The Management of Persistent Pain From a Branch of the Trifid Mandibular Canal due to Implant Impingement

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The mandibular canal is a conduit that allows the inferior alveolar neurovascular bundle to transverse the mandible to supply the dentition, jawbone, and soft tissue around the lower lip. It is now acknowledged that the mandibular canal is not a single canal but an anatomical structure with multiple branches and variations. Iatrogenic injury to branches of the mandibular canal that carry a neurovascular bundle has been reported to cause injury to the main canal as severe as if the main canal itself is traumatized. These injuries include bleeding, neurosensory disturbance, or the formation of traumatic neuroma, and so far, they have involved cases with the bifid mandibular canal. This current report presents a case of neurosensory disturbance that resulted from the impingement of a branch of a trifid mandibular canal during implant insertion. Its management included analgesics, reexamination, and reinserting a shorter implant.

Key Words: mandibular canal, trifid canal, implant, neurosensory disturbance

INTRODUCTION

The mandibular canal is a conduit that allows the inferior alveolar nerve, artery, and vein to course intraosseously from the mandibular foramen to the mental foramen.[1,2] The determination of the exact location of the mandibular canal and the identification of any branches arising from it is of utmost importance prior to performing surgical procedures in the mandible, so as not to injure them.[2] In older textbooks, the mandibular canal is usually described as a single channel containing the inferior alveolar neurovascular bundles,[3] but newer literature reports the presence of multiple smaller branches that run roughly parallel to the main trunk as one of its variant.[1,2] It has been mentioned that these branches occasionally are large enough to become a secondary mandibular canal, forming the so-called bifid mandibular canal.[1] Another anatomical variation seen is the trifid canal, which is rare and has been reported only in case reports as an incidental finding with no clinical implication.

The presence of intraosseous mandibular branches is not new. It was noticed in anatomy dissection almost 9 decades ago, although its clinical implication was not understood then. However, branches are usually detected by means of radiograph as they do not have any clinical landmark.[1] Occasionally, these accessory canals exit through multiple foramina that are seen when a flap is raised.[4] Nevertheless, this multiple branching usually goes unrecognized because many dentists are unaware of or are unfamiliar with this anatomical variation, even though they may be recorded in panoramic radiographs. Currently, there are only a handful of research studies that report the presence of mandibular nerve branching.[2]

It is acknowledged that these branching canals may contain nerve bundles and arteries, indicating their potential significance in providing innervation and blood supply to the mandible.[4] Worse, it has been reported that while 60% of the mandibular canal contains the entire inferior alveolar nerve, the remaining 40% of branches may distribute such that a distinct canal is not present.[5] Thus, iatrogenic injury may result from the failure to detect them, both radiographically and clinically. Injury to any of these branches may result in bleeding and worse development of traumatic neuromas, although such reports have yet to be communicated.[2] A search of the literature regarding injuries to the accessory branches of the mandibular canal found only 1 case report with neurosensory disturbance that followed a lower left third molar surgery and another case of neurosensory disturbance that resulted from the impingement of a bifid canal by a dental implant fixture.[6] These 2 cases show that iatrogenic injury to a smaller branch of the main nerve can result in an equally dire consequence, similar to the extent as if the main nerve was affected.

The following case report highlights the presence of trifid canals in a patient in which one of the canal's branches was impinged by a dental implant, resulting in persistent pain postoperatively. It was detected only after employing cone-beam computerized tomography (CBCT) scanning and image manipulations with third-party software. Its management included analgesics, reexamination, and reinserting a shorter implant.

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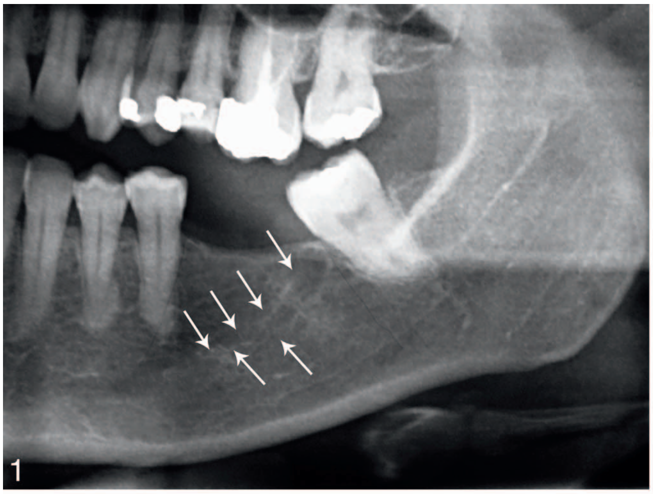

