A Coronectomy and Orthodontic Protraction of an Impacted Lower Third Molar Compressed to the Inferior Alveolar Nerve: A Case Report

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Abstract
Background: Neurological damage may occur during a third molar extraction procedure when the tooth root is near the mandibular canal. Although the incidence of this complication is low, a great range of variability has been reported in the literature. Several methods to reduce or eliminate this complication have been proposed, such as orthodontic-assisted extraction, extraction of the second molar, or an intentional odontectomy. Objective: The objective of this case report is to present a low risk extraction procedure: a coronectomy with forced eruption (COFE) to avoid potential neural damage when removal of lower wisdom tooth compressing inferior alveolar nerve in our daily practice. Study Design: Case report. Materials and Methods: A 15-year-old male patient was referred from a dental clinic for bilateral extraction of impacted mandibular third molars. The initial computed tomographic scan showed the intimate relationship between the teeth and the inferior alveolar nerve. In order to prevent nerve injury, the COFE technique was used. This procedure consisted of the surgical removal of the crown portion to create a space. Then the root was protracted by power tubing. The patient returned to the hospital every 4 weeks to change the power tubing. Results: The roots of the third molar were moved a distance from the mandibular canals by orthodontic force after 4 months. Then the roots were successfully removed with no neurological consequences. Conclusion: Removal of an impacted lower third molar with the COFE technique can offer a successful method to prevent neurological damage for cases of a compressed inferior alveolar nerve.

Keywords
Inferior alveolar nerve; Wisdom tooth; Nerve injury; Two-stage extraction

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CASE REPORT

A Coronectomy and Orthodontic Protraction of an Impacted Lower Third Molar Compressed to the Inferior Alveolar Nerve: A Case Report

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ABSTRACT

Background: Neurological damage may occur during a third molar extraction procedure when the tooth root is near the mandibular canal. Although the incidence of this complication is low, a great range of variability has been reported in the literature. Several methods to reduce or eliminate this complication have been proposed, such as orthodontic-assisted extraction, extraction of the second molar, or an intentional odontectomy.

Objective: The objective of this case report is to present a low risk extraction procedure: a coronectomy with forced eruption (COFE) to avoid potential neural damage when removal of lower wisdom tooth compressing inferior alveolar nerve in our daily practice.

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Materials and methods: A 15-year-old male patient was referred from a dental clinic for bilateral extraction of impacted mandibular third molars. The initial computed tomographic scan showed the intimate relationship between the teeth and the inferior alveolar nerve. In order to prevent nerve injury, the COFE technique was used. This procedure consisted of the surgical removal of the crown portion to create a space. Then the root was protracted by power tubing. The patient returned to the hospital every 4 weeks to change the power tubing.

Results: The roots of the third molar were moved a distance from the mandibular canals by orthodontic force after 4 months. Then the roots were successfully removed with no neurological consequences.

Conclusion: Removal of an impacted lower third molar with the COFE technique can offer a successful method to prevent neurological damage for cases of a compressed inferior alveolar nerve. 

Keywords: Inferior alveolar nerve; Wisdom tooth; Nerve injury; Two-stage extraction

INTRODUCTION

Neurological damage can occur during third molar extraction procedures when the roots are near the mandibular canal. This damage may involve temporary or permanent paresthesia, and the damage rate is 0.4 %~8.4 % from past literature reviews.1–3 The risk of this complication mainly depends on the position of the third molar in relation to the inferior alveolar canal before surgery.4 If the inferior alveolar nerve (IAN) is in close proximity to the roots, the incidence may be as high as 19 %.5

To minimize the risk of irreversible neurological complications, several approaches have been proposed. One of the methods to reduce the risk is orthodontic extraction after a coronectomy. The advantages of a coronectomy are minimizing the
IAN damage rate, and rendering a complicated orthodontic device for anchorage unnecessary. But the disadvantages of a coronectomy are the possible need for more surgery and more surgical procedures, and the total treatment time is usually much longer than 6 months. Another method is orthodontic extraction. This procedure has proven useful for safely extracting impacted third molars in the presence of high risks (particularly neurologic complications) due to the tooth's close proximity to the mandibular canal. But orthodontic extraction may require a complicated orthodontic device for anchorage.

In this article, we describe an orthodontic-assisted extraction combining a coronectomy and forced eruption (COFE) procedure. The patient is first prepared with tooth anchorage (a lingual holding arch), then surgical exposure of the third molar and a coronectomy are performed. Roots of the third molar are protracted with a partial orthodontic appliance until the safety of the extraction can be confirmed. The total treatment time is less than 6 months. After the third molars are extracted, full-mouth orthodontic treatment can be initiated. The prognosis is good, and few complications are noted.

