RADIOGRAPHIC ESTIMATION OF MENTAL NERVE LOOP POSITIONING - A PILOT STUDY

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Abstract

Introduction : Modern dentistry has changed tremendously with implant therapy. For successful implant therapy, making a proper treatment plan considering both surgical and prosthetic parts is the key to success. The anterior loop is described as the mental canal which rises from the mandibular canal and runs outward, upward and backward to open at the mental foramen. During surgery, surgeons usually expose the mental foramen to visualize the position of the mental nerve. However, without knowing the anterior loop length, surgeons have a high risk of violating the anterior loop.

Aim: The aim of this study was to assess the prevalence of anterior loop of mental nerve by using CBCTs, comparing the right and left side mental foramen, assessing the diameter of foramen and checking if there is any association between anterior looping and age or gender significantly.

Materials and Methods : The CBCT's of 33 patients who required an implant in the lower arch were assessed to check the presence or absence of looping of the mental nerve. The dimensions of the mental foramen was compared on the right and left side based on its shape, size, extent with relation to mandibular 2nd premolar and lower border of mandible. Galileos implant viewer software was used in measuring the parameters and CATVVision software was used for nerve tracing, mental loop assessment and visualisation. The results were tabulated and interpreted using SPSS software (version 23). Chi-square test was performed to evaluate the association of the various parameters.

Results: From the results, it was observed that the prevalence of anterior looping of the mental nerve in this study was 10%. It was found that looping in the left side predominantly and the study shows a female predilection of 63%. On Chi-square analysis the position of the mental foramen from the lower border of the mandible was found to be statistically significant ($p<0.05$). However no significant difference was observed with respect to mental nerve looping on the basis of gender or side of loop being present. Previous studies have also cited that no statistically significant difference was observed between right and left sides or between different gender groups.

Conclusion: When placing implants in close proximity to mental foramina, caution is recommended to avoid injury to the mental nerve and its neurovascular bundle. Therefore, the precise location of the mental loop must be identified using proper radiographic techniques before surgery.

Keywords: Innovation; Anterior Loop; Mental Nerve; CBCT; Implants; Surgery

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1. Introduction

Awareness regarding the various anatomical landmarks is pivotal for effective dental treatment, particularly in surgical procedures. The mandibular canal through which the inferior alveolar nerve and vessels pass is one of the most vital anatomical landmarks in the mandible with regard to placement of implants, local anaesthesia (1). Mental nerve is the branch of inferior alveolar nerve as it exits the mental foramen to supply sensory innervations to the front of the chin and lower lip as well as the mandibular anterior teeth and the premolars(2).

In some individuals, the inferior alveolar nerve passes downward and then follows an upward and posterior path to exit the canal from the mental foramen as the mental nerve. This deviation is referred to as the anterior loop of the mental nerve and could be attributed to the posterior shift of the mental foramen from the deciduous canine region to the deciduous molar region during mandibular development. Interforaminal implant surgery necessitates awareness concerning the significance of landmarks such as the anterior loop of the mental nerve (3–6).

The interforaminal zone is being contemplated as a safe zone for implant surgeries by many dentists, however some dentists do tend to overlook the phenomena of anterior looping of the mental nerve while planning implant placements (7). Whilst injuries during implant surgery are not frequent, the severity of the trauma ascertains exquisite care for prevention. Consequently, understanding the nerve course and anatomy is crucial for dentists to avoid any damage during the surgery (8).

The precise evaluation of distinct anatomical factors such as the position of the mandibular canal, maxillary sinus, the width of the cortical plates, the existing bone density (9,10) is very important in appropriate implant selection and planning the most appropriate implant position in the existing clinical condition. The mental nerve may possess an anterior loop that cannot be detected clinically. Hence accurate radiographic examination is essential to determine the nerve anatomy for dental implant placement (11,12).