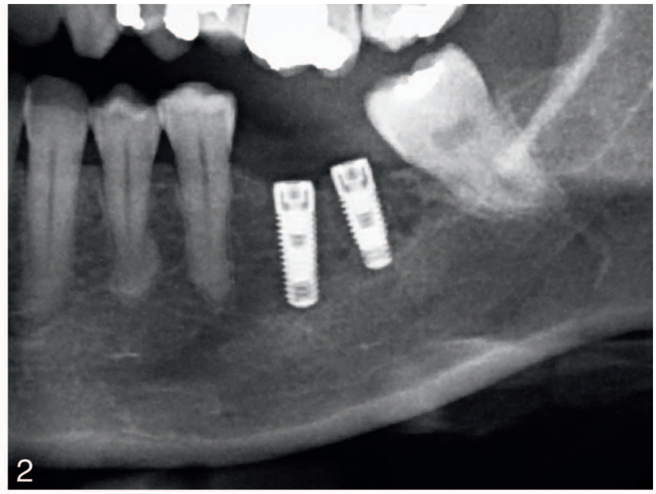

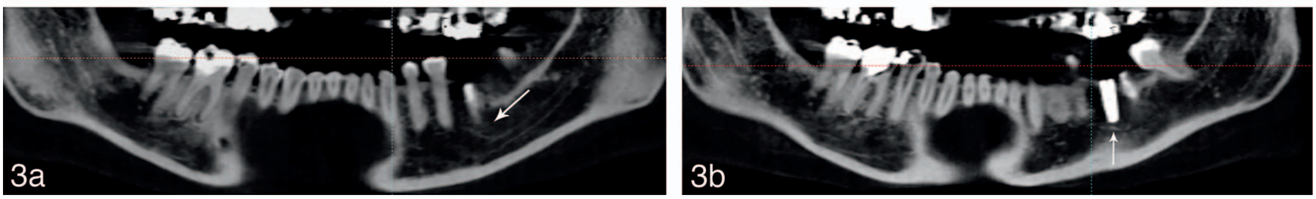

Figures 1–3. Figure 1. The cropped dental panoramic tomograph (DPT) shows the left mandible. The arrows show a combination of faint lines indicative of the presence of an accessory canal, which was missed preoperatively. These accessory canals appeared as radiopaque lines that were thought to be bony trabeculae. **Figure 2.** The cropped DPT showing the implants in the left mandible are distant from the mandibular canal. **Figure 3.** Arrows show the direct impingement of the mesial implant onto one of the accessory mandibular canals, as seen in 2 different panoramic planes employing the SimPlant software.

Case Report

A 42-year-old woman requested endosseous implants to replace her missing mandibular left first molar, which was extracted several years earlier. Clinical examination showed the alveolar ridge to be about 3 mm wide. The adjacent mandibular left second molar had tilted mesially, and the space between the distal wall of the mandibular left second premolar and the mesial wall of the mandibular left second molar was 14 mm.

Estimated measurement of her dental panoramic tomograph (DPT) showed there was more than 12 mm of alveolar bone height to the inferior alveolar nerve canal (Figure 1).

After discussing with the patient, 2 Zimmer implants were placed in the region; Ø3.7 mm $\times$ 11.5 mm implant mesially and Ø3.7 mm $\times$ 10 mm distally (Zimmer Biomet Inc, Carlsbad, Calif). She was given only buccal and lingual infiltration with 2% mepivacaine with adrenaline (Scandonest 2% Special; Septodont, Maur-des-Fossés, France). The buccal wall was augmented simultaneously using a combination of autogenous bone and Puros cortical particulate allograft (0.5 mL/0.25–1.0 mm; Zimmer), covered by a CopiOs pericardium membrane (Zimmer). The periosteum was relieved to allow closure without tension, with special care not to injure the branches of the mental nerve.

The patient did complain of feeling some discomfort during the insertion of the mesial implant. However, the intraoperative periapical radiograph taken did not show any breach of the mandibular canal. She was provided with 500 mg amoxicillin 3 times per day (t.d.s.), 400 mg ibuprofen t.d.s., and 1 g paracetamol 4 times per day (q.d.s.) for 1 week postoperative. She was reviewed after 1 week with a complaint of severe pain radiating from the implant site. The pain was constant and sharp in nature and was only temporarily relieved with the analgesics provided (120 mg etoricoxib o.d. and 1 g paracetamol q.d.s.). However, there was no paresthesia of the left lower jaw, and the surgical site appeared to be healing well. A new DPT was repeated, and again, the implant appeared to be located away from the mandibular canal (Figure 2).

