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ORIGINAL ARTICLE

Assessment of Different Patterns of Entry of Mental Nerve in Mental Foramen: A Cone Beam Computed Tomography Study

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ABSTRACT

Aim: There is variation in the emergence of the mental nerve through the mental foramen. Cone beam computed tomography (CBCT) is very efficient in providing variations of mental nerve. The present study was aimed to determine different patterns of mental nerve at mental foramen region with the help of CBCT.

Materials and methods: One hundred and twenty CBCT images of patients requiring a dental implant in mandibular premolar region were taken with Planmeca CBCT machine. All sections were obtained. The presence of a straight pattern, an anterior loop, and the right-angled pattern was detected.

Results: It included 75 males and 45 females. The difference was significant (p = 0.05). A total of 20 percent patient exhibited an anterior loop, 72% had a straight pattern, and 8% had a right-angled pattern. The difference was statistically significant (p = 0.01). The straight pattern was seen in 61 males and 25 females, anterior loop in 10 males and 14 females. The difference was statistically significant (p = 0.01). The right-angled pattern was observed in 4 males and 6 females. A straight pattern was seen mostly (59) on the left side as compared to the right side (27), on the left side, the anterior loop was seen in 13 as compared to 11 on the right side. The right-angled pattern was seen mostly on right side (7) as compared to the left side (3).

Conclusion: Different patterns of mental nerve were observed. The most common pattern was straight followed by anterior loop and right angled. Three-dimensional (3D) nature of CBCT is useful in providing details. It offers less exposure to the patient as compared to computed tomography (CT). Thus, it is an effective diagnostic tool in the assessment of mental nerve.

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Clinical significance: The CBCT proves beneficial in assessing the different pattern of entry of mental nerve in mental foramen.

Keywords: Anterior loop, Cone beam computed tomography, Straight pattern.

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INTRODUCTION

Mental nerve is the branch of the inferior alveolar nerve (IAN) which is a terminal branch of the mandibular nerve, is the main nerve supplying the skin of the mandible. It exits through the mental foramen. The exact location and pattern of entry of mental nerve into the mental foramen are of paramount importance. Thorough knowledge is necessary to avoid any damage to the nerve during any surgical procedure.[1]

Any surgical procedure in the mandibular region requires careful analysis of the mandibular anatomical landmarks. The presence of inferior alveolar canal, submandibular gland fossa and the mental nerve is the challenge for the dentist. Nowadays, dental implants have revolutionized the dentistry regarding longevity. The placement of dental implants in the premolar-molar region demands exact determination of vital structures in the region. The variation in their structure, anatomy is a challenge for dentists as they may show disparity. Radiographic analysis of the various anatomical structures is essential to avoid iatrogenic complications. The most common complication is paresthesia in the chin and lower lip.[2]

Inferior alveolar nerve canal (IANC) carries IAN has a superior and inferior border. IAN may be directed anteriorly from the mental foramen forming the loop by curving back termed as anterior loop of IAN. Kuzmanovic et al.[3] in their morphologic and radiographic study determined the anterior loop of the mental nerve. Madinger et al.[4] conducted an anatomical–radiologic study and found an anterior loop of the mental canal.

The mental nerve may show an anterior loop, straight pattern (anterior directed) and right-angled (perpendicular)

pattern. Numerous morphometric studies have been performed to locate the mental nerve and its variation in pattern.[5,6] There are limited radiographic studies determining the pattern of mental nerve. The CBCT is advancer radiographic tool providing 3D representations of the anatomical landmarks. It has been proved beneficial for the assessment of vital structures as all the planes (coronal, axial and sagittal) may be utilized for visualization. Considering the 3-D nature of CBCT, the present study was performed to determine various patterns of the mental nerve into the mental foramen with the help of CBCT.

MATERIALS AND METHODS

The present study was conducted on 120 CBCT images of the patients visited the Department of Oral Medicine and Radiology. All patients required a dental implant in the mandibular premolar region. Ethical clearance was obtained from the institutional ethical committee. Patients with an impacted tooth in the premolar region, history of trauma, history of surgery in the premolar-molar region were excluded from the study.

