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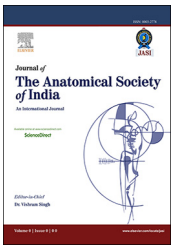

Original Article

Characterization of anatomical structures using panoramic X-rays: Part II: Mandibular incisive canal

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ABSTRACT

Introduction: The mandibular incisive canal (MIC) is the anterior extension of the mandibular canal which contains the mandibular incisive nerve and blood vessels that provide blood supply and innervation to the mandibular anterior teeth.
Methods: In order to determine the detectability, extent, and position of the MIC, conventional panoramic radiographs of 215 Chilean patients were analyzed.
Results: The MIC was detected in 35.9% of cases, and was more frequently observed in male patients (37.5% in males and 34.7% in females) and on the right side of the mandible (44.6% in the right side and 27.4% in the left side). The results showed a tendency for the detectability of the MIC to decrease with age. The average extensions of the MIC on the right and left sides of the mandible were found to be 8.16 mm and 5.58 mm, respectively. The average minimum and maximum distances from the lower limit of MIC to the lower margin of the mandible were 11.7 mm and 13.2 mm, respectively.
Discussion: Panoramic radiographs have limited effectiveness when being used to determine the presence, extent, and precise location of the MIC. Since there are significant differences in detectability, length, and path of the MIC between panoramic radiographs and anatomical studies, the use of cone beam (CT) scans is recommended for invasive treatments of the interforaminal jaw area.

1. Introduction

Various surgical procedures involve the interforaminal area of the mandible, such as dental implants, bone grafts, and bone block extraction, among others. Usually, it is considered a safe area for this type of treatment, as it is supposedly free of anatomical structures that might be damaged. However, there have been reports of altered sensation after these types of treatments, in addition to bruising, edema, and failure of implant osseointegration.[1–3]

The exact anatomy of the anterior portion of mandible is still controversial. In 1928, Olivier[4] first described the anatomical course of the inferior alveolar nerve (IAN), which travels

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the mandibular canal, heading in the anterior direction and then becomes divided into two terminal branches: mental nerve, which emerges from mental foramen and the incisive nerve located in the mandibular incisive canal (MIC), which also contains blood vessels.[5] However, other studies refute the existence of an incisive canal as such.[6]

Studies using CT scans to detect the presence of the incisive canal have detected it in over 80% of cases[7–9] and in some cases recommend it (the use of CT scans) over panoramic radiographs, which have limitations in identifying this structure.[10,11] However, Mardinger et al.[5] report the partial or complete presence of bony cortical walls of the mandibular canal in most cases, and that the correlation of this phenomenon with two-dimensional radiographic findings is statistically significant.

Moreover, it should be noted that panoramic radiographs are still one of the most frequently used methods in clinical practice, and that their economic cost is significantly lower than CT scans. Consequently, it is essential to determine the ability of conventional panoramic radiography to detect this structure. Thus, the objective of this research was to study the effectiveness of panoramic radiographs in identifying the MIC and its anatomical relationships.

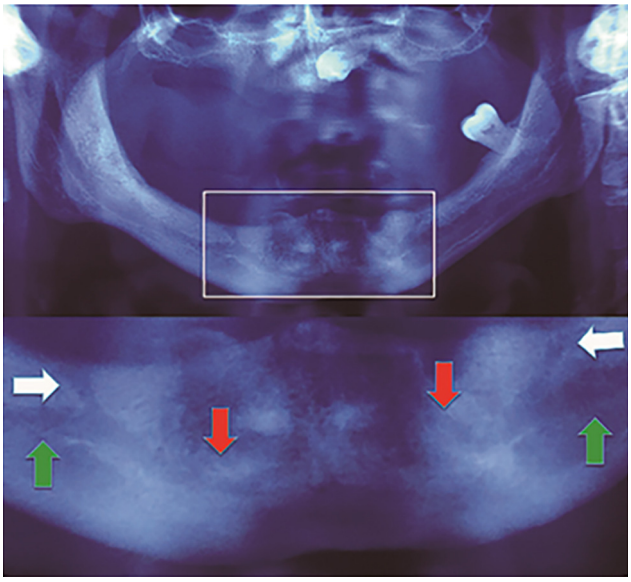

Fig. 1 – Visualization of MIC in panoramic radiograph. The presence of the mandibular canal (green arrow), mental canal (white arrow), and the MIC (red arrow) is observed.

