



## ASSESSMENT OF ANTERIOR LOOP OF MENTAL NERVE AND MANDIBULAR BONE DENSITY USING CBCT AMONG PATIENTS VISITING THE DENTAL HOSPITAL - A RETROSPECTIVE STUDY

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### ABSTRACT

**Objective:** Comparison the length and pattern of anterior looping of mental nerve and assess the bone mineral density at the site of mental foramen using CBCT. **Methods:** A total of 508 CBCT images of patients were taken from the Department of Oral Medicine and Radiology, Coorg Institute of Dental Sciences, Virajpet. The patient's CBCT image data was chosen in compliance with the inclusion and exclusion criteria for a retrospective analysis. The criteria for anterior loop of mental nerve which was developed by Solar et al (1994) was used for analyzing the different patterns of mental nerve. The criteria for bone density which was developed by Misch was used for analyzing bone density around the mental foramen region on either side, age and gender. **Results:** The mean length of anterior loop of mental nerve based on age groups ( $p=0.586$ ) and gender ( $p=0.276$ ) were found to be statistically non-significant; whereas mean length of anterior loop of mental nerve based on sides was found to be statistically significant ( $p<0.001$ ). The pattern of anterior loop of mental nerve based on age groups ( $p=0.380$ ) and gender ( $p=0.007$ ) were found to be statistically non-significant; whereas the pattern of anterior loop of mental nerve based on sides was found to be statistically significant ( $p<0.001$ ). The mandibular bone density among study subjects based on age groups ( $p=0.243$ ) and gender ( $p=0.162$ ) were found to be statistically non-significant; whereas mandibular bone density based on sides was found to be statistically significant ( $p<0.001$ ). **Conclusion:** The results of the study focused on evaluating the anatomical characteristics of the anterior loop (AL) of the mental nerve and mandibular bone density using cone-beam computed tomography (CBCT). Hence as public health dentist it is our duty to promote standardized CBCT use protocols and training in public dental clinics to ensure consistency in anterior looping identification and measurement.

**KEYWORDS :** Anterior loop of mental nerve, Cone beam computed tomography, Mandibular bone density, Mental foramen, Mental nerve

### INTRODUCTION

In dentistry, intraoral surgery frequently results in post-operative complications, including unintentional injury to the inferior alveolar nerve. Local anaesthetic block injections have the potential to induce injuries to the inferior alveolar nerve (IAN). Treatment planning for surgical procedures such as implant fixture placement in the mandible, flap reflection, osteotomy and bone harvesting is dependent on an understanding of anatomy and the ability to forecast the site of anterior looping. This helps to avoid unintended complications.

Bone mineral density is directly influenced by a number of factors including age, gender, hormonal imbalance, low calcium diet and certain systemic disease which affects the jaws.

Prolonged tobacco and alcohol use increases bone loss. Reduced bone density in the jaw can lead to premature loss of teeth and poor osseointegration of the dental implants.

Prior assessment of bone mineral density, assessment of the morphology and anatomical positioning of the inferior alveolar canal and mental foramen using CBCT provides a great insight to the clinician and helps in the appropriate treatment planning.

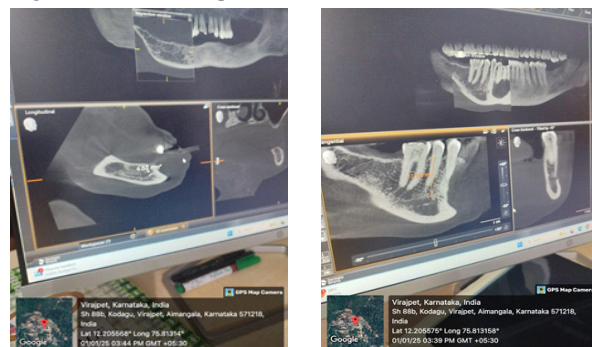
### MATERIALS AND METHODS

The patients' CBCT image data were chosen in compliance with the inclusion and exclusion criteria for a retrospective analysis. The tangential, cross sectional and axial sectional planes were used to assess the CBCT projections. CBCT images of patients were grouped into two - 18-40 and 41-70

years old. The criteria for anterior loop of mental nerve which was developed by Solar et al (1994) was used for analyzing the different patterns of mental nerve. The measurement was also made of the distance between the alveolar crest and the upper border of the mental foramen. The criteria for bone density which was developed by Misch was used for analyzing bone density around the mental foramen region on either side. Comparison of anterior loop of mental nerve and mandibular bone density were carried out based on different variables like age group, gender and side.

