Use of cone-beam computed tomography in the diagnosis of sensory nerve paresthesia secondary to orthodontic tooth movement: A clinical report

Randeep S. Chana,a William A. Wiltshire,b Anastasia Cholakis,c and Gary Levine

d Winnipeg, Manitoba, Canada

In this article, we report an incident of transient neuropathy secondary to tooth movement involving the inferior alveolar nerve. This clinical report reflects the need to thoroughly examine potentially high-risk patients for neuropathy using advanced diagnostic tools such as cone-beam computed tomography when diagnosing and planning treatment. (Am J Orthod Dentofacial Orthop 2013;144:299-303)

Transient neuropathy secondary to orthodontic tooth movement has been reported as a rare occurrence.1-7 Nevertheless, reports of paresthesia during orthodontic treatment reflect the need to thoroughly assess the possible risk of injury to the inferior alveolar nerve before the start of orthodontic therapy as part of the process of informed consent.

Orthodontic treatment involves complicated tooth movements in 3 dimensions. Accurate assessment of root proximity to the inferior alveolar nerve in the buccal and lingual dimensions might not be possible with conventional 2-dimensional panoramic radiographs. This indicates the need for a cone-beam computed tomography (CBCT) scan in potentially high-risk patients. A CBCT scan is considered an accurate method to evaluate the position of the mandibular canal.8 To determine the course of the inferior alveolar nerve bundle suggests the need for CBCT before attempting treatment in this area to minimize the risk of neuropathy.8

Sensory disturbances of the lower lip are more commonly reported as a result of orthognathic surgery to the lower jaw,6,9-11 internal rigid fixation of mandibular fractures,6,12 removal of third molars,6,13,14 dentoalveolar surgery,6,15 endodontic treatment,6,16 or a tumor near the mandibular canal.6,17 To date, there are only a few case reports of paresthesia after tooth movement impinging the inferior alveolar nerve.1-7 The reported causes of nerve disturbances are all classified as neuropraxies18 or first-degree nerve injuries.19 Neuropraxia results from minor compression of the nerve trunk, causing a conduction blockade.19 Axonal continuity is maintained; this results in a temporary conduction blockade.19 Patients clinically report sensory disturbances lasting from hours to months, usually with complete sensory recovery.19 We present a case report of sensory disturbance of the lower lip and the chin occurring during inadvertent intrusion of a third molar into the inferior alveolar nerve canal during orthodontic treatment.

CASE REPORT

A healthy 27-year-old man came for orthodontic treatment to address his chief complaint of “correcting his crooked teeth.” After analyzing his clinical examination findings and records, we determined that a nonsurgical extraction treatment plan with a temporary skeletal anchorage device was necessary to align his severely crowded teeth (Fig 1). The clinical examination showed a symptomatic endodontically treated maxillary right first molar (tooth 16; Federation Dentaire Internationale tooth numbers are used throughout this article) with a large amalgam restoration. The decision was made to extract the symptomatic molar and the maxillary left first premolar (tooth 24). Because the patient was already missing the mandibular second...
molars bilaterally, retraction of the posterior segments into these edentulous spaces using a temporary skeletal anchorage device and the existing third molars for additional anchorage was planned. The third molars would eventually be extracted at the completion of treatment. The initial panoramic radiograph showed the close proximity of the mandibular third molars (teeth 38 and 48) to the inferior alveolar nerve (Fig 2).

After extraction of teeth 16 and 24, a temporary skeletal anchorage device (Vector; Ormco, Glendora, Calif) was placed in each posterior quadrant to facilitate anchorage for the retraction. A maxillary transpalatal arch was cemented on teeth 17 and 27 to facilitate intrusion of these molars and reinforce anchorage. All temporary skeletal anchorage devices were placed under local anesthesia (2% lidocaine, 1:100,000 epinephrine) with no postoperative complications (Fig 3). Blugloo (Ormco) was placed on the occlusal surfaces of teeth 38 and 48 to free the interocclusal contact to facilitate the distalization (Fig 4).

For the maxillary arch, sectional mechanical principles were used after bonding with an 0.018-in Victory MBT (3M Unitek, Monrovia, Calif) prescription fixed appliance. Bondable buttons were used to retract teeth 36 and 46 individually with elastomeric power chains. Power chains were used on the buccal and lingual surfaces so as not to cause a rotational moment while retracting the mandibular first molars (Figs 3 and 4).

