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CASE REPORT

CLINICAL ASSESSMENT & SURGICAL IMPLICATIONS OF IMPLANT PLACEMENT IN MENTAL FORAMEN REGION: A CASE REPORT

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ABSTRACT:
The mental foramen is a strategically important landmark during osteotomy procedures. Its location and the possibility that an anterior loop of the mental nerve may be present mesial to the mental foramen needs to be considered before implant surgery to avoid mental nerve injury.To avoid nerve injury during surgery in the foraminal area, guidelines were developed based on the literature with respect to verifying the position of the mental foramen and validating the presence of an anterior loop of the mental nerve. These guidelines included leaving a 2 mm zone of safety between an implant and the coronal aspect of the nerve. 3D imaging with CBCT is essential to determine the anatomical structures anatomical variations & help the clinicians for the treatment and surgical plan.
Key words: Implant, Surgical, Foramen

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INTRODUCTION

The mental foramen is an important landmark when considering placing implants in the foraminal region of the mandibular arch. The mental foramen is the end of the mandibular canal through which the inferior alveolar nerve and blood vessels pass. The mental nerve is a terminal branch of the inferior alveolar nerve. It emerges from mental foramen (MF), divides into three branches beneath the angulioris muscle and provides for the innervation of the skin and mucous membrane of the lower lip and chin, and vestibular gum of the mandibular incisors[1,2]. MF is generally localized under the second premolar or between two premolars. Differences in its location, the number of foramina, and the possibility that an anterior loop of the mental nerve may be present mesial to the mental foramen need to be considered prior to preparing an osteotomy in this region. This article reviews the literature with respect to the mental foramen and makes clinical suggestions to reduce inadvertent damage to the mental nerve during osteotomy development.

The shape, location, & opening angulation of mental foramen are variable. The mental canal is most commonly angled in a superior direction from the mandibular canal(i.e., average is approximately 50 degrees, with a range from 11 to 70 degrees).Size of mental foramen has to be reported from 2.5mm to 5.5mm.The most common shape is ovoid (65%) &round (23%).[3] After extraction of teeth and resorption of alveolar bone, the mental foramen is closer to the alveolar crest.[4,5] In extreme situations, the mental foramen and mandibular canal can be adjacent to the crest of the alveolar ridge.[6]Radiographs indicating close proximity of the foramen to the alveolar crest dictate that the foramen should be surgically located to avoid nerve damage prior to osteotomy development.

DETECTION OF THE MENTAL FORAMEN ON RADIOGRAPHS

OPG: Radiographic assessment of the mental foramen must be interpreted cautiously. Jacobs et al.[7] reported the foramen was detected on 94% (N=545) of panoramic radiographs, but clear visibility was only attained 49% of the time. Similarly, Yosue and Brooks[8] noticed the foramen on 87.5% (N =297) of panoramic radiographs, and it was distinct 64% of the time. In another investigation in which four skulls were radiographed, Yosue and Brooks [9] concluded that panoramic and periapical films reflected the actual position of the foramen in the skulls<50% the time.

Anterior loop of mental foramen: Jacobset al.[7] found an anterior loop on 11% of patient panoramic radiographs (N =545); they did not record the size of the anterior loops. Misch and Crawford[10] noted an anterior loop whose average length was 5 mm in 12% of patient panoramic radiographs (N=324). They did not provide a range of findings or incidence data with regard to specific sizes of detected loops.

Peri-apical Films: With respect to peri-apical films, the mental foramen was found on 75% (N=75) in one investigation[11] and on 46.8% (N=1,000) in another study[20].To enhance foramen detection, it was suggested that a vertical bitewing and a panoramic film be taken in conjunction with a horizontal peri-apical film[12].Mental foramen does not appear on all radiographs as Yosue and Brooks[8,9] hypothesized that the inability to see it may be due to the difficulty in differentiating the foramen from the trabecular pattern, thin mandibular bone which provided no radiographic contrast, overly dark radiographs, or because the lingual cortical plate of bone was very thick and the foramen did not decrease the density of the bone enough to be detected. Image distortion can occur due to positioning the head on panoramic films or angulation of peri-apical films[9], and this also may account for failure to detect the foramen.

Anterior loop: Radiographic determinations regarding the presence or length of the anterior loop of the mental foramen are suspect because there is a poor correlation with cadaver dissection assessments[16,17,19].