In conclusion, the COFE procedure for an impacted lower third molar can offer a successful method to prevent neurological damage in cases with a compressed IAN.

PATIENT AND METHODS

Diagnosis

A 15-year-old male patient, in good general health, was referred from a dental clinic for bilateral extraction of impacted mandibular third molars. He had no past medical history and drug allergy. The initial panoramic radiograph showed the mandibular third molars in horizontal impaction with the root apexes superimposed over the IAN (Figure 1). He was referred to the oral surgery department for

Figure 1. Initial photo and X-ray. CBCT shows that the bilateral impacted mandibular third molars were pressing into the inferior alveolar nerve (IAN).
wisdom teeth extraction. A cone beam computed tomographic (CBCT) scan with slicing thickness of 0.5 mm confirmed the intimate relationship between the teeth and the IAN. Therefore, both extractions had an elevated risk of neurologic disturbances. After consultation with the oral surgery department, the final treatment plan was COFE.

**Treatment method**

Before treatment, the patient signed an informed consent form for this operation. The presentation of this report was also assessed by the Institutional Review Board of TMUH. COFE targeted at moving the roots away from the inferior alveolar nerve; thus, once it is possible to remove part of the tooth structure and create space for the remaining part to move, it will be regarded as indicated for this method. First, tooth anchorage was prepared with banding of the bilateral first molars and lingual holding arch delivery, and then the bilateral premolars were bonded and continuously tied with molar tubes (Figure 2). With the anchorage preparation, we could reduce the amount of distal movement while protracting the roots. A coronectomy of the third molar was performed at the Department of Oral Maxillofacial Surgery afterwards. Crowns of the third molars were sectioned and removed, then a twisted wire was hooked to the root of the third molar and extended to the buccal side of the premolars. Protraction (forced eruption) of the third molar roots was achieved by power tubing (elastomeric material) attached between extended wires and brackets of the first premolars. The patient returned to the hospital every 4 weeks to change the power tubing. In addition, every 3 months, a panoramic x-ray film of the patient was taken for a routine check.

**Treatment results**

After 4 months, panoramic film and CT were checked again, and the roots of the third molars were some distance away from the mandibular canals (Figure 3). Then the root was safely removed in the oral surgery department without lower lip numbness or any neurological deficits after the operation. There were no loose or displaced anchorage or adjacent teeth. Now, full mouth orthodontic treatment could be initiated.

**DISCUSSION**

Mandibular third molar removal is a common procedure in oral and maxillofacial surgery. Anatomically, the mandibular third molar is close to important structures such as the IAN, lingual nerve, adjacent second molar, etc. The lower the tooth position is, the more difficult it is to extract and also more complications that may occur during the operation or postoperatively. Alternatively, some doctors will perform coronectomy first and make the root part erupt automatically. Some doctors will perform COFE to remove the wisdom teeth more
efficiently compared with coronectomy only whilst reducing the risks of complications.

In order to avoid severe complications, especially a lower impacted third molar close to the mandibular canal, Bonetti first used orthodontic extraction to treat more than 80 patients without complications. But his technique needs a long time of traction of 6–12 months, especially to move mesially inclined and horizontal teeth away from the IAN. This leads to less postoperative edema and reduces the risk of direct trauma to the nerve. With Bonetti’s technique, bands on bilateral mandibular first molars are needed for buccal and lingual wires, and a cantilever which is the system’s active part for tooth extrusion must be untied, reshaped, and reactivated every 4–6 weeks. It also requires a relatively long treatment time and frequent patient follow-up before the tooth is ready to be extracted. The authors mentioned that this technique, although effective in reducing the risk of paresthesia, is time-consuming and expensive and might not be well tolerated by patients. The orthodontic device is applied to a difficult area of the mouth and may cause compression and ulceration of neighboring tissues with a degree of discomfort.

Some doctors use a coronectomy to provide space for an impacted third molar moving forward by spontaneous migration or with orthodontic force. This novel technique aims to exploit the potential eruption by providing a space distal to the second molar by removing a portion of the crown of the mandibular third molar.

A systematic review about coronectomy vs. total removal for third molar extraction was reported in 2012. According to the authors, they selected two randomized controlled trials (RCTs) and two non-randomized controlled trials (CCTs), including 699 patients and 940 third molars, and performed meta-analysis and sensitivity analysis. The results indicated that use coronectomy can protect inferior alveolar nerves in the extraction of third molars with high risk of nerve injury as compared with total removal, and the risk ratios of post-operative infections were similar between the two surgical modalities.

