Relationship between the Mental Foramen, Mandibular Canal, and the Surgical Access Line of the Mandibular Posterior Teeth: A Cone-beam Computed Tomographic Analysis

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Abstract

Introduction: The purpose of this study was to investigate the relationships between the location of the mental foramen (MF) and the mandibular canal (MC) and the surgical access line (SAL) of the mandibular posterior teeth using cone-beam computed tomographic (CBCT) scans. **Methods:** CBCT scans of 204 subjects ranging in age from 18–76 years old were evaluated. The vertical and horizontal distances from the MF to the SAL of the mandibular premolars and first molars and the vertical distance from the MC to the SAL of the second premolars and first molars were measured via CBCT scans. **Results:** The average vertical distance between the MF and the SALs showed significant increases sequentially from the first premolars to the distal roots of the first molars, and the shortest average distance of 2.74 mm was obtained for the first premolars. The SALs of the second premolars were the closest to the MF in the horizontal direction with an average distance of 1.5 mm. In 19.9% of the cases, the vertical and horizontal distances between the MF and the SALs of the second premolars were less than 2 mm. In addition, the MF was located superior to the root apices in 6.62% of the cases. The majority of the SALs were located at a vertical distance from the MC that was more than 2 mm. Men and women exhibited significant differences in both the horizontal distance from the MF to the SALs of the first premolars and the vertical distance from the MC to the SALs of the second premolars. **Conclusions:** To improve the success of endodontic microsurgery, adequate knowledge of the anatomic relationships between the location of the MF and MC and the SAL of the mandibular posterior teeth is indispensable to surgeons. *(J Endod 2017;■:1–5)*

Key Words

Cone-beam computed tomography, endodontic microsurgery, mandibular canal, mental foramen

Significance

Endodontic surgical procedures in the mandible are complicated because of the nearby presence of the mental foramen and the inferior alveolar nerve canal. We examined the relationship between these structures and the respective tooth apex. We believe that these can help surgeons during surgery.

Endodontic microsurgery consists of a series of procedures that include osteotomy, apical root resection, root-end preparation, and root-end filling. It is a type of apical surgery that is performed with a surgical operating microscope. A higher success rate can be achieved with the removal of all necrotic tissue and complete sealing of the entire root canal system. With orthograde root canal treatment and endodontic microsurgery, almost all teeth with lesions of endodontic origin can be successfully treated (1–3). However, for certain cases, the surgery is challenging because of the close proximity of important anatomic structures, such as the maxillary sinus, mental foramen (MF), and mandibular canal (MC). To avoid unexpected injury to these structures, 3-dimensional (3D) radiographic examinations of the surgery area using cone-beam computed tomographic (CBCT) scans are typically required (4).

Kim and Kratchman (5) suggested that the osteotomy diameter in endodontic microsurgery should be no larger than 4 mm to provide an adequate operation space and conservation of healthy bone. Furthermore, Kim and Kratchman found that a root resection of 3 mm was required to remove the majority of the lateral canals and apical ramifications, which have the potential to cause failures. Therefore, at least 3 mm of the root tip should be exposed after osteotomy for root resection. Surgical access can be compared with a cylinder with a diameter of 4 mm, with the central line of the cylinder being perpendicular to the surface of the buccal bone and traveling through a point 1 mm from the apex. For convenience in clinical applications, the line that passes through the root apex tip and is perpendicular to the surface of the buccal bone is set as the surgical access line (SAL) on CBCT scans to analyze the relationships between the MF and MC and the SALs of the mandibular posterior teeth.

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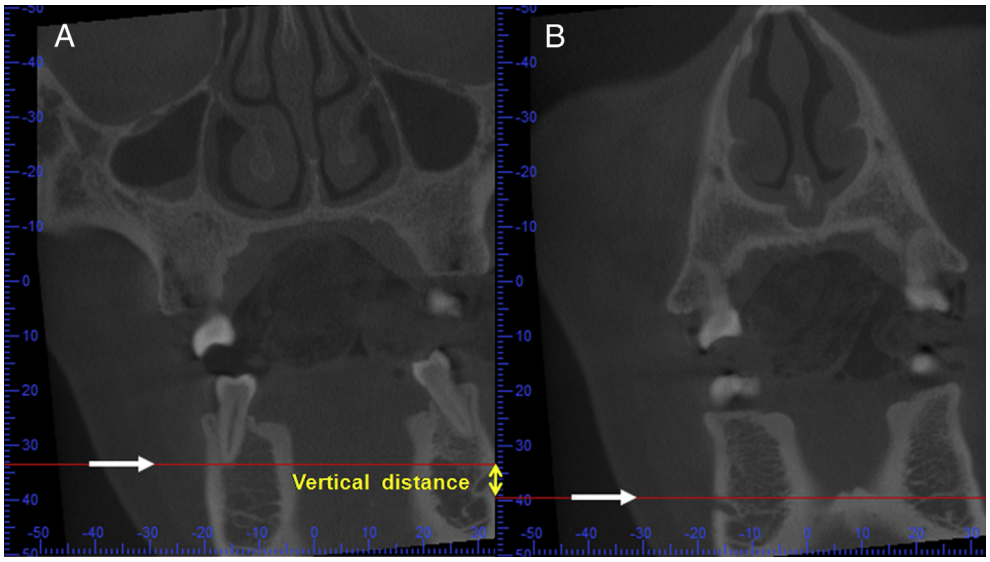