CASE REPORT

A 42-year-old female patient with no systemic disease applied for implant therapy. OPG and peri-apical radiographs were made and mental nerve & anterior loop cannot be accurately located in 2nd premolar region. Then CBCT was used to diagnose the height and thickness of the edentulous alveolar bone with exposure settings of 90 kVp, 8 mA, and 7.7 sec. Thickness of radiographic slices was 1 mm. After the examination of CBCT images, exact width and height were considered at the left side of the mandible, superior to MF. Anatomic variations should be considered during the planning of dental implant placement to prevent neurovascular bundle damage. The area of mandibular second left premolar was measured about 8.25 mm in height and 5.54 mm in width. The area of mandibular first& second left molar was measured about 12.03 mm& 12.84mm in height and 5.82 mm& 5.94mm in width respectively to place dental implants. Regarding to the measurements, for area of mandibular second left premolar 3.3-8 mm, for mandibular first & second left molar 3.3-9.5mm implants were placed. Considering that, it was hard to diagnose the Mental foramen, Anterior loop, and intraosseous relationships with conventional methods such as intraoral and panoramic radiography, hence CBCT images were obtained. On the CBCT cross-sectional image of the related area, exact relation was detected between implants and neurovascular canals [Figure 5 & 6]. During 1 year of postoperative follow-up, no neurosensory disturbance was observed.

FIGURE 1 & 2: PRE OPERATIVE INTRAORAL PHOTOGRAPHS

FIGURE 3 INTRAORAL PERIAPICAL IN SECOND PREMOLAR
FIGURE 4 OPG IN SECOND PREMOLAR REGION (MENTAL NERVE) REGION RADIOGRAPH (MENTAL NERVE)

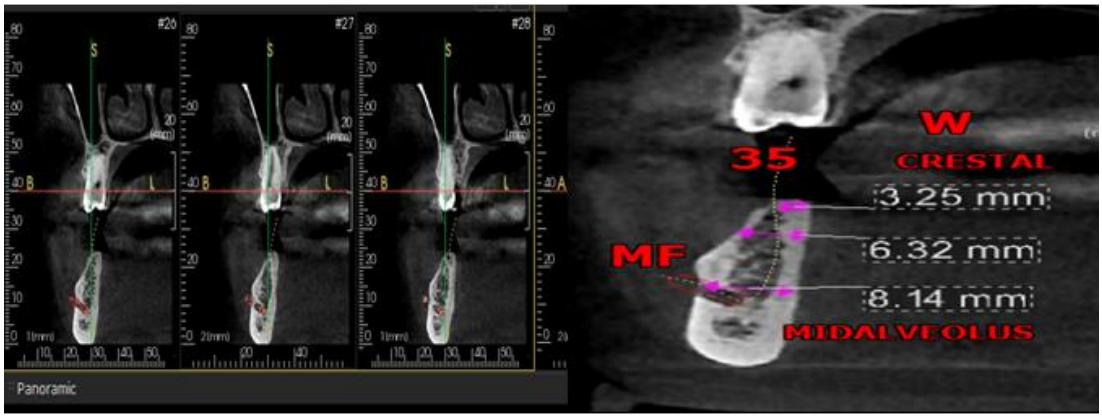

FIGURE 5 & 6: CBCT IN SECOND PREMOLAR REGION (MENTAL NERVE)

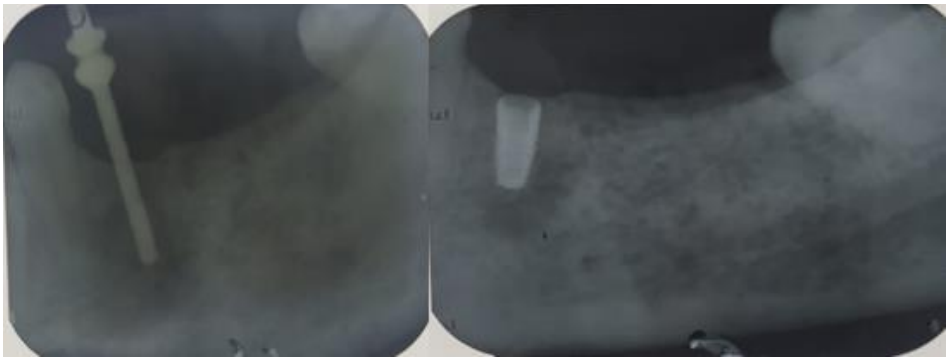

FIGURE 7: IOPAR WITH PARALLELING PIN
FIGURE 8: 3.3×8 MM IMPLANT PLACED IN SECOND PREMOLAR REGION

FIGURE 9: IMPLANTS PLACED IN MANDIBULAR REGION
FIGURE 10: IMPLANTS WITH GINGIVAL FORMER

DISCUSSION

Guidelines to Avoid Nerve Injuries in the Mental Foraminal Region: Observe the position of the inferior alveolar nerve and mental foramen on a panoramic radiograph and peri-apical films. It is desired to place an implant leaving a 2-mm safety zone above the nerve. 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 peri-apical 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 millimeters. The presence of the anterior loop is verified using a curved probe.