2. Materials and method

This study is a descriptive study. Conventional panoramic radiographs taken in a private clinic in the city of Temuco, Chile were analyzed. The radiographs were taken using the standard technique with *Orthopantomograph* (Proline CC, Planmeca, Helsinki, Finland) and the developing process was done in an automatic processor (Dürr XR 24 pro, Bietigheim-Bissingen, Germany), Image plate Kodak, T–MAT G/RA (New York, USA). All radiographs analyzed in the study were from patients with known age and gender. Radiographs of patients under age 21 and/or evidencing distortions or alteration in contrast were excluded. The sample consisted of 215 films, of which 73 were men and 142 women, aged from 21 to 82. The unit of analysis was the side (right and left) of the jaw. All cases showing presence of pathologies and/or impacted teeth were excluded. A total of 212 right and 208 left sides were analyzed.

The presence of MIC and its differentiation into mental canal and loop of the mandibular canal were determined as outlined in Fig. 1.

To take measurements on the panoramic radiographs, a negatoscope was used. The lines were made manually on a transparency overlaid on the image plate. A line (line L1) tangential to the lower margin of the mandible, parallel to the horizontal (Fig. 2)[12] was plotted. Another line was drawn perpendicular to L1 and tangential to the most medial point of the mental foramen (line L2). A third line was drawn tangential to the most anterior point of the MIC visible on the panoramic radiograph (line L3). Finally, a line (L4) was drawn through the midsagittal plane determined by the anterior nasal spine (Fig. 2). Next, the following parameters were measured:

(1) Minimum distance (D1) from the lower limit of the MIC to the lower margin of the mandible (Fig. 2). To determine the shortest distance, all mandibular margin distances to the MIC were measured at intervals of 1 mm.
(2) Maximum distance (D2) from the most anterior lower limit of the MIC to the lower margin of the mandible (Fig. 2). To determine the greatest distance, all mandibular margin distances to the MIC were measured at intervals of 1 mm.
(3) Extension of the canal (D4), from L2 to L3 (Fig. 2) [9].

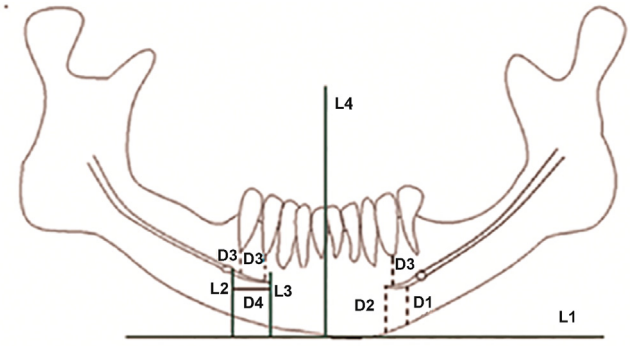

Fig. 2 – Drawing based on a panoramic radiograph, with MIC paths and distance measurements. The location of the measurement of the D1, D2, and D3 distances varies, depending on the position of measurement of minimum distance (D1), maximum distance (D2), and teeth in relation to the path of the MIC location (D3).

Furthermore, the distance from the upper limit of the canal to the root apex (D3) of all related teeth was measured, tracing lines perpendicular to L1 (Fig. 2).

Measurements were taken with a Mitutoyo digital caliper (Mitutoyo America Corporation, IL, USA) with an accuracy ± 0.02 mm. These were performed by a single operator who