The cone beam computed tomography (CBCT) is suggested for the specific and precise assessment of these anatomical landmarks as CBCT provides a three-dimensional image revealing comprehensive maxillofacial anatomical landmarks and allows the assessment of their position and exact location without any overlap or distortion (13). Our team has extensive knowledge and research experience that has translate into high quality publications (14–23))

The aim of the current study was to assess the prevalence of anterior looping of mental nerve by using cone beam computed tomographies, comparing the right and left side mental foramen, assessing the diameter of foramen and other associate factors and checking if there is any association between anterior looping and age or gender significantly.

2. Materials and Methods

The study was performed by analysing the CBCT's of 33 patients who visited the Department of Prosthodontics in a Private Dental Hospital and required an implant in the lower arch, to check for the presence or absence of looping of the mental nerve. The study was carried out from January 2021 - February 2021. The Ethical clearance for the study was obtained from the Ethical Board of Saveetha University. The dimensions of the mental foramen was compared on the right and left side based on its shape, size, extent with relation to mandibular 2nd premolar and lower border of mandible. Galileos implant viewer software was used in measuring the parameters and CATVVision software was used for nerve tracing and mental loop assessment and visualisation. Exclusion criteria were as follows, a history of some previous mandibular surgery, such as orthognathic surgery, developmental disorders, operation for cysts and tumors in the mandible and previous trauma to the mandible.The following parameters were assessed from the CBCTs, of the sample population :

1. Age
2. Gender
3. Looping - present/absent
4. Shape of mental foramen
5. Diameter/size of the foramen
6. Distance of the foramen from the lower border of the mandible
7. Relation of the mental foramen with 2nd premolar

The parameters were compared between the right and left mental foramen for each individual. The results were tabulated and interpreted using SPSS software (version 23). Chi-square test was performed to evaluate the association of the various parameters assessed.

3. Results

The mean age of the study in which anterior looping of the mental nerve was observed to be predominant was 36yrs [Figure 1]. The study showed a female predilection and also looping was found to be present more in the female population compared to the male population.[Table.1] The shape of the mental foramen assessed in this study were found to be circular, elliptical, quadrangular. Out of these, circular was predominantly present and also found to be in association with presence of looping [Figure2].The mean diameter of the foramen was found to be relatively larger in males compared to females when looping was absent. However, in the

presence of looping the mean diameter of the foramen was found to be greater in females compared to males [Figure 3].

The presence of looping was found to be present in 4.4% of the study population. Among the analysed CBCTs the looping was found to be present in the left mental foramen and relatively none in the right mental foramen in this study [Figure 4]. The position of the mental foramen from the 2nd premolar was found to be relatively closer if there is presence of looping both in males and females compared to its position and mean distance from the 2nd premolar in the absence of looping in both males and females. On Chi square analysis this was statistically significant as p=0.006 [Figure 5].

The mean position of the mental foramen from the lower border of the ramus was found to be relatively closer in both males and females if there is presence of looping compared to its mean distance during absence of looping in both males and females. On Chi square analysis the association was found to be statistically significant, p=0.002 [Figure 6].

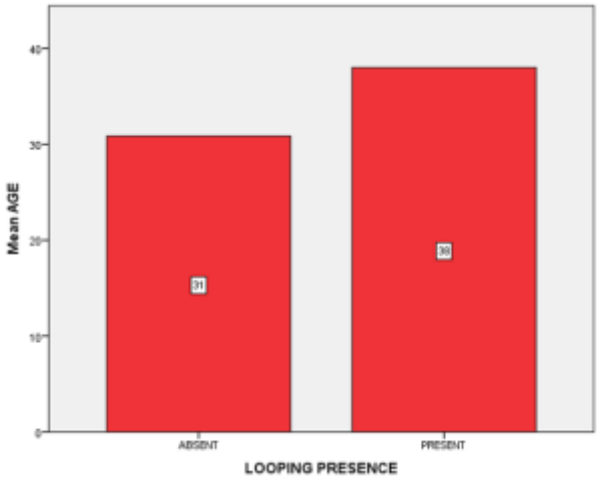

Figure 1 : Bar chart depicting the age distribution of the study with correspondence to presence or absence of looping. The X-axis depicts the presence or absence of looping, the Y-axis depicts the mean age. Looping was found to be predominantly present in individuals of around 36yrs.

SEX * LOOPING PRESENCE Crosstabulation

Count

		LOOPING PRESENCE		
		ABSENT	PRESENT	Total
SEX	male	25	1	26
	female	38	2	40
Total		63	3	66

Table 1 : Gender distribution as observed in this study. Study shows a female predilection with 40 individuals being females and 6 individuals being males. Looping was found to be present more in females compared to males.

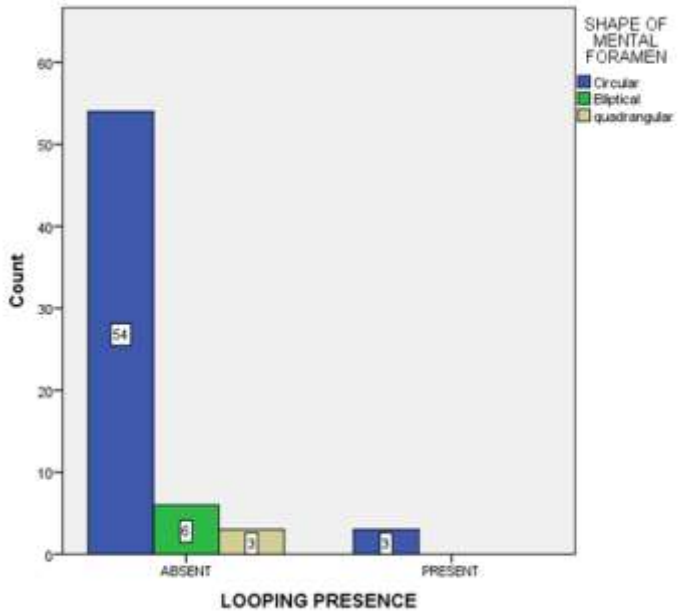

Figure 2 : Bar chart depicting the shape of mental foramen observed against the presence or absence of looping. The X-axis depicts the presence or absence of looping while the Y-axis depicts the number of individuals. The blue bar depicts the circular shaped foramen, while the green bar depicts elliptical shaped foramen and the beige colour bar depicts quadrangular shaped foramen. The circular shape of mental foramen was found to be present predominantly.

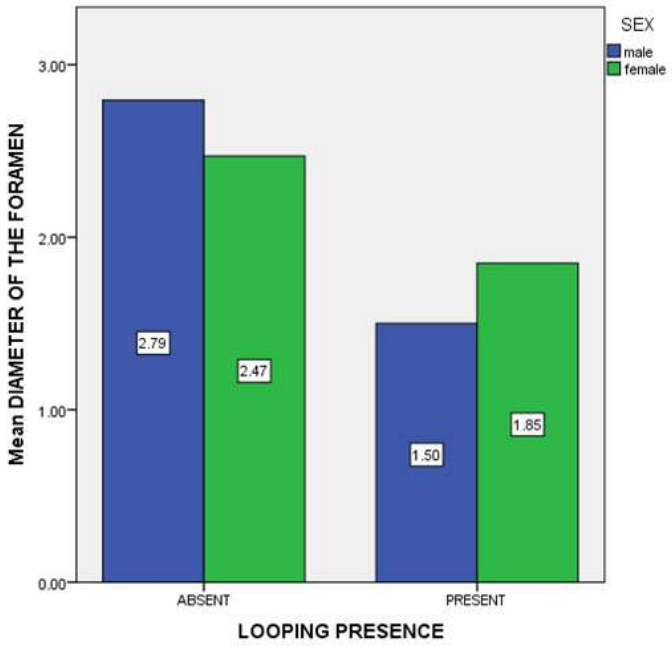

Figure 3 : Bar chart depicting the mean diameter of the foramen observed with respect to both the genders. The X-axis represents the presence or absence of looping. The Y-axis depicts the mean diameter of the foramen. The blue bar depicts the male population, while the green bar depicts the female population. The mean diameter of the foramen in males who had anterior looping was 1.5mm, in females 1.85mm. The mean diameter of the foramen in males who had absence of looping was2.79mm, females 2.47mm. The diameter of mental foramen was found to be greater in individuals where looping was absent compared to when looping is present.

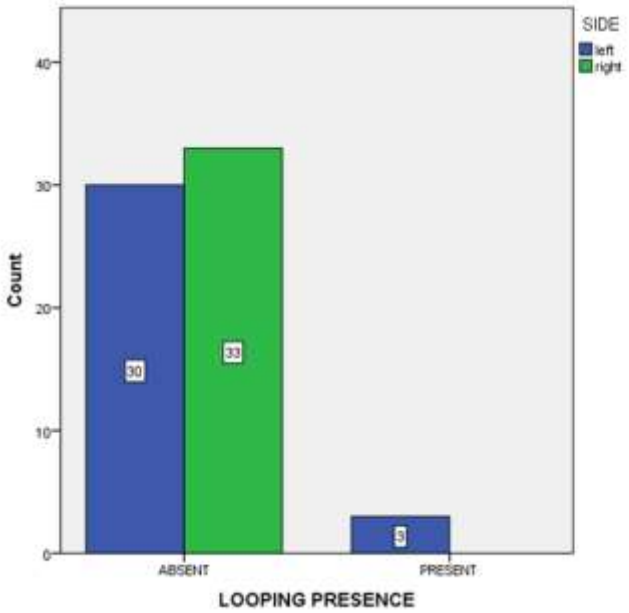

Figure 4 : Bar chart depicting the presence of looping and the predominant side of the loop present. The X-axis depicts the presence or absence of looping. The Y-axis depicts the number of individuals. The blue bar depicts the left side of the foramen while the green bar depicts the right side of the foramen. In this study, the looping if present was found only in the left mental foramen.

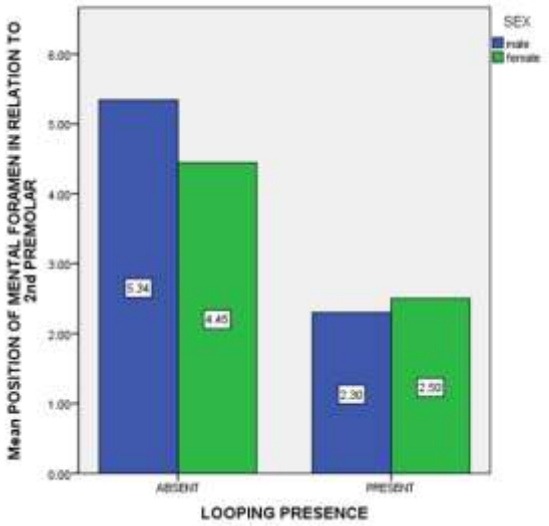

Figure 5 : Bar chart depicting the association between mean position of the mental foramen in relation to second premolar and the gender distribution. The X-axis depicts the presence or absence of looping the Y-axis depicts the mean position of the mental foramen in relation to the 2nd premolar. The blue bar depicts males while the green bar depicts females. The position of the mental foramen in relation to the 2nd premolar was found to be closer to the premolar when looping was present. On association between the mean position of the mental foramen in relation to 2nd premolar and the gender distribution as observed in this study, it was statistically significant, p=0.006 (Chi-square analysis)