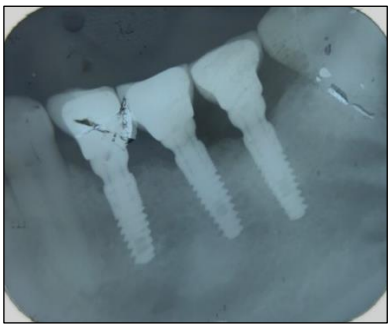

FIGURE 11 FINAL POSTOPERATIVE IOPAR

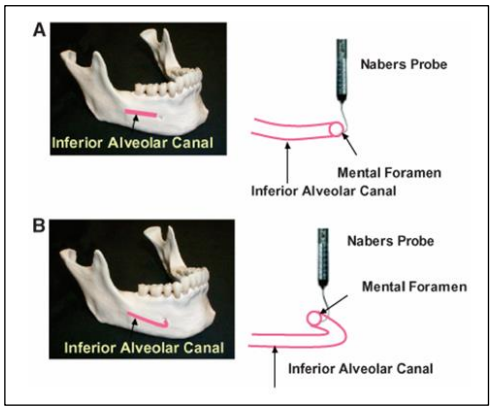

FIGURE 12A): If placement of the probe into the mental foramen on the distal side reveals that the mental canal is patent, then the anterior loop is not present.

B): If placement of a probe into the mental foramen on the distal side reveals that the mental canal is not patent, then an anterior loop of the mental nerve exists. The nerve must have traversed inferiorly and looped back to the foramen creating an anterior loop. Detection of a patency on the mesial aspect of the mental foramen may reflect either the anterior loop of the mental nerve or the incisal nerve canal. It is not possible to differentiate between the two by probing

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. 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[18].

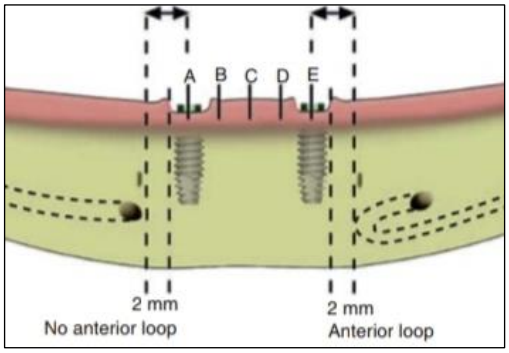

FIGURE 13: Anterior loop measurement should be added to 2mm safety zone to ensure adequate space between the implant and the foramen

The panoramic radiography, which is popular in dental practice, is an inexpensive, quick, easy, and low dose diagnostic tool. However, offering only two-dimensional (2D) images, inability to measure the bone width, distortions in the horizontal plane, and magnifications in the vertical plane are the limitations of this method. In addition, the accuracy of the image depends largely on the experience of the technician; accurate positioning of the patient is also important[13].

CBCT is a more effective tool for presurgical 2D assessment of the neurovascular structures (such as MF and its variations), than panoramic radiography.CBCT is specifically designed for 3D imaging of the maxillofacial region. CBCT has better resolution with lower dose radiation than CT. Clinicians can have an opinion about anatomical volume acquisition with CBCT[14]. Implants position and anatomical structures can be checked with CBCT analysis. It gives exact linear measurements with isotropic pixels, and metallic artifacts are significantly reduced. It is commended tool in implantology due to its 2D and 3D reconstruction possibilities. CBCT is considered to be a gold standard for dental and maxillofacial imaging[15].

CONCLUSION

Detecting the variations of MF is important to avoid complications such as paresthesia and hemorrhage before implant surgery although AMF is a rare anatomical variation of MF. Therefore, 3D imaging with CBCT is essential to determine the anatomical structures anatomical variations. Radiographic examination particularly 3D images can be useful and help the clinicians for the treatment and surgical plan.

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