**Fig 1** illustrates the length of the anterior loop of the mental nerve

**Fig 2** illustrates the depth of the location of mental foramen



### RESULTS

The results showed that based on age group distribution, 261 (63.2%) of the subjects were between the ages of 18 and 40 and 151 (36.8%) were between the ages of 41 and 70. According to

the study participant's gender distribution, 197 (47.9%) were men and 215 (52.1%) were women. According to age groups, 10 (3.8%) of the subjects in the 18–40 age group and 5 (3.3%) of the subjects in the 41–70 age group exhibit anterior loop presence. According to gender, the anterior loop is present in 7 (3.3%) of the males and 8 (4.1%) of the females. 6 (2.8%) and 13 (6.4%) of the subjects, respectively, had the anterior loop of the mental nerve on their right and left sides. The mean length of anterior loop of mental nerve based on age groups ( $p=0.586$ ) and gender ( $p=0.276$ ) were found to be statistically non-significant; whereas mean length of anterior loop of mental nerve based on sides was found to be statistically significant ( $p<0.001$ ). The pattern of anterior loop of mental nerve based on age groups ( $p=0.380$ ) and gender ( $p=0.007$ ) were found to be statistically non-significant; whereas the pattern of anterior loop of mental nerve based on sides was found to be statistically significant ( $p<0.001$ ). The mandibular bone density among study subjects based on age groups ( $p=0.243$ ) and gender ( $p=0.162$ ) were found to be statistically non-significant; whereas mandibular bone density based on sides was found to be statistically significant ( $p<0.001$ ).

**TABLE 1: DISTRIBUTION OF STUDY SUBJECTS**

| Variable  | Groups | Number (%)  |
|-----------|--------|-------------|
| Age Group | 18-40  | 261 (63.2%) |
|           | 41-70  | 151 (36.8%) |
|           | Total  | 412         |
| Gender    | Female | 215 (52.1%) |
|           | Male   | 197 (47.9%) |
|           | Total  | 412         |

**TABLE 2: PREVALENCE OF ANTERIOR LOOP OF MENTAL NERVE BASED ON VARIABLES**

| Variable  | Groups       | Number (%) |
|-----------|--------------|------------|
| Age Group | 18-40 (261)  | 10 (3.8%)  |
|           | 41-70 (151)  | 5 (3.3%)   |
| Gender    | Male (197)   | 7 (3.3%)   |
|           | Female (215) | 8 (4.1%)   |
| Side      | Right        | 6 (2.8%)   |
|           | Left         | 13 (6.4%)  |

**TABLE 3: MEAN LENGTH OF ANTERIOR LOOP OF MENTAL NERVE BASED ON VARIABLES**

| Variable  | Groups | Mean length (in mm) | P value    |
|-----------|--------|---------------------|------------|
| Age Group | 18-40  | $3.91 \pm 0.1$      | 0.586 (NS) |
|           | 41-70  | $4.91 \pm 0.13$     |            |
| Gender    | Male   | $3.84 \pm 0.977$    | 0.276 (NS) |
|           | Female | $2.8 \pm 1.24$      |            |
| Side      | Right  | $3.37 \pm 1.22$     | <0.001(S)  |
|           | Left   | $2.57 \pm 1.66$     |            |

S: Significant at p value <0.05 using chi square test; NS: Not Significant.

