ARTIGO ORIGINAL

DOI: https://dx.doi.org/10.12662/1809-5771RI.128.5117.p76-79.2025

VISIBILITY AND MORPHOLOGICAL ASPECTS OF THE MANDIBULAR INCISIVE CANAL AND THE ANTERIOR LOOP OF THE MENTAL NERVE BY CONE BEAM COMPUTED TOMOGRAPHY

ABSTRACT

The objective of the present study was to evaluate cone beam computed tomography (CBCT) scans of patients who sought a diagnostic imaging service for various reasons. The study compared measurements of the mandibular incisor canal (MIC) and the anterior loop of the mental nerve (ALMN) in dentate and edentulous patients. A cross-sectional observational study was conducted to evaluate the prevalence of morphometric characteristics, specifically the values of the ALMN, the MIC, and the mental foramen (MF) in the course of the mandibular canal. The study also correlated these values with the gender and age of the patients evaluated. The quantitative data were subjected to the Kolmogorov-Smirnov normality test, and cross-checks with parametric data were subjected to the Student t-test or ANOVA/Bonferroni, while non-parametric Mann-Whitney or Kruskal-Wallis/Dunn tests were used for non-parametric data. Categorical data were expressed as absolute and percentage frequency and compared using Fisher's exact test or Pearson's chi-square test. The study evaluated 97 patients, with 61 (62.9%) females and 36 (37.1%) males. The mean age of the patients was 52 ± 12 years, with 17 (17.9%) patients falling within the 20-40 age range, 51 (53.7%) within the 40-60 age range, and 27 (28.4%) above the age of 60. The diameter of the mandibular foramen (MF), the extensions of the mental foramen (MIC) and the anterior longitudinal muscle (ALMN), and the bone height below and above the MF were found to be similar on both sides. However, the factors of gender and age were found to influence the height of bone near the MF. Regardless of region, patients who lost more than three teeth in the mandible exhibited a reduction in available bone height below and above the MF.

Keywords: cone beam computed tomography; inferior alveolar nerve; mental foramen; mandible; anatomical variation.

Johndner Amaral Soares
Dental Surgeon, Master
Email: johndner@yahoo.com.br
Orcid: https://Orcid.org/0009-0001-1259-1552

Edson Luiz Cetira Filho
Dental Surgeon, Master, Doctor
E-mail: edson.cetira@gmail.com
Orcid: https://Orcid.org/0000-0002-1513-9027

Paulo Goberlânio de Barros Silva
Dental Surgeon, Master, Doctor
E-mail: paulo_goberlanio@yahoo.com.br
Orcid: https://Orcid.org/0000-0002-1513-9027

Phillipe Nogueira Barbosa Alencar
Dental Surgeon, Master, Doctor
E-mail: drphillipenogueira@hotmail.com
Orcid: https://Orcid.org/0000-0002-0026-3359

Fabrício Bitu Sousa
Dental Surgeon, Master, Doctor
E-mail: fbitu@hotmail.com
Orcid: https://Orcid.org/0000-0002-6430-9475

Autor correspondente:
Edson Luiz Cetira Filho
E-mail: edson.cetira@gmail.com

Submetido em: 05/02/2024
Aprovado em: 10/06/2024

Como citar este artigo:
SOARES, Johndner Amaral; CETIRA FILHO, Edson Luiz; SILVA, Paulo Goberlânio de Barros; ALENCAR, Phillipe Nogueira Barbosa; SOUSA, Fabrício Bitu. Visibility and morphological aspects of the mandibular incisive canal and the anterior loop of the mental nerve by cone beam computed tomography. **Revista Interagir**, Fortaleza, v. 20, n. 128 Suplementar, p 76-79. 2025.

1 INTRODUCTION

The inferior alveolar nerve (IAN) runs bilaterally within the mandibular canal (MC) until it gives rise to its terminal branch. The mental nerve emerges from the mental foramen (MF), a bilateral structure located in the anterior portion of the mandible. The mental nerve is responsible for the sensory innervation of the skin of the chin, lower lip, and vestibular gingiva of the anterior teeth of the lower dental arch (Oliveira-Santos, *et al.*, 2012; Haas *et al.*, 2016).

