramen region are genioplasties and anterior segmental osteotomy procedures³⁰. Microgenia corrections and insertion of alloplastic implants or autogenous bone grafts and reduction genioplasties an cases of acromegaly

or asymmetry are also related to the osteotomies in mental foramen region. The osteotomy cuts are planned according to the position of mental foramen seen on radiographs and sometimes the osteotomy cut has to be modified in to the step rather than having a straight line cut. Also the mental nerve transposition is being carried out in some cases³¹.

- 4) In cases of fractured mandible of parasymphysis region the position of mental foramen and its involvement in to the fracture site is very important. Parasymphysis fracture passing through the mental foramen generally shows hematoma formation and neurosensory loss after trauma. Reliving of the mental nerve impinged in between the fractured fragments while open reduction and internal fixation of can resolve the neurosensory disturbances if integrity of the epinurium and prineurium covering the nerve fibers is not disrupted. The internal fixation of fractured parasymphyseal region requires two plates to be secured on the mandible to avoid tension gapeing in the lower and occlusal borders as guided by the Champy's lines of osteosynthesis. While securing these plates with intraosseous screws the placement of these screws should be atleast 5mm away from the mental foarmen to avoid damage to the mental neurovascular bundle³².
- 5) With the loss of teeth in lower premolar region the alveolar ridge resorption will lead to the bone loss in the upper border changing the relative position of the mental foramen from mid level towards the upper border of the mandible towards the alveolar ridge. The complete denture flanges are to be extended in to the vestibule. These flanges may impinge on the mental nerve emerging out of the foramen near to the alveolar ridge. In severe cases of alveolar resorption the bone loss is so much that the incisive and inferior alveolar nerves are exposed out of bone and lying just below the mucosa which may cause pain on denture wearing. In these cases the lateralization of nerve or mental nerve repositioning procedures are to be carried out. This is done by extending the foramen towards the lower border with the lateral cortex osteotomy and enlargement of foramen down wards³³.
- 6) The apices of premolars are found to be very close to the mental foramen. Thus when the endodontic treatment is planned for these teeth over obturation of root canals can lead to the impingement and irritation to the mental nerve. Wang *et al* reported that the average distance between the bottom of the lower second premolar socket and the superior border of the mental foramen is 2.50 mm. Such a short distance could harm the mental nerve by overfilling the root canal during root canal treatment of premolars³⁴.

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