

Measuring Anterior Loop Length Of The Inferior Alveolar Nerve-An Institutional CBCT Study In Telugu Population

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Abstract

Background: The anterior loop (AL) of the inferior alveolar nerve (IAN) is the section of the nerve that exists anterior to the mental foramen before entering the canal. The presence of AL is essential for implant placement in the interforaminal region of the mandible. Cone-beam computed tomography (CBCT) can evaluate the position and specific location of these anatomical differences.

Material and methods: The current research comprised 48 individuals (24 female and 24 male) CBCT pictures of patient records from October 2022 to March 2023 in the department of implant dentistry. In CBCT, the whole mandible was evaluated from axial, coronal, and panoramic perspectives (CARE STREAM). Patients who participated in the research ranged in age from 20 to 40 years. T-test was performed to evaluate statistical differences between the left and right sides and between the genders.

Results: The mean age of the participants is 48.214.91 years. There were no significant differences between boys and females on the right ($p=0.595$) and left ($p=0.973$) sides with regard to the mean ALL. Likewise, both men ($p=0.9$) and females ($p=0.166$) exhibited no variations in the mean ALL between the right and left sides.

Conclusion: Prior to surgery or implant implantation, it is necessary to use the CBCT method and prepare appropriately to minimize nerve damage.

Keywords: Mandible, mental foramen, CBCT, anterior loop of the inferior alveolar nerve, dental implantation.

INTRODUCTION

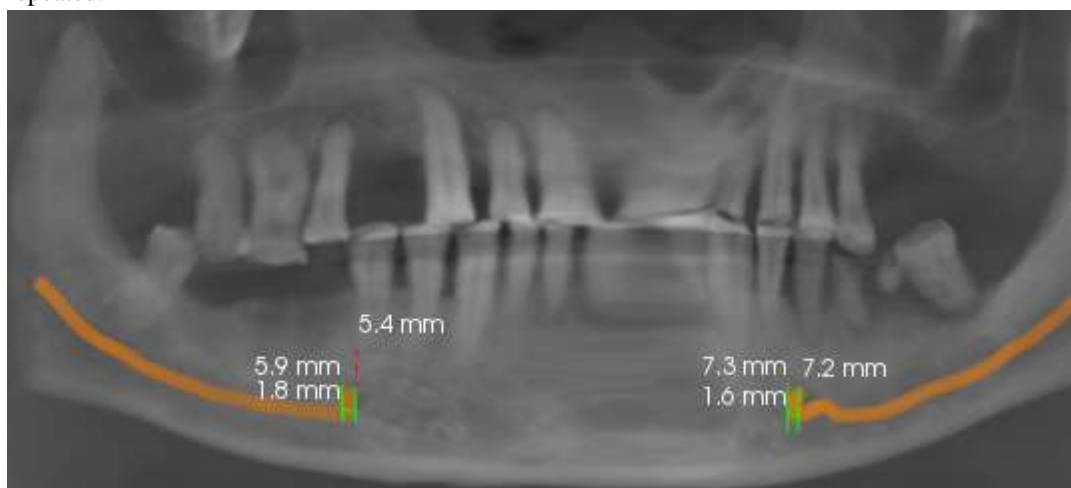
The mental nerve is a branch of the inferior alveolar nerve that provides somatic afferent fibers to the anterior gingiva, lower lip, and chin.¹ During implant placement and osteotomy surgeries, the anterior nerve loop is a crucial anatomical characteristic to consider. Preventing damage to the nerve loop will avoid any reversible or permanent nerve damage induced by medical intervention. Thus, implant placement or other selected procedures in the interforaminal area may breach the anterior loop, causing chin and lower lip sensitivity issues.² To prevent these difficulties, one should maintain a minimum distance of 5 mm from the mental foramen.³⁻⁶ Despite the presence of such guidelines, it is nevertheless preferable to determine the exact location of the anterior loop, since this distance may vary across persons and cultures.⁴ Even using two-dimensional radiography techniques, the anterior loop cannot be precisely identified.⁷⁻⁹ Despite the fact that 3D radiographic techniques, such as cone-beam computed tomography (CBCT), may aid in precisely locating the anterior loop, other approaches are more reliable. The length of the anterior loop, and perhaps its very presence, have been the subject of intense debate in previous investigations.¹⁰⁻¹² It has been found that the prevalence of anterior loops ranges from 7% to 85.2%.¹³⁻¹⁵ The average anterior loop length has been recorded as ranging between 0.4 mm and 6 mm.^{16,17} It is essential to have an in-depth awareness of anatomical landmarks in order to reduce complications throughout various surgical procedures and implant implantation. Few studies have used contemporary radiography techniques to evaluate

the diversity of the anterior loop in Telugu ethnicities. Thus, the present study sought to determine the incidence and length of anterior loop in a Telugu population. The frequency and length of the anterior loop, as well as the presence of any potential associations between the prevalence and length of the anterior loop with age and gender, constituted the research topics.