To facilitate the retraction of teeth 36 and 46, 2 mm of Blugloo was placed on the disto-occlusal surfaces of teeth 38 and 48 on April 5, 2011. After this, the patient came for routine adjustment appointments on April 26 and May 2, 2011, with no postoperative complaints or complications. He reported tingling and numbing of his lower left lip and chin beginning on May 5, 2011, exactly 1 month after the Blugloo placement. The numbing sensation continued to increase to a 90%
loss of feeling in this area by May 16, 2011 (Fig 5), 41 days after the temporary skeletal anchorage device placement. On May 16, 2011, he came to the clinic to address his concerns of paresthesia. He was assessed by the attending periodontist (A.C.) and orthodontist (W.A.W.) using mechanoceptive testing via 2-point discrimination. The examination showed paresthesia in the area innervated by the inferior alveolar nerve (Fig 5). At this time, the radiographic examination showed no evidence of pathologic entities and ruled out any potential issues with the temporary skeletal anchorage device placed mesially to tooth 38 (Fig 6). The most reasonable explanation of the sensory disturbance was that the third molar was invading the space of the inferior alveolar nerve as it was being intruded by the Blugloo placed on April 5, 2011.

To confirm this finding, small-field CBCT imaging (K9500; Kodak, Rochester, NY) was taken of the area of tooth 38 (Fig 7). The CBCT image allowed for visualization of the course of the inferior alveolar nerve in relation to the roots of the teeth and the proximity to the temporary skeletal anchorage device in a transverse view (Fig 7). The CBCT images showed that the mesiobuccal root of the mandibular left third molar was invading the space of the inferior alveolar nerve in both the coronal (Fig 8) and sagittal (Fig 9) views. After the radiographic evaluation, the Blugloo was removed from teeth 38 and 48, and anterior bite turbos were placed to facilitate disclusion. A follow-up examination was completed on June 9, 2011, when the patient reported a subjective 90% improvement of his paresthesia. Once again, 2-point discrimination testing was completed for objective evaluation of the affected area. The patient was able to distinguish 2 distinct points (3 mm apart) where he had previously experienced paresthesia. Removal of the Blugloo let the tooth to relapse away from the inferior alveolar nerve, allowing sensation to return to the patient’s lower left lip and chin. At a subsequent follow-up appointment 1 month later, full sensory recovery had taken place.

**DISCUSSION**

In this patient, the CBCT images showed that the root of the mandibular left third molar was encroaching on the inferior alveolar canal. The explanation for the paresthesia was therefore evidently the inadvertent intrusion of the mesiobuccal root of tooth 38 against the canal, causing pressure on the inferior alveolar nerve. Once the Blugloo was removed, tooth 38 relapsed occlusally, allowing for relief of the pressure on the mandibular nerve and subsequent resolution of the patient’s symptoms of paresthesia.

Management of this patient emphasizes the importance of the use of CBCT in the diagnosis and confirmation of various conditions, which are at times not evident with normal radiography. Several studies have shown CBCT imaging to be superior in generating images to locate root position and proximity to vital...
structures compared with 2-dimensional radiographs. For this patient, CBCT imaging was used to rule out signs of pathology and confirmed the close root proximity of tooth 38 to the inferior alveolar nerve in 3 dimensions.

The CBCT image helped us to visualize the position of the inferior alveolar canal. The anatomy of the position of the inferior alveolar nerve is highly variable from patient to patient. Carter and Keen described 3 distinct anatomic patterns of the intramandibular course: type...
1, the nerve courses straight toward the mental foramen lying close to the root apices; type 2, the nerve follows a lower pathway in the mandible with dental branches passing obliquely in an anterosuperior direction to the teeth; and type 3, the nerve divides into 2 branches, one passing superiorly to supply the molars and the other inferiorly to innervate the premolars, canines, and incisors.

According to this classification, this patient had a type 1 intramandibular course.

To our knowledge, there are only 7 cases of paresthesia reported secondary to orthodontic tooth movement. All of them involved either the mandibular second premolar or the mandibular second or third molar invading the space of the inferior alveolar nerve.1-7 The paresthesia resolved within 2 days to 4 weeks after the forces were removed or the relevant tooth was extruded. In this case study, the patient’s symptoms of paresthesia resolved shortly after removal of the orthodontic forces placed on the tooth compressing the inferior alveolar nerve. Other than baseline neurosensory testing on subsequent follow-up appointments, he did not require further treatment regarding this complication. For patients with neurologic disturbances, persistence of the symptoms would require referral to a specialist for investigation and management to rule out pathology.

CONCLUSIONS

Although inferior alveolar nerve paresthesia secondary to orthodontic tooth movement is rare, an increase in reported cases reflects the need for careful examination of root proximity to these vital structures before orthodontic treatment. If predictive factors are noted on the radiographic examination that put a patient at high risk of nerve damage, he or she should be informed.22 Technologies such as CBCT imaging should be used to better visualize anatomic relationships with treatment goals in mind to anticipate injury to the inferior alveolar nerve during treatment. In the case of orthodontically induced paresthesia, deactivation of the force usually resolves the patient’s symptoms. However, if the paresthesia persists 2 weeks after removal of the forces, the patient should be referred to a specialist (radiologist or pathologist) to rule out other potential causes.

REFERENCES