The patient was continued with another course of antibiotics and analgesics (625 mg amoxicillin with clavulanic acid 2 times per day, 120 mg etoricoxib 1 time per day (o.d.), and 1 g paracetamol q.d.s.). As the pain persisted, she was advised to have a CBCT scan done. The CBCT scanning was done employing the i-CAT imaging system (Imaging Sciences International Inc, Hatfield, Penn) with an exposure parameter setting of 120 kVp, 3–7 mA, 20 seconds, and image acquisition at 0.3-mm voxel size.

Subsequently, the scanned volumetric data were transferred to the workstation with the interactive SimPlant software (SimPlant 3-D Pro version 13.1; Materialise Inc, Leuven, Belgium). The SimPlant software allows viewing in axial, cross-sectional, panoramic, and 3-dimensional visualization of the jaw on the same screen. Again, the images were manipulated to determine the cause of this complaint. Surprisingly, the impingement of an accessory branch was evidently confirmed when different panoramic plane views were employed (Figure 3).

Interestingly, when the scan volume was manipulated in the axial format, the patient appeared to have 3 corresponding

Figures 4 and 5. Figure 4. Arrows show the presence of 3 different accessory mental foramina, corresponding the abnormality at the left edentulous alveolar region seen in Figure 1. **Figure 5.** Periapical view of mandibular left first molar area, after replacement of the Ø3.7 mm × 11.5 mm implant with a Ø4.1 mm × 8 mm implant. Arrows point to the radiolucency lined by radiopaque lines apical to the implant.

accessory buccal foramina, suggesting 3 (trifid) canals (Figure 4). One obvious foramen was adjacent to the medial implant.

The mesial implant was then removed and replaced with a shorter Zimmer implant of Ø4.1 mm × 8 mm. The patient reported that the intensity of the pain suffered reduced tremendously once this procedure was done. Upon 1-week follow-up, she claimed that there was only minimal pain on swallowing and talking, which did not require her to have any analgesics. There was no paresthesia at the lower left jaw. The symptoms resolved completely after 3 months, and the construction of the prostheses was subsequently performed (Figure 5).

Discussion

Neurosensory disturbance that occurs following dental implant insertion is not a new problem.[7] Temporary paresthesia has been reported while persistent problems are encountered in some implant patients.[8] Most of these cases involved the inferior alveolar nerve and its terminal branch, the mental nerve, and the accompanying anterior loop.[9,10] Throughout the past 3 decades, the prevalence of inferior alveolar nerve injury following implant surgery in the mandible has reduced dramatically as a result of improved awareness and the use of routine imaging (including volumetric scanned data) for presurgical assessment. Removing the offending implant has been the advocated practice in managing this complication.[11] This current report is believed to be the first for a neurosensory disturbance that results from the impingement of 1 branch of a trifid canal. Sometimes these accessory canals appear as radiopaque lines that can easily be mistaken as bony trabeculae.

Studies by several authors have shown that the mandibular canal is usually surrounded by a thin bony plate.[12] However, Polland et al[13] described it as being composed of irregularly shaped bony slices. This bony plate is formed by a thin trabecular bone with many circumferentially located voids. Because of this formation, radiographically the mandibular canal appears as a dark, linear radiolucency that lies within 2 thin radiopaque borders (superiorly and inferiorly). However, as stated earlier, corticalization is variable and is incomplete in some normal mandibular canals. The radiopaque border may be disrupted in radiographic images, and it also may be invisible in some other cases. Because of this, several researchers have reported difficulty in identifying the mandibular canal on panoramic images.[14] Klinge et al[14] reported that normal mandibular canals in cadaver specimens were not visible in 36.1% of panoramic radiographs. Interestingly, Naitoh et al[15] reported that dental panoramic radiographs failed to identify 3 of 5 bifid canals that were identified using multislice CT images.

It must be borne in mind that the current case highlights the importance of being familiar with the anatomical details of the mandibular canal, which include potential branching. Failure to identify anatomical variations can complicate surgery and result in adverse consequences, as reported here and also elsewhere. Because of this, Maqbool et al[6] strongly recommended that CBCT become a standard of care for implantology at the posterior mandible. As a learning outcome of this current report, the impingement lends support to using CBCT more routinely. Mandibular canal branching may be more common than we think. This case also shows that removing the offending implant and replacing it with a shorter implant can alleviate pain that arises from the impingement onto a branch of the accessory mandibular canals.

Abbreviations

CBCT: cone-beam computerized tomography
DPT: dental panoramic tomograph

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