MATERIALS AND METHODS

In the current retrospective cross-sectional investigation, 48 CBCT pictures of patients were analyzed using patient records from October 2022 to March 2023 from the Department of Implant Dentistry. These patients included 24 women and 24 males. First, the anatomy of the whole mandible was evaluated in axial, coronal cross-sectional, and panoramic cbct perspectives (CARE STREAM). The software was used to trace the IAN, the anterior loop, and a portion of the incisive nerve. Using the cross-sectional view, the entrance and exit of the mental foramen were discovered. In the panoramic image of the slice, the anterior and posterior walls of the mental foramen and the most anterior point of the AnLL, as observed in the cross-sectional view, were represented by vertical lines.

The vertical length of the nerve from the canal to the entrance of the mental foramen was determined from the cross-sectional image and translated to the panoramic view. After marking the most anterior confinement of the anterior loop, a measurement was taken between these two sites. This offered a real length for the AnLL in comparison to the anteroposterior spread of the loop along the nerve's diagonal path. On the right side, a measurement was taken from this point to the mesial confinement of the anterior loop, and this procedure was repeated.



STATISTICAL ANALYSIS

Data were analyzed using IBM SPSS version 20 software (IBM SPSS, IBM Corp., Armonk, NY, USA). Independent samples t tests, paired t tests were done to analyze the study data. For data visualization, bar charts were employed. P value < 0.05 was deemed statistically significant.

RESULTS

The mean age of the study sample was 48.2±14.91 years. Of the 48 study subjects, 24 were males and 24 were females. On the right side, the mean ALL among males was 1.56±0.68 and among females was 1.47±0.54. On the left side, the mean ALL among males and females was 1.55±0.62 and 1.56±0.56, respectively. There were no significant differences in mean ALL between males and females on the right (p=0.595) and left (p=0.973) sides. Similarly, there were no differences in mean ALL between the right and left sides among both males (p=0.9) and females (p=0.166).

Table 1: Comparison of mean ALL on the right and left sides based on gender

Side	Gender	N	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval	P value
Right	Male	26	1.569231	.6827997	.1339080	1.29-1.84	0.595

	Female	22	1.472727	.5435175	.1158783	1.23-1.71	
Left	Male	26	1.557692	.6217222	.1219297	1.306-1.808	0.973
	Female	22	1.563636	.5602257	.1194405	1.31-1.81	

Independent samples t test; $p \leq 0.05$ considered statistically significant

Table 2: Comparison of mean ALL between the right and left sides stratified by gender

Side	Gender	N	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval	P value
Male	Right	26	1.569231	.6827997	.1339080	1.29-1.84	0.9
	Left	22	1.557692	.6217222	.1219297	1.306-1.808	
Female	Right	26	1.472727	.5435175	.1158783	1.23-1.71	0.166
	Left	22	1.563636	.5602257	.1194405	1.31-1.81	