All CBCT images were obtained from planmeca CBCT machine under standardized parameters (85 kVp, 12 seconds, 10 mA) with a field of view 8 × 5 cm. Sagittal, axial and coronal sections were obtained. Panoramic views were utilized for generation of sections. All sections were evaluated by a senior radiologist (Fig. 1). The presence of an anterior loop, straight pattern and right angle pattern was recorded on both the left and right side (Figs 2 to 4). Results were tabulated and subjected to statistical analysis. A p-value <0.05 was considered significant.

RESULTS

Out of 120 patients, males were 75 and females were 45. The difference was significant ($p = 0.01$) (Table 1). The anterior loop was observed in 20% (24) patients, the straight pattern in 72% (86) patients and right-angled pattern in 8% (10) patients. The Chi-square test was applied, and the difference was statistical significant ($p = 0.01$) (Table 2). The anterior loop was observed in 10 males and 14 females; the straight pattern was higher in males (61) as compared to females (25). The difference was statistically significant ($p = 0.01$). The right-angled pattern was observed in

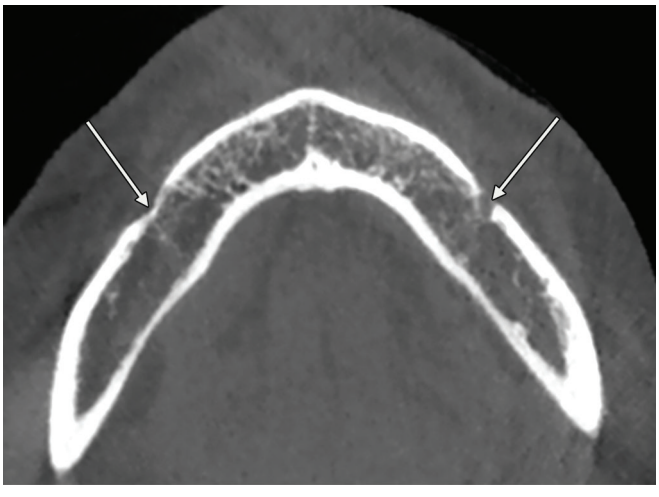


Fig. 1: Axial section showing left and right mental foramen

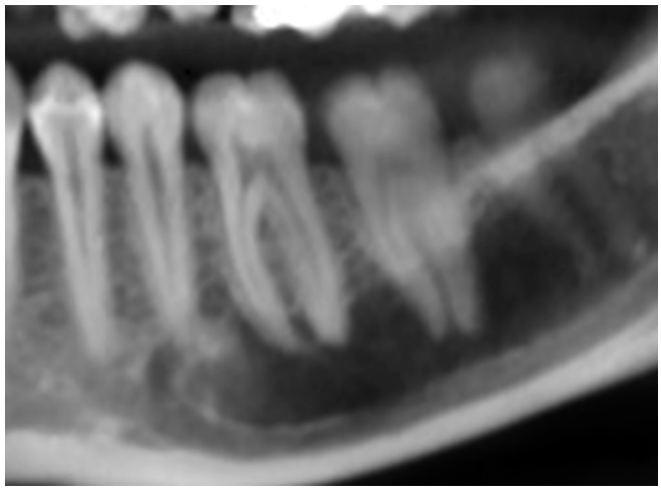


Fig. 2: Sections showing anterior loop pattern

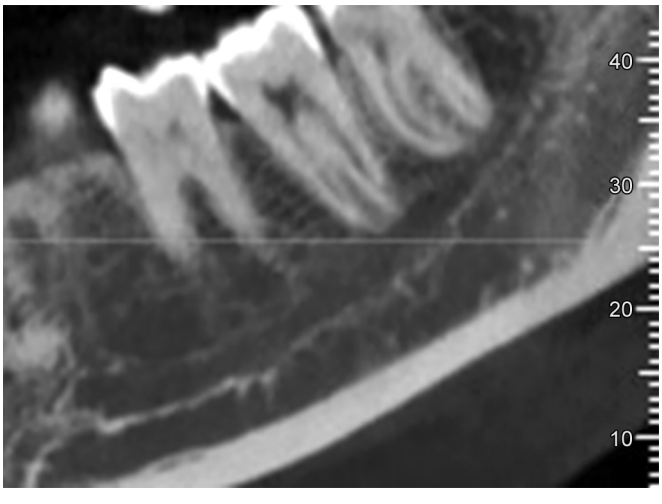


Fig. 3: Section showing straight pattern

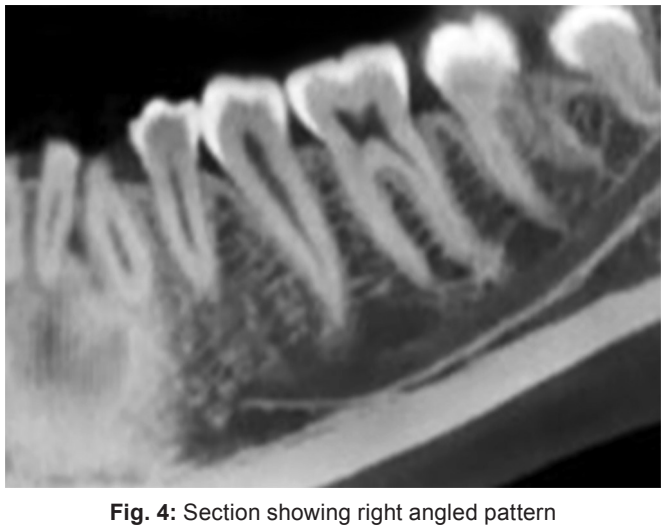


Fig. 4: Section showing right angled pattern

Table 1: Distribution of patients

Total - 120		
Males	*Females*	*p-value*
75	45	0.05

Table 3: Different patterns in both genders

Pattern	*Males*	*Females*	*p-value*
Anterior loop	10	14	0.21
