A Preferable Technique for Protecting the Inferior Alveolar Nerve: Coronectomy

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Purpose: The aim of this study was to evaluate the effectiveness of coronectomy for teeth whose root apices are very close to the inferior alveolar canal.

Patients and Methods: The 43 patients of this study needed removal of their lower third molar, whose root apices were very close to the inferior alveolar canal. These patients underwent 47 coronectomies.

Results: The mean follow-up period was 9.3 months (range, 1 to 48 months). The mean total amount of root movement was 3.4 mm at 6 months, 3.8 mm at 12 months, and 4.0 mm at 24 months.

Conclusions: The technique of coronectomy is defined as removing the crown of a tooth but leaving the roots untouched, so that the possibility of nerve damage is reduced. Coronectomy is a preferable technique for patients who run a risk of injury to the inferior alveolar nerve during third molar surgery.

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The removal of erupted, partially impacted, or totally impacted third molars is still one of the most commonly applied oral surgery operations. The procedure is not particularly difficult, but can lead to several complications, including damage to the inferior alveolar and lingual nerves. Damage to the inferior alveolar nerve when extracting lower third molars is often caused by the intimate relationship between the nerve and the roots of the teeth. The technique of coronectomy was proposed as a means to remove the crown of a tooth while leaving the roots (which may be intimately related to the inferior alveolar nerve) untouched, so that the possibility of nerve damage is reduced.[1,2]

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Patients and Methods

Forty-three patients (20 women and 23 men, aged between 18 and 38 years) who needed removal of 47 lower third molars whose root apices were too close to the inferior alveolar canal were included in the study. They underwent coronectomies to remove the crown of a tooth, leaving its roots in situ to reduce the risk of damage to the inferior alveolar nerve. The application of this technique was based on radiographic features in routine preoperative dental orthopantomographs. Three radiological features were accepted as indicators of the proximity of roots to the inferior alveolar canal: diversion of the canal, darkening of a root, and interruption of the canal walls.[3] All patients were thoroughly informed about the surgical technique. Patients who had systemic disorders or who were more predisposed to local infection were excluded.

Operations were performed under local anesthesia. A conventional mucoperiosteal flap with a releasing incision was raised and retained with a retractor. Coronectomy involved transsection of the tooth 2 to 3 mm below the enamel of the crown into the dentine. So as not to mobilize the roots, the crown was totally transected from the roots, without applying high forces. After removal of the crown of the tooth, the remaining root fragments were reduced with burs, so that the remaining roots were at least 2 mm below the crest of the lingual and buccal plates in all places. The socket was then irrigated with saline, and the mucoperiosteal flap was replaced with sutures.

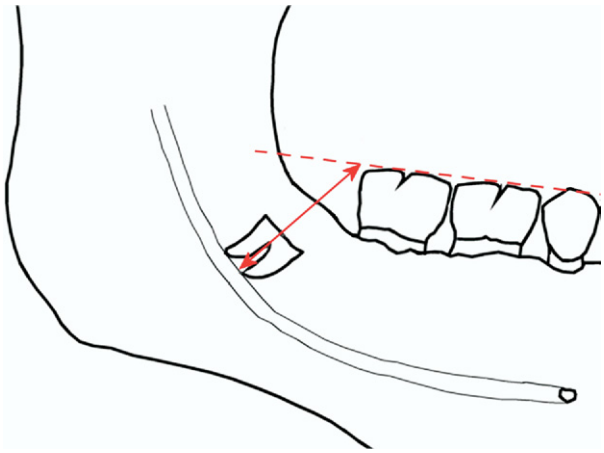

FIGURE 1. View of measuring method of root movement. *Dashