Original Research Paper

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ASSESSMENT OF ANTERIOR LOOP OF MENTAL NERVE IN CENTRAL INDIAN POPULATION USING CONE BEAM COMPUTED TOMOGRAPHY SCANS: A RETROSPECTIVE ANALYTICAL STUDY.

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ABSTRACT **Introduction:** "Anterior loop (AL) of mental nerve, an important structure, is located within the interforaminal area of the mandible. Clinicians should be thorough with anatomy and presence of AL to avoid iatrogenic injury to the nerve during the procedure. **Objective:** To assess the presence, course and length of anterior loop of mental nerve using CBCT and to compare the difference between gender and sides. **Materials and Methods:** The CBCT images of 111 patients taken for various clinical indications were evaluated in different CBCT sections to determine the presence and length of AL and compared between the genders and sides of the mandible. The data was analyzed using chi square and Independent t-test. **Results:** The prevalence of AL was found to be 88.2% and was 85.71% in males and 90.90% in females. The side wise prevalence in males was found 58.30% on left side and 46% on right side whereas it was 54% on left side and 53% on right side in females.Prevalence of type 3 anterior looping was more on left side as compared to right side which was 49.5 %, and type 2 looping more common on right side which was 55%. **Conclusion:** The total prevalence of AL is found 88.2%. Because of the variations of AL length and Type of AL in each patients, utmost care is required while placing implant in proximity to mental foramen to avoid injury to AL. Therefore, an accurate evaluation of AL must be established using CBCT imaging prior to any surgical procedure.

KEYWORDS : Anterior loop, Mental nerve, CBCT scans, Prevalence

INTRODUCTION

In the management of an edentulous mandible, the most viable option is a full arch implant-supported restoration that involves 4-5 implants in the interforaminal area. The implant closest to the mental foramen is the key factor for increasing the anterior-posterior spread and reducing distal cantilever[1]. During preparation, the drill may come in contact with the anterior loop (AL) of the mental nerve/inferior alveolar nerve (IAN) and result in iatrogenic damage, which may present as anaesthesia, paraesthesia, dysaesthesia, or even overt pain in the area innervated by the mental nerve[2].To avoid such iatrogenic complications, the clinicians should be thorough with anatomy and its variations such as anterior loop of IAN. The inferior alveolar nerve may extend beyond the mental foramen in an anterior and inferior direction, curving back to the foramen and forming a loop, termed as anterior loop of inferior alveolar nerve or of mental nerve[3].

Clinically, the anterior loop cannot be seen but detected in cone beam computed tomography (CBCT), spiral CT, and magnetic resonance imaging.CBCT scans have significantly improved the precision of preoperative oral surgery planning, primarily because it is noninvasive, gives 3D assessment, high resolution images and low radiation dose[4]. The objective of the present study was to quantify the ability of CBCT scans to assess the prevalence and the length of anterior loop of mental nerve and to compare the difference between gender and sides.

MATERIALS AND METHODS

The study was conducted in the department of Oral Medicine and Radiology. To estimate the proper sample size for evaluating the difference between groups, StatSoft STATISTICA (Using G Power Analysis) was used. For this present retrospective analytical study, the sample size was calculated using effect size of 0.4, power of the study 80% with critical F at 1.91. The Beta error was kept 0.2 and alpha error was kept at 0.05, with confidence interval at 95%. The total required sample size is 111.The present study comprised of 55 women and 56 men with a total of 111 participants. CBCT scans of whole mandibular arches were retrieved from the pool of CBCT scans taken on 3D Orthophos Sirona CBCT machine and analyzed to evaluate the inferior alveolar canal and anterior loop of mental nerve in interforaminal region (Fig 1). All images were assessed under optimal viewing conditions with Galileos 3D imaging software.

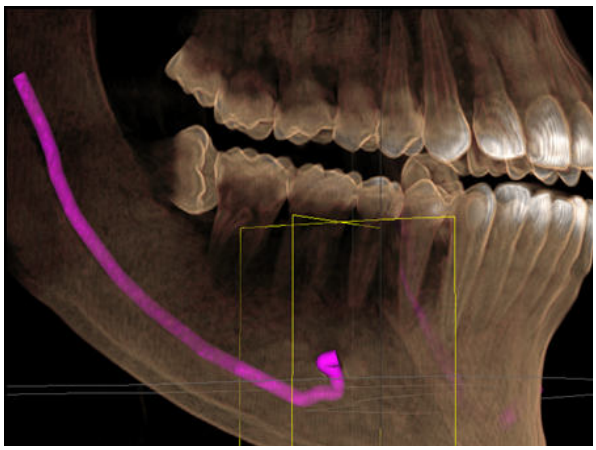


Fig 1: Showing the tracing of Inferior alveolar nerve and the formation of loop on right side

Inclusion criteria consists of patients above the age of 20 years. Low-quality image scans with scattering or insufficient accuracy of bony

borders in the mandibular region, errors/distorted images,patient movement, patients with history of trauma to the mandible, developmental anomalies, and pathological lesions, bone disease were excluded.

Using the software, plane A was placed to align with the most anterior aspect of the mental foramen (Fig 2). This was first identified using 3-dimensional window in full-screen mode for increased accuracy. Once the plane had been drawn, it was verified on the axial view for correctness. The plane B was drawn parallel to the Alpha-plane and touched the most anterior aspect of the loop of the IAN (Fig 3). To verify where the most anterior aspect of the anterior loop was, all the available views were scrolled through using the reconstructions. Once satisfied that it had been identified, we confirmed the Beta-plane. The distance between the Alpha- and Beta-planes constituted the length of the loop[5].

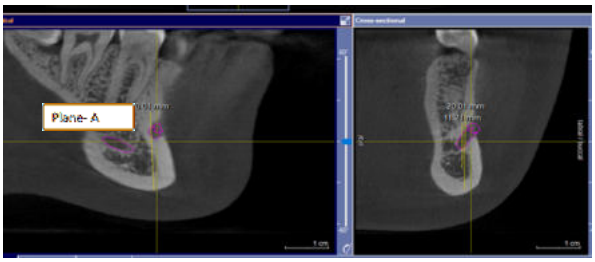


Fig 2: Plane A to the anterior most point of mental foramen in tangential and cross-sectional view

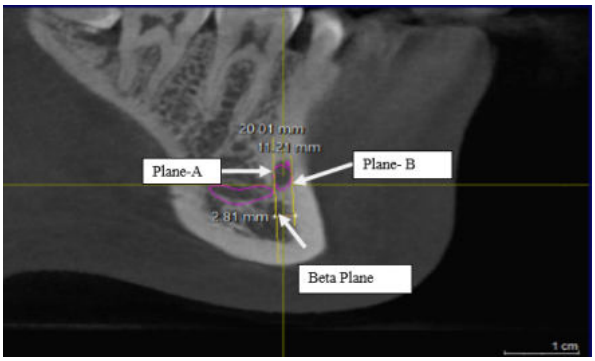


Fig 3: Showing the plane B to the anterior most point of the anterior loop in tangential view and the plane- Beta joining plane A and plane B

RESULTS

CBCT scans of 111 participants were selected for the study. The mean age of the participants was 35.58+/-7.862 years. The frequency distribution according to gender is depicted in Table 1.
50.5% were males while 49.5% were females.

Table1: Gender wise distribution of study sample.

Gender	Frequency	Percentage
Male	56	50.5%
Female	55	49.5%

Table 2: Gender wise prevalence of AL on right and left side and total prevalence respectively

Gender	(n =)	AL frequency observed (n =)	Prevalence	Left Side		Right Side	
Male	56	48	85.71 %	28	58.30 %	20	46.0%
Female	55	50	90.90 %	27	54.00 %	23	53.0 %
Total	111	98	88.2%	55	49.50%	43	38.7%

Table 3: Side wise comparison of length of loop

Side	Mean mm	Std. Deviation (+/-)	Std. Error of Mean	Min. mm	Max. mm	95% Confidence Interval of the Difference		p-value
						Lower	Upper	
Right	.0805	.37876	.03595	.00	3.21	-0.04200	0.24235	0.164
Left	.0694	.30943	.02937	.00	3.26	-0.05845	0.17488	0.322

Independent t test applied

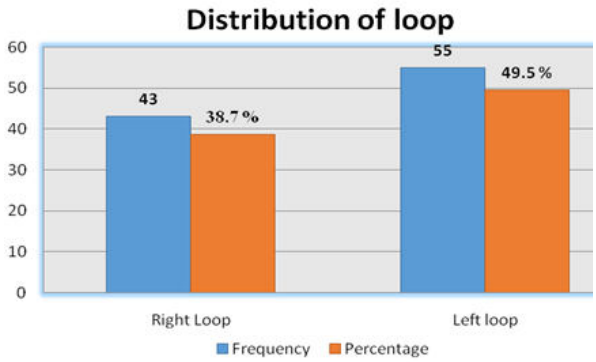
The mean length of loop for right was found to be 0.0805+/-0.0359, which was found non-significant (p=0.164), thus failing to reject the null hypothesis.

The mean length of left loop was 0.0694+/-0.309 which was also found statistically non-significant (p=0.322).

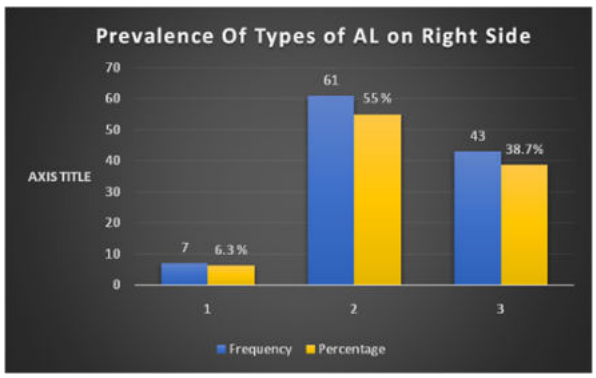
Table 4: Correlation between length of right and left loop.

Length of loop right* length of loop left	R	P
	0.799	0.00

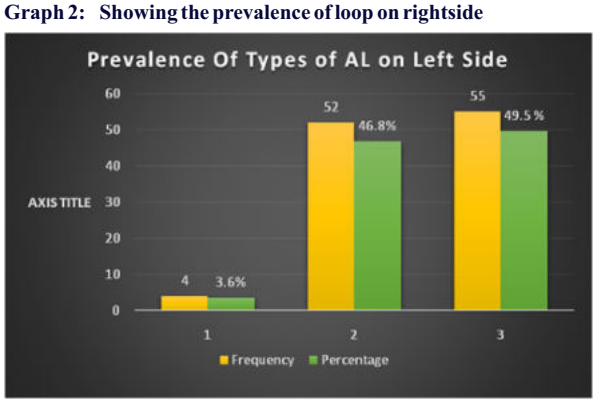
The correlation between length of right and left loop which was found to be positive (0.799) and significant (P=0.00)



Graph 1: Showing the distribution of Loop on right and left side respectively



Graph 2: Showing the prevalence of loop on rightside



Graph 3: Showing the prevalence of Loop on left side

DISCUSSION

The successful placement of implants depends on accurate evaluation of anatomical variation such as AL of mental nerve by 3D CBCT imaging and proper pretreatment planning[6]. The mandibular canal is a bilateral, intraosseous pathway that carries the inferior alveolar nerve from the mandibular foramen to the mental foramen, providing innervations to the teeth of the anterior mandible, the soft tissues adjacent to the foraminal area, and the integument of the chin[7,8].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"[4]. The consideration of this anatomical variation becomes important when planning surgical procedures of the anterior

mandible, such as osteotomy, bone harvesting, and the placement of dental implants.