Paired t test; $p \leq 0.05$ considered statistically significant

Figure 1: Comparison of mean ALL on the right and left sides based on gender

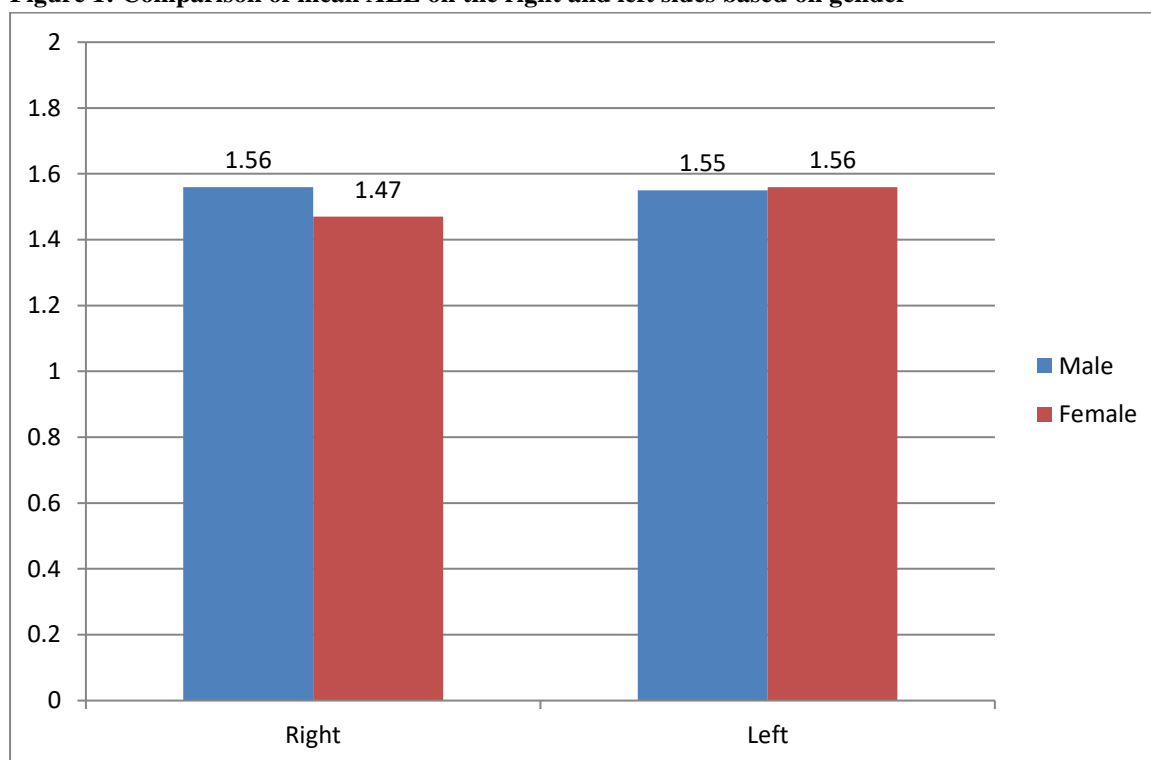
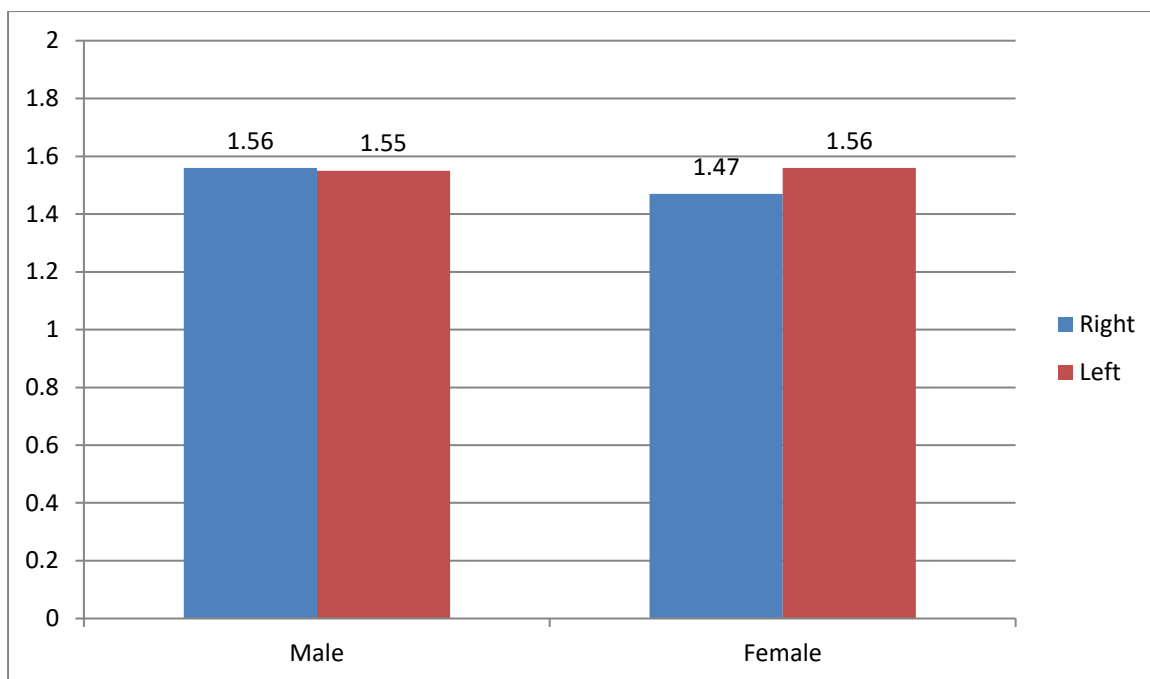