Straight pattern	61	25	0.01
Right angled pattern	4	6	0.3
Total	75	45	–

4 males and 6 females which was statistical non- significant ($p > 0.05$) (Table 3). Graph 1 shows that on the left side anterior loop was observed in 13 patients, the straight pattern in 59 patients and right pattern in 3 patients while on the right side, the anterior loop was observed in 11 patients, the straight pattern in 27 patients and right pattern in 7 patients. There was a statistical difference in the distribution of a straight pattern, and right-angled pattern on both sides ($p < 0.05$) whereas anterior loop patterns were non- significant ($p > 0.05$).

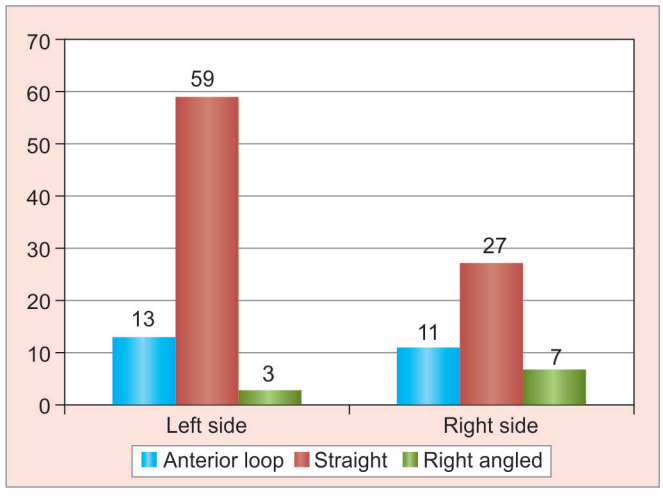
DISCUSSION

The awareness of various anatomical landmarks is necessary for the success of any surgical procedures. The surgical extraction of teeth in case of impacted third molar, placement of the dental implant, flap surgery, apicectomy or orthodontic tooth movement, etc. requires precise knowledge of the landmarks and for the betterment of the patients. Various studies have demonstrated various patterns and course of the mental nerve. Kuzmanovic et al.[3] in 2003 assessed the anterior loop of mental nerve by the radiologic and morphological study. Raghunandan et al.[7] in their panoramic study evaluated various patterns of mental nerve in mental foramen and also detected the presence of an anterior loop. The determination of various patterns of mental nerve with the help of CBCT was performed. Authors suggested that careful assessment of mental nerve is of paramount importance in dental implant planning. Failure to detect variation in mental nerve can lead to injury to nerve ultimately resulting in paresthesia of the region.