Previously panoramic radiographs were commonly used for planning of oral surgeries and implant.The length of the AL of the mental nerve cannot be measured with panoramic radiography unless the mental canal is connected to the mandibular canal, since it can easily be confused with a large incisive canal.Another factor that can interfere with the accurate measurement is that panoramic views produce an inherent magnification distortion, in the range of 20% to 30%[9,10]. CBCT scans have significantly improved the precision of preoperative oral surgery planning, primarily because this 3D imaging is effective in any type of bone.

The present study is comprised of CBCT scans of 111 participants; out of which 50.5% are males and 49.5% females (Table 1). The anterior loop (AL) frequency was observed in 48 males (85.71%) out of 56 males with 58.30 % (28 males) prevalence on left side and 46.0 % (20 males) on right side.AL frequency observed in 50 females (90.90%) out of 55 females with 54.00% (27 females) prevalence on left side and 53.0% (23 females) on right side. Total prevalence of loop on right side was 38.7% and on left side 49.5% (Table 2).The minimum and maximum nerve loop length is 2.17 mm and 4.12 mm respectively. The mean length of loop on right was found to be 0.0805+/-0.0359 which was found non-significant (p=0.164). The mean length of loop of on left was 0.0694+/-0.309 which was also found to be statistically non-significant (p=0.322) (Table 3).The correlation between length of right and left loop which was found to be positive (0.799) and significant (p=0.00) (Table 4).

The CBCT study carried out by Chun-I Lu (2015)[4]gives the measurements of the AL comparing the right and left side in different gender and age groups. The anterior loop was present in 624 of 732 hemimandibles. Minimal and Maximal AL length were 2.87 mm and 6.67 mm. The prevalence on right side is 85.8% and on left side is 84.7%, and in gender, the prevalence for male is 85.5% and for female is 85%. In present study the prevalence on right side was 38.7% and on left side was 49.5%; in gender, the prevalence for male was 85.7% and for female was 90.90%.

Nascimento et al (2016)[3] studied 250 CBCT scans of 94 males and 156 females. The AL was seenin 92 (48.9 %) males and 116 (37.2 %) females. Bilateral prevalencefound was 54.1% (73 scans), left side prevalence 24.4% (33 scans) and right-side prevalence 21.5% (29 scans). In the present study the prevalence on left side was found 58.30% in males and 54.00% in females. On right side, the prevalence of loop was seen in 20 (46.0%) males and 23 (53.0%) females and the total prevalence on right side was 38.7% and 49.5% on left side. Gender wise prevalence of loop was 90.90 % in females and 85.71% in males.

In present study the distribution of AL on left side was 49.5% which was more as compared to right side (38.7%) (Graph 1).The most common AL on right side was type 2 (55%) followed by type 3 (38.7%) (Graph 2) and the most common AL on left side was type 3 (49.5%) followed by type 2 (46.8%) (Graph 3).Gupta et al (2021)[6] found the prevalence of anterior loop according to gender, age and dentition status in which the prevalence of anterior loop of inferior alveolar nerve was found to be 56 %. The prevalence was found to be more on right side compared to left side. According to the variations of anterior loop, they found the most common anterior looping of inferior alveolar nerve of type 3 followed by type 1.

CONCLUSION

- After evaluating 111 CBCT Scans of patientsit was revealed that in males the AL prevalence is 85.7% and in females90.9%.
- The side wise prevalence on right side was 46% in males and 53% in females whereas on left side, it was 58.3% in males and 54% in females.
- The prevalence of type 2 loop is 55% on right side and the prevalence of type 3 loop is 49.5% on left side.
- The correlation between length of right and left loop was found to be positive(0.799) and significant (p=0.00).
- The anterior loop of the mental nerve becomes a critical surgical reference point during treatment planning.
- Therefore, while placing implants in close proximity to mental foramina, utmost caution is recommended to avoid injury to mental nerve and its neurovascular bundle.
- The use of CBCT provides accurate measurements of length of anterior loop of mental nerve.
- Because of the wide range of the AL observed in our study, no fixed distance mesialy or anteriorly from the mental foramen should be considered to be a "safe" distance without the use of 3D imaging. Analyzing CBCT scans using the method described in this article can be a useful tool for avoiding implant surgical complications.

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