Figure 2: Comparison of mean ALL between the right and left sides stratified by gender



DISCUSSION

The anterior loop of the inferior alveolar nerve is a sensitive anatomical trait that should be considered when inserting dental implants anterior to the mental foramen.

With the advent of technology, advancements have been made in the fields of implants and surgery. Diagnostic aptitude determines the precision with which distinct nerves that must be safeguarded may be recognized throughout these surgical procedures and implants.¹⁸

Cone-beam computed tomography (CBCT) is an imaging technique that allows such anatomical variations to be observed and changes to be performed prior to implant insertion surgery. CBCT allows for enhanced visualization of mandibular anatomical changes, such as the anterior loop and lingual foramen, hence reducing surgical complications.¹⁹

In the present investigation, the prevalence of the anterior loop of the inferior alveolar nerve was found to be 1.56 ± 0.68 on the right side among males and among females was 1.47 ± 0.54 . On the left side, the mean ALL among males and females was 1.55 ± 0.62 and 1.56 ± 0.56 , respectively.

In agreement with the findings of research by Rosa et al.²⁰, de Oliveira-Santos et al.²¹, and Uchida et al.¹⁷, the current study discovered that there were no significant variations between the length of the anterior loop on the left and right sides.

Because of this, one might reach the conclusion that the loop is symmetrical. According to Oliveira-Santos et al.²¹, the current investigation did not identify any significant variations in the length of the anterior loop between the sexes. On the other hand, Uchida et al.¹⁷ found that there was a difference. Before a conclusion can be formed on this topic, further research is necessary.

Anjali gupta (2021)¹⁹ did a research to evaluate the prevalence of the anterior loop of inferior alveolar nerve and its anatomical variations with age, gender, and dentition status in the Indian population. She determined that the prevalence of the anterior loop of inferior alveolar nerve was 56%. On the right side, prevalence was shown to be greater than on the left. There were no significant differences in frequency or mean length of the anterior loop of the inferior alveolar nerve based on dentition status.

A research done by Saraswathi Gopal et al (2017)²² to evaluate the existence and length of the anterior loop in the mental foramen area using CBCT indicated that the anterior loop was detected in 25% of the patients, with an average length of 3.24 mm. The right side had the most amount of anterior looping at 26%, while the left side exhibited the least at 24%. Similar to the current research, a bias for men was seen in the majority of cases.

This research has some limitations. The sample size was minimal. In addition, it was preferable to evaluate the dependability of procedures by re-evaluating selected situations, ideally by a second observer or at the very least by the same observer for a second time. In addition, artifacts and voxel sizes may influence the interpretation of

CBCT images. Using CBCT volumes that could not be extrapolated to anatomical conditions diminished the external validity of the results. Moreover, the findings were unable to represent the Indian ethnicity since CBCT volumes were collected from a single center. Yet, these were the limitations of every prior study.

CONCLUSION

The anterior loop was seen in 48 individuals. Overall, the incidence of ALL among men was 1.56 ± 0.68 and among females it was 1.47 ± 0.54 . There were no significant differences between boys and females on the right ($p=0.595$) and left ($p=0.973$) sides with regard to the mean ALL. Likewise, both men ($p=0.9$) and females ($p=0.166$) exhibited no variations in the mean ALL between the right and left sides.

The AL of the IAN is an anatomical marker of crucial importance. Knowledge about its structure and prevalence has a significant impact on the therapeutic plan. Despite the fact that several techniques are utilized to examine the anatomy of the AL, CBCT can accurately offer evidence regarding the landmark and facilitate appropriate treatment planning. So, while planning operations in the interforaminal area, dentists should classify the existence of the AL and measure them accordingly. To confirm the findings of the current investigation and make a solid suggestion about safety margins, larger sample size studies are necessary.

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