Renton et al. reported results from a randomized controlled clinical trial comparing the incidence of IAN injury between a coronectomy group and an extraction group of patients with a mandibular impacted third molar the roots of which were in contact with the nerve bundle. The incidences of
nerve injury were 19% in the extraction group and 0% in the coronectomy group. Of 58 coronectomies, no roots required reoperation or removal during the 2-year follow-up. It is noteworthy that of the 94 M assigned to the coronectomy group, 36 had to be removed during surgery because of accidental root dislodgement. In those cases, the incidence of IAN injury was 8%. No case of IAN injury was reported by Pogrel et al. among 41 patients requiring extraction of mandibular impacted third molars in proximity to the IAN. Over 6 months after the coronectomy, only one sectioned molar required extraction due to impaired healing, and another molar had migrated to the occlusal plane and was extracted.

The disadvantage of a coronectomy is the possible need for a second operation to remove the root, a late infection of retained roots, and a high complication rate of unsatisfactory healing. Another potential complication that should be considered is postoperative tooth hypersensitivity induced by the odontectomy. These result in much more time, money, and pain. But it could be an optimal solution for tooth ankylosis when an orthodontic extraction technique is ineffective. Orthodontic extraction can also avoid a mandibular fracture which is a rare but major complication during or after surgical third molar removal. It can also be used for patients with mandibular atrophy.

A meta-analysis and systematic review showed that an average of 2 mm migration of the remaining fragment would occur within 2 years, with no statistically significant differences in terms of pain and infection compared with complete surgical extraction. A 3-year post-coronectomy follow-up study revealed that if root migration occurs after a coronectomy, it will occur within the first 24 months, and none of the retained roots had migrated after 24 months. Those authors also confirmed that no complications occurred in terms of infection, pain, or pathologic changes within the first 3 years after a coronectomy. A randomized controlled clinical trial also proved that a coronectomy has fewer complications in terms of IAN deficits, pain, and a dry socket. We need to consider factors affecting root migration when coronectomy is conducted. Lee et al. concluded that surgeons should ensure sufficient space for root migration, and the important factors included angulation, depth and complete removal of the coronal portion. Both coronectomy without orthodontic force and COFE method could reduce the risk of nerve injury; however, COFE method is regarded as more efficient clinically.

In this case, the patient’s parents were worried about nerve injuries and had concerns about leaving the root part in the bone. To reduce the risk and to provide a comparably efficient way for removal of the wisdom teeth, we used the new COFE method to combine a coronectomy and orthodontic-assisted extraction to shorten the traction time. In addition, we used elastomeric material to traction the residual root. There was no need for complicated orthodontic devices or wire bending. It is much simpler than activating a cantilever wire. The combination of a coronectomy and an orthodontic appliance can promise a safe position of the impacted tooth root and extraction of the root at an earlier time compared to spontaneous root migration. Another aspect to consider is recovery after third molar surgery. Extraction of mandibular third molars below the occlusal plane increases the risk of delayed recovery of the health-related quality-of-life. Moreover, third molars in close proximity to the IAN have a significant negative impact on recovery for pain and oral function. The surgical-orthodontic approach changes the anatomic aspect; third molars are extruded to the level of the occlusal plane and are moved away from the mandibular canal. The extraction is very fast and easy, leaving the patient with only slight postoperative discomfort.

This technique is not without drawbacks; however, the orthodontic appliance may cause some discomfort. Soft-tissue damage from impinging on the mucosa of the cheek and the gingiva is common. Such damage is practically unavoidable due to the specific topographic localization; working in this area of the mouth is difficult, and the action of the masseter muscle leads to cheek compression against orthodontic appliances. This damage can be kept under control by using orthodontic wax; regardless, it is absolutely reversible once the appliance is removed.

An effective synergy between the surgeons and orthodontists, and a good periodontal support team, can help maximize the efficiency of the operation and save time. Moreover, because it involves a greater number of appointments, this procedure may be more expensive than simple extraction. The orthodontic extraction technique that we outline herein was developed over several years of practice and has been steadily improved in terms of predictability of clinical results and especially decreased operation and recovery times.

CONCLUSIONS

By using this COFE technique, we successfully protracted the root of third molars, and ensured the safety of extraction of deeply impacted teeth. It takes
4 months to move the root away from the mandibular canal. The prognosis is good, and no complications were noted. So, removal of the impacted lower third molar with the COFE technique can offer a successful method to prevent neurological damage, but the limitation would be the surgeon’s field. With atrophic mandible, surgeons might have difficulty operating the procedures.

The CBCT showed that the inferior alveolar nerve was not compressed with alveolar nerve after 4 months of treatment. Further investigations could focus on the average shortest time of separating the roots and the nerve. More comprehensive research of patient’s post-op status and prognosis should be conducted as well.

FUNDING
All authors declare that the study has received no financial support.

ETHICAL APPROVAL
Not required.

PATIENT CONSENT
Provided.

CONFLICTS OF INTEREST
The authors declare no conflicts of interest.

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