Figure 1. The vertical distance between the upper edge of the MF and the SAL of the mandibular posterior teeth. (*A*) The level of the SAL. (*B*) The level of the upper edge of the MF.

The anatomic relationships between the MF and MC and the SALs of mandibular posterior teeth should be confirmed before performing surgery on a patient. It has been regarded as a difficult factor to evaluate before surgery (5). In addition, altered sensation can occur after endodontic treatment if nerves are injured, and this complication can affect a patient for a short or long time (6–8). Surgical procedures on mandibular posterior teeth are performed in the vicinity of the MF and MC and may cause nerve injury. Therefore, determining the locations of the MF and MC before surgically accessing the roots represents an indispensable procedure for surgeons (9, 10).

For nonsurgical dental treatment, 2-dimensional radiography is helpful for diagnosing diseases and identifying the locations of anatomic structures. However, 2-dimensional radiography has disadvantages; for example, superimposition, geometric distortion, and anatomic noise usually lead to errors in the locations of various structures (11, 12). With the emergence of 3D radiography in oral medicine, CBCT imaging is increasingly used to help with diagnosis and nonsurgical and surgical treatment planning for dental diseases. Aminoshariae et al (13) summarized the techniques used to determine the accurate location of the MF; CBCT imaging was considered the best. Fewer errors were observed when the mandibular bone and anatomic structures were evaluated using CBCT imaging than when using other methods (14). In addition, CBCT imaging delivers sensitive and accurate measurements (15) and can display root fractures (16–18).

Kim et al (4) reported that the MF and MC are important anatomic structures of the mandible and indicated that injury to these structures should be avoided in the process of endodontic microsurgery. Most studies published on the MF have focused on its diameter, angle, distribution, and distance to the alveolar crest (19–21). Although Chong et al (9) evaluated the relationship between the MF and mandibular teeth, they examined only the shortest distance between the MF and root

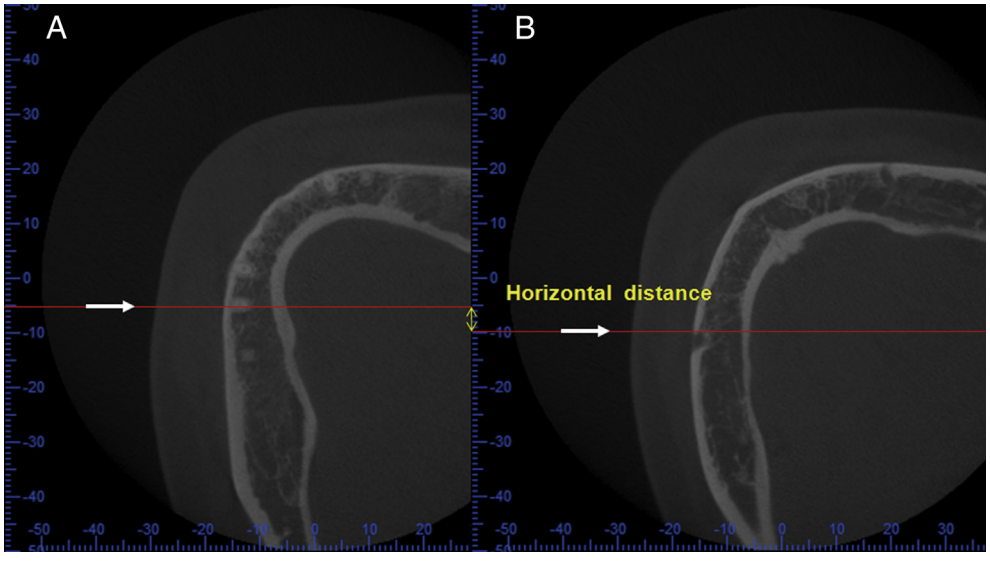

Figure 2. The distance in the horizontal direction between the side edge of the MF and the access line of the surgery for the mandibular posterior teeth. (*A*) The level of the SAL. (*B*) The level of the side edge of the MF.