**TABLE 4: PREVALENCE OF PATTERN OF ANTERIOR LOOP OF MENTAL NERVE BASED ON VARIABLE**

| Variable  | Groups | Pattern  | Number (%)  | P value    |
|-----------|--------|----------|-------------|------------|
| Age Group | 18-40  | Type I   | 188 (72.3%) | 0.380 (NS) |
|           |        | Type II  | 61 (23.5%)  |            |
|           |        | Type III | 11 (4.2%)   |            |
|           | 41-70  | Type I   | 119 (78.3%) |            |
|           |        | Type II  | 27 (17.8%)  |            |
|           |        | Type III | 6 (3.9%)    |            |
| Gender    | Male   | Type I   | 148 (68.8%) | 0.007 (NS) |
|           |        | Type II  | 59 (27.4%)  |            |
|           |        | Type III | 8 (3.8%)    |            |

|      |                          |          |             |            |
|------|--------------------------|----------|-------------|------------|
| Side | Female                   | Type I   | 159 (80.7%) | <0.001 (S) |
|      |                          | Type II  | 29 (14.7%)  |            |
|      |                          | Type III | 9 (4.6%)    |            |
|      | Right                    | Type I   | 346 (83.8%) |            |
|      |                          | Type II  | 61 (14.8%)  |            |
|      |                          | Type III | 5 (1.4%)    |            |
|      | Left                     | Type I   | 337 (81.6%) |            |
|      |                          | Type II  | 62 (15%)    |            |
|      |                          | Type III | 13 (3.4%)   |            |
|      | Both sides (symmetrical) | Type I   | 305 (91.3%) |            |
|      |                          | Type II  | 28 (8.4%)   |            |
|      |                          | Type III | 1 (0.3%)    |            |

S: Significant at p value <0.05 using chi square test; NS: Not Significant.

**TABLE 5: DISTRIBUTION OF MANDIBULAR BONE DENSITY BASED ON VARIABLES**

| Variable  | Group                    | Mandibular bone density classification (misch bone classification) | Number (%)  | P value    |
|-----------|--------------------------|--------------------------------------------------------------------|-------------|------------|
| Age Group | 18-40                    | D1                                                                 | 122 (46.9%) | 0.243 (NS) |
|           |                          | D2                                                                 | 138 (53.1%) |            |
|           |                          | D3                                                                 | 0           |            |
|           |                          | D4                                                                 | 0           |            |
|           |                          | D5                                                                 | 0           |            |
|           | 41-70                    | D1                                                                 | 79 (52%)    |            |
|           |                          | D2                                                                 | 72 (47.4%)  |            |
|           |                          | D3                                                                 | 0           |            |
|           |                          | D4                                                                 | 0           |            |
|           |                          | D5                                                                 | 1 (0.6%)    |            |
| Gender    | Male                     | D1                                                                 | 113 (52.6%) | 0.162 (NS) |
|           |                          | D2                                                                 | 101 (47%)   |            |
|           |                          | D3                                                                 | 0           |            |
|           |                          | D4                                                                 | 0           |            |
|           |                          | D5                                                                 | 1 (0.4%)    |            |
|           | Female                   | D1                                                                 | 88 (44.7%)  |            |
|           |                          | D2                                                                 | 109 (55.3%) |            |
|           |                          | D3                                                                 | 0           |            |
|           |                          | D4                                                                 | 0           |            |
|           |                          | D5                                                                 | 0           |            |
| Side      | Right                    | D1                                                                 | 239 (57.9%) | <0.001 (S) |
|           |                          | D2                                                                 | 173 (42.1%) |            |
|           |                          | D3                                                                 | 0           |            |
|           |                          | D4                                                                 | 0           |            |
|           |                          | D5                                                                 | 0           |            |
|           | Left                     | D1                                                                 | 284 (68.8%) |            |
|           |                          | D2                                                                 | 127 (30.8%) |            |
|           |                          | D3                                                                 | 0           |            |
|           |                          | D4                                                                 | 0           |            |
|           |                          | D5                                                                 | 1 (0.4%)    |            |
|           | Both sides (Symmetrical) | D1                                                                 | 201 (69.3%) |            |
|           |                          | D2                                                                 | 89 (30.7%)  |            |
|           |                          | D3                                                                 | 0           |            |
|           |                          | D4                                                                 | 0           |            |
|           |                          | D5                                                                 | 0           |            |

S: Significant at p value <0.05 using chi square test; NS: Not Significant.