In this study, we observed anterior loop, straight pattern and perpendicular pattern of mental nerve. We found that 24 patients exhibited an anterior loop. The prevalence found to be 20%. Our results are in agreement with the results of Yosue and Brooks[8] who found the anterior loop in 21% of the population. However, Misch and Crawford[9] evaluated 324 panoramic radiographs and found the anterior loop in 12% of cases. Another study by Jacobs et al.[10] found the anterior loop in 11% of the study population. The most common straight pattern

Table 2: Different patterns of mental nerve

Anterior loop	*Straight pattern*	*Right angled pattern*	*p-value*
24 (20%)	86 (72%)	10 (8%)	0.01



Graph 1: Frequency of occurrence on both sides

was seen (72%). Similar results were seen in the study by Raghunandan et al.[7] where the straight pattern was seen in 79% of the studied population. The right-angled pattern was seen in 8% of the population. Kajan and Salari[11] conducted a study on 84 Irani populations and found 36.9% occurrence of an anterior loop. We found that the anterior loop was seen more frequently in females as compared to males. However, Uchida et al.[12] in their study found that males have higher prevalence as compared to females. We observed that straight pattern was significantly higher than any other pattern. There was a significant difference in the occurrence of a straight pattern between males and females.

Another study by Kaya et al.[13] compared the panoramic radiographs with spiral computed tomography for the assessment of the anterior loop of the mental nerve. They observed CT revealed anterior loops in 34% of cases as compared to 28% seen in panoramic radiographs. They suggested that CT evaluation is a necessary step before any surgical planning and found CT better as compared to panoramic radiographs.

We also compared left and right side and found that found that straight pattern was significantly higher on the left side as compared to right side. Similarly, the right-angled pattern was significantly higher on the right side. This is in contrast to the study by Raghunandan et al.[7] who observed straight pattern more on the right side. Filo et al.[14] found a bilateral occurrence of an anterior loop on the mental nerve in most of the patients. They suggested CBCT as an important radiographic aid before placing a dental implant in the mandibular region especially around premolars. Hu et al.[15] found 61.5% of loop pattern, 23.1% of straight pattern and

15.4% of a vertical pattern of mental nerve. Solar P et al.[16] conducted a study to the detected intra-osseous path of the mental nerve and suggested that 1 to 10 mm of distance from anterior margin of mental foramen should be considered as a safety margin. This much distance from the anterior loop is highly advisable as most of the complications may be avoided which are prone to occur due to lack of knowledge of its variation. However, there is no standardized protocol that may be followed. Ngeow et al.[17] in their study of visualization of the anterior loop in dentate population in different age group suggested a minimum of 6mm of distance between mental foramen and a distal surface of the dental implant. Bavitz et al.[18] have suggested 1 mm of distance between both structures.

The placement of a dental implant in mandibular premolar requires a radiographic evaluation of mental nerve. The complications such as numbness of the lower lip and chin are seen in cases where extensive radiographic analysis is missing. Before the advent of CBCT, this purpose was solved by panoramic imaging which was lacking in terms of fine details. The anterior loop was not evident in most of the cases thus limiting its usefulness. With the CBCT, this drawback has vanished.[19]

This study utilized CBCT which is 3D imaging modality. Only a few studies have been done so far in the detection of various patterns of mental nerve. Most of the studies were performed on either on the human skull or panoramic radiographs. Kieser et al.[20] evaluated path of the emergence of mental nerve in the human skull in Caucasoid and found it in the posterior direction right-angled pattern. CBCT is beneficial in this regards as it offers better details and less patient exposure. All the three planes such as axial, sagittal and coronal planes may be utilized. The overlapping of structures and ghost images are the main drawbacks of panoramic radiographs. Moreover, these radiographs are two dimensional in nature where fine details are missing.

CONCLUSION

CBCT is an effective diagnostic tool in detection of a variation of the morphology of mental nerve. Three-dimensional nature provided details; with less exposure to the patient as compared to CT where exposure parameters are quite higher thus minimizing the complications not only in patients in terms of radiation exposure but iatrogenic complications also. Mental nerve shows variation in its appearance in the mandibular premolar region. In our study, we found different patterns. Most common pattern straight, anterior loop and right angled. CBCT proved to be useful in the detection of variations of nerve effectively.

CLINICAL SIGNIFICANCE

The CBCT proves beneficial in assessing the different pattern of entry of mental nerve in mental foramen.

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