The MF serves as an anatomical reference for procedures performed on the buccal aspect of the mandibular body. Previous studies have demonstrated that the location of the MF may vary according to ethnicity. Therefore, it is crucial to understand the anatomical characteristics of the local population with regard to the position and morphology of the MF (Jacobs *et al.*, 2007).

The objective of this study was to identify the MIC, the general objective being the anterior loop of the mental nerve (ALMN) and the MF, and the specifics being to evaluate their anatomical variations and relate these findings to gender, age, the presence or absence of teeth in the premolar and molar region through CBCT evaluation. The necessity for this study is evidenced by the significance of precise localization of these anatomical variations in our population, which is essential for the safe surgical manipulation of the anterior mandibular region.

2 MATERIALS AND METHODS

The study was observational, quantitative, and cross-sectional. It utilized images from an image bank of a private clinic of reference in dental imaging in Fortaleza, Ceará, Brazil, which were performed from January 2018 to September 2018. Patients were referred for CBCT for various clinical reasons, including third molar extraction and implant planning, irrespective of the research development.

All research procedures were conducted in accordance with the Declaration of Helsinki and the Nuremberg Code, in compliance with the Norms of Research Involving Human Beings (Res. CNS 466/12) of the National Health Council, and in adherence to the ethical standards and patients' rights set forth in these documents.

A trustee agreement was duly signed by the individual responsible for the service (see Annex 1).

This research was submitted to Plataforma Brasil and was reviewed by the Human Research Ethics Committee of Centro Universitário Christus, which assigned the CEP protocol number 03063618.0.0000.5049 (ANNEX 2).

A comparison of mandibular canal wall thickness in patients aged 76 and 86 years revealed a statistically significant difference (1.43±0.41 vs. 1.17±0.39, respectively; $p < 0.05$). A total of 100 CT scans must be evaluated to obtain a representative sample that is consistent with the hypothesis of this study, with a power of 90% and a confidence level of 95% (Xie *et al.*, 1997).

The data were tabulated in Microsoft Excel and exported to the Statistical Package for the Social Sciences (SPSS) software version 20.0 for Windows, in which the analyses were performed adopting a 95% confidence interval.

The quantitative data, which were expressed as mean and standard deviation, were submitted to the Kolmogorov-Smirnov normality test. The data were subjected to statistical analysis using Student's t-test, ANOVA/Bonferroni (parametric data), Mann-Whitney, or Kruskal-Wallis/Dunn (non-parametric data). Categorical data were expressed as absolute and percentage frequency and compared using Fisher's exact or Pearson's chi-square test.

CBCT images were analyzed using Blue Sky Plan version 3.39.4 software (Blue Sky Bio, LLC, Grayslake, IL, USA). Prior to commencing the analysis, the investigator was instructed to adjust the sagittal, coronal, and axial reconstructions to ensure that the occlusal plane was parallel to the ground. Additionally, the orientation line for the panoramic reconstruction was to

be marked to contour the entire mandibular arch at the height of the alveolar ridge or the cervical level of the teeth. The parasagittal sections were evaluated at a thickness of 0.25 mm. The axial, coronal, sagittal, panoramic, and parasagittal reconstructions were subjected to analysis.

3 RESULTS

A total of 100 CT scans of patients were analyzed, and 97 met the inclusion criteria. The three subjects who were excluded from the study exhibited distortions in image quality and shape due to trauma or bone lesions in the study region, rendering it impossible to measure the data accurately. A total of 97 patients were included in this study, with 61 (62.9%) females and 36 (37.1%) males. The mean age of the patients was 52 ± 12 years, with 17 (17.9%) patients between 20 and 40 years, 51 (53.7%) between 40 and 60 years, and 27 (28.4%) over 60 years of age.

The mean foramen diameter was 3.88 ± 0.95 mm, the mean ALMN extension was 3.16 ± 1.05 mm, the mean MIC extension was 9.17 ± 4.02 mm, and the mean bone heights above and below the foramen were 8.39 ± 4.15 mm and 12.8 ± 1.67 mm, respectively. There was no significant difference between the right and left sides.