**TABLE 6: DISTRIBUTION OF MANDIBULAR BONE DENSITY**

| Mandibular bone density classification (misch bone classification) | Number (%)   |
|--------------------------------------------------------------------|--------------|
| D1                                                                 | 201 (48.79%) |
| D2                                                                 | 210 (50.97%) |
| D3                                                                 | 0%           |
| D4                                                                 | 0%           |
| D5                                                                 | 1 (0.24%)    |

## DISCUSSION

In the present study shows the prevalence of the anterior loop of mental nerve among study subjects based on different variables.

Based on age groups, 10 (3.8%) subjects in the age group of 18-40 years and 5 (3.3%) subjects in the age group of 41-70 years shows the presence of anterior loop. Based on gender, 7 (3.3%) males and 8 (4.1%) females show the presence of anterior loop. Based on side, 6 (2.8%) and 13 (6.4) subjects showed the presence of anterior loop of mental nerve on Right and Left side respectively.

- The results are in contrast with the study conducted by Deepshikha Rodricks et al in Indore (2018) where the presence of anterior loop was 47.5% in the age group 20-40 years old
- The results are in contrast with the study conducted by Mitra Karbasi Kheir et al in Iran (2017) where it showed that 32.8% of images had anterior loop.
- The results are in contrast with the study conducted by Deepshikha Rodricks et al in Indore (2018) where the presence of anterior loop was 51% on right side and 37% on left side
- The results are in contrast with the study conducted by Mitra Karbasi Kheir et al (2017) in Iran where on right side the presence of anterior loop was found to be higher among females (16.7%) compared to males and on the left side the presence of anterior loop was found to be higher among males (16.7%) compared to females.
- The results are in contrast with the study conducted by Versha Rani Giroh et al (2022) in Indore where the prevalence of anterior loop of mental nerve on right side (7.3%) was higher compared to left side (6.5%).

In the present study the mean length of anterior loop of mental nerve was found to be 3.37 mm higher on right side compared to 2.57mm on left side.

- The results are in accordance with the study conducted by Deepshikha Rodricks et al in Indore (2018) where the mean length of anterior loop of mental nerve was found to be 0.5mm on right side and 0.37 mm on left side
- The results are in accordance with the study conducted by Mitra Karbasi Kheir et al (2017) in Iran where the mean length of anterior loop of mental nerve was found to be 2.69 mm on right side compared to 2.36 mm on left side.
- The results are in accordance with the study conducted by Versha Rani Giroh et al (2022) in Indore where the mean length of anterior loop of mental nerve was 3.48 mm in length on right side and 3.14 mm on left side.
- The results are in contrast with the study conducted by Versha Rani Giroh et al (2022) in Indore where the mean length of anterior loop of mental nerve was found to be 3.46 mm in length among males and 3.2 mm among females.
- The results are in contrast with the study conducted by Mahdi Hadilou et al (2022) in Iran where the mean length of anterior loop of mental nerve was found to be 2.13 mm among males and 1.85 mm among females

In the present study the prevalence of mandibular bone density when it is seen on both side 69.3% were high density,

30.7% were of intermediate density and none of them were of low density.

- The results are in contrast with the study conducted by Mustafa Alkhader et al (2017) where 15.6% of sites were of low bone density, 47.9% were of intermediate density, and 36.5% were of high density.
- The results are in contrast with the study conducted by Kirti Dahiya et al (2018) where 21% were of low bone density, 39.5% were of intermediate density and 39.4% were of high density.

In the present study the comparison of mean length of anterior loop of mental nerve between two gender (male and female) was found to be statistically non-significant ( $p > 0.05$ ).