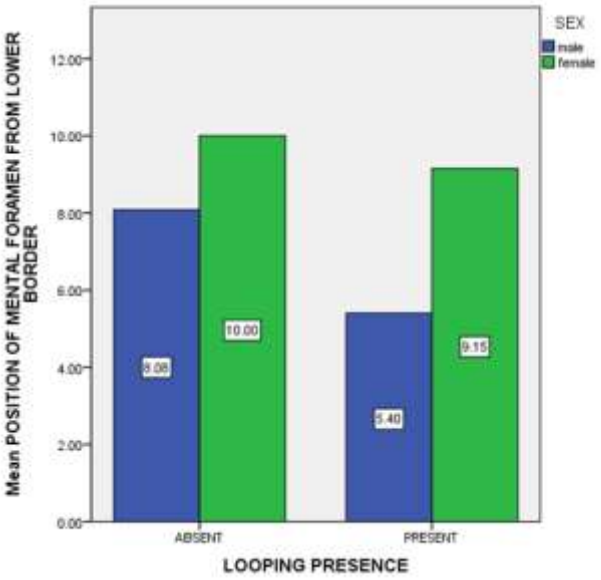

Figure 6 : Bar chart depicting the association between mean position of the mental foramen from lower border of ramus and the gender distribution. The X-axis depicts the presence or absence of looping the Y-axis depicts the mean position of the mental foramen from the lower border of ramus. The blue bar depicts males while the green bar depicts females. On association between the mean position of the mental foramen from the lower border of ramus and the gender distribution as observed in this study, it was statistically significant, p=0.002 (Chi-square analysis)

4. Discussion

Dental implants have become a scientific cornerstone after the serendipitous invention by Dr.Branemark (24). The most important anatomical consideration while placing an implant in the mandibular arch is the location of the inferior alveolar canal which contains inferior alveolar nerve and artery. Injury to these vital structures during implant placement can cause pain, altered sensation, excessive bleeding (25). Hence it is important to determine the location as well as the configuration of the mandibular canal prior to implant placement.
CBCTs offer a non distorted and non overlapped image which give a better picture regarding the diagnosis and treatment modality to be planned (26). Galileo's viewer is the software used in this study to view the CBCTs and CATVVision software which was used to help tracing the nerve canal and thereby the identification of the presence or absence of the anterior nerve looping. The advent of technology has made it possible to reduce the intraoperative and postoperative complications by precise diagnosis priorly.
Mental nerve looping was found predominantly in the female population. However, previous studies have cited that there is no difference with regard to gender and looping (27). The results are not in concordance to previous studies since this was a pilot study, unicentric and geographic trends were not assessed. Looping was found more commonly associated with the left mental foramen compared to the right. Hence, it was not statistically significant. Previous literature on prevalence studies and comparisons have reported that about 11% of the study population possessed bilateral loops and the occurrence of looping is a 40% prevalent condition in the population.
The mental loop if present is observed in different variants namely Type 1, Type 2, Type 3(28–30). The shape of the mental foramen through which the nerve passes, circular, elliptical, quadrangular. The circular shape of the mental foramen was observed in this study. However, whether these pose as a contributing factor towards looping of the mental nerve or not need to be studied with a more variant, greater sample population and randomized control trials.
While placing implants it is important to keep in mind the various anatomical considerations and mark it in CBCT to prevent any mishap (31). Although the implant injury rates are too low, the consequences are severe hence appropriate care must be taken. In the presence of anterior looping of the mental nerve a safe distance must be maintained to ensure the integrity of the nerve, previous studies have reported that a mean safe anterior distance from the anterior loop is about 3 mm + (2.5-3.1 mm) = 5.5-6.1 mm, regardless of age [20].

5. Conclusion

When placing implants in close proximity to mental foramina, caution is recommended to avoid injury to the mental nerve and its neurovascular bundle. Hence, the precise location of the mental loop must be identified using proper radiographic techniques before surgery.

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Conflict Of Interest:

None declared

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