Furthermore, tooth absence did not influence the diameter of the MF, the ALMN, or the MIC extension. However, patients with more than three tooth losses exhibited lower heights above ($p < 0.001$) and below ($p = 0.048$) the foramen. The tooth absences responsible for bone reduction above the foramen were found to be missing anterior teeth ($p < 0.001$), premolars ($p < 0.001$), and molars ($p < 0.001$). The absence of anterior teeth was the sole factor contributing to the reduction in height below the foramen ($p=0.002$), with no significant influence of the absence of premolars ($p=0.111$) and molars ($p=0.827$).

Of the imaging measurements, only the height below the foramen exhibited a correlation with other measurements. Specifically, it was inversely correlated with the foramen diameter ($p=0.048$, $r=-0.143$) and directly correlated with the height above the foramen ($p<0.001$, $r=0.248$).

4 DISCUSSION

It is of paramount importance to study the anatomy and anatomical variations of the ALMN and MIC in order to perform successful surgery in the anterior region of the mandible, or the region close to the MF. The surgical site for the installation of dental implants for the treatment of total or partial edentulism with implant-supported prostheses in the mandible is typically located between the MFs.

The study by Benninger *et al.* (2011) considered the presence of ALMN to be an anomaly, rather than an anatomical finding. The study by De Brito *et al.* (2016) is in disagreement with the present study, which reported the presence of ALMN and MIC in 25.9% of the sample. When present, the ALMN and MIC were found to be less than 1mm in size. Nevertheless, all studies concur that meticulous observation of these structures is imperative for mandibular procedures in close proximity to the MF.

In the present study, the prevalence of ALMN ranged from 18.6% to 23.7% of cases, which is consistent with the findings of Chen e*t al.* (2015), Juan *et al.* (2016), and Hass *et al.* (2016). However, the work of Arzouman *et al.* (1993) yielded prevalence findings of 56%, which may be attributed to the fact that this study evaluated a relatively small number (n=25) of dry skulls through panoramic views.

The tooth loss factor does not affect the visualization or measurement of the diameter of the mandibular foramen (MF) or the extensions of the mental nerve canal (MIC) and the anterior longitudinal muscle nerve (ALMN). Regardless of geographical location, patients who have lost more than three teeth in the mandible have less available bone height below and above the MF. The loss of teeth in the anterior region of the mandible has a direct impact on the reduction of available bone height below the MF. The height of the bone be-

low the MF is inversely related to the diameter of the MF and directly related to the height of the alveolar bone above the MF.

REFERENCES

ARZOUMAN, M. J. *et al.* Observations of the anterior loop of the inferior alveolar canal. **The International journal of oral & maxillofacial implants,** v. 8, n. 3, 1993.

BENNINGER, B. *et al.* Dental implant placement investigation: is the anterior loop of the mental nerve clinically relevant? **Journal of Oral and Maxillofacial Surgery**, v. 69, n. 1, 2011.

BRITO, A. C. R. *et al.* Panoramic radiographs underestimate extensions of the anterior loop and mandibular incisive canal. **Imaging Science in Dentistry**, v. 46, n. 3, 2016.

CHEN, Z. *et al.* Relationship between the position of the mental foramen and the anterior loop of the inferior alveolar nerve as determined by cone beam computed tomography combined with mimics. **Journal of Computer Assisted Tomography**, v. 39, n. 1, 2015.

HAAS, Letícia F. *et al.* Anatomical variations of mandibular canal detected by panoramic radiography and CT: a systematic review and meta-analysis. **Dentomaxillofacial Radiology**, v.45, n. 2, 2016.

JACOBS, Reinhilde *et al.* Neurovascularization of the anterior jaw bones revisited using high-resolution magnetic resonance imaging. **Oral Surgery Oral Medicine Oral Pathology Oral Radiology Endodonthic**, v. 103, n. 5, 2007.

JUAN, Del Valle Lovato *et al.* Anterior loop of the inferior alveolar nerve: Averages and prevalence based on CT scans. **Journal Prosthetic Dentistry**, v. 115, n. 2, 2016.

OLIVEIRA-SANTOS, Christiano de *et al.* Assessment of variations of the mandibular canal through cone beam computed tomography. **Clinical Oral Investigations**, v.16, n. 2, 2012.

XIE, Q. *et al.* Resorption of mandibular canal wall in the edentulous aged population. **The Journal of prosthetic dentistry**, v. 77, n. 6, 1997.