- The results are in contrast with the study conducted by Versha Rani Giroh et al (2022) in Indore where the distribution of overall (on either side) pattern of MN was highly significant between male and female participants studied ( $P < 0.01$ ).
- The results are in contrast with the study conducted by Mahdi Hadilou et al (2022) in Iran where the difference between groups was statistically significant ( $P < 0.05$ ).

In the present study the comparison of mean length of anterior loop of mental nerve between two sides (right and left) was found to be statistically significant ( $p < 0.05$ ).

- The results are in contrast with the study conducted by Versha Rani Giroh et al (2022) in Indore where the difference in the measurement were not statistically significant ( $P > 0.05$ ).
- The results are in contrast with the study conducted by Mitra Karbasi Kheir et al (2017) in Iran where there were no statistically significant differences between the mean lengths of the anterior loop in both sides.
- The results are in contrast with the study conducted by Deepshikha Rodricks et al (2018) in Indore where the differences in anterior and caudal loop between males and females on the right and left sides based on ranks could not satisfy the limit of statistical significance ( $P > 0.05$ )

In the present study, the prevalence and the mean length of anterior loop of anterior loop was done in India only. Among various studies done by different researchers by different countries, the mean length seems to vary. Several research studies on anterior loop were undertaken by different authors:

| Authors                     | Country          | Mean Length of anterior loop                           |
|-----------------------------|------------------|--------------------------------------------------------|
| Sahman and Sisman           | Turkey           | Right side- $2.19 \pm 1$<br>Left side- $2.08 \pm 0.89$ |
| Koivisto et al              | USA              | -                                                      |
| Lu et al                    | USA (California) | $1.46 \pm 1.25$                                        |
| Vujanovic-Eskenazi et al    | Spanish          | $1.59 \pm 0.93$                                        |
| Apostolakis and Brown et al | Greece           | 0.89                                                   |
| Filo et al                  | Switzerland      | 1.16                                                   |
| Rosa et al                  | Brazil           | $2.4 \pm 0.93$                                         |
| Chen et al                  | USA              | $6.22 \pm 1.68$                                        |
| Chen et al                  | Taiwan           | $7.61 \pm 1.81$                                        |
| Uchida et al                | Japanese         | $2.2 \pm 0.8$                                          |

Overall, the study reinforces that CBCT is indispensable for ensuring anatomical safety and enhancing clinical outcomes in dental procedures involving the mandibular region. Routine CBCT evaluation can significantly reduce the risk of neurovascular damage and improve treatment predictability.

## CONCLUSION

The present study was conducted to evaluate the length and pattern of anterior looping of mental nerve and to assess the bone mineral density at the site of mental foramen using CBCT. Based on the results, following conclusions are drawn:

- The mean length of anterior loop of mental nerve based on age groups ( $p=0.586$ ) and gender ( $p=0.276$ ) were found to be statistically non-significant; whereas mean length of anterior loop of mental nerve based on sides was found to be statistically significant ( $p<0.001$ ).
- The pattern of anterior loop of mental nerve based on age groups ( $p=0.380$ ) and gender ( $p=0.007$ ) were found to be statistically non-significant; whereas the pattern of anterior loop of mental nerve based on sides was found to be statistically significant ( $p<0.001$ ).
- The mandibular bone density among study subjects based on age groups ( $p=0.243$ ) and gender ( $p=0.162$ ) were found to be statistically non-significant; whereas mandibular bone density based on sides was found to be statistically significant ( $p<0.001$ ).

Hence it is recommended that as a public health dentist to encourage the use of CBCT as a reliable diagnostic tool before surgical procedures (e.g., implant placement, periapical surgery, periodontal surgery) in the mandibular region to prevent iatrogenic nerve injuries; to advocate for safer surgical practices by incorporating anatomical and bone density considerations into community implant outreach programs and government-supported oral rehabilitation initiatives; to train general dentists and specialists on identifying variations in mental nerve pathway to improve patient safety; to recommend the inclusion of CBCT imaging facilities in teaching hospitals and public health centres where advanced oral rehabilitation services are provided and to promote research correlating CBCT findings with clinical outcomes, such as implant survival rates and patient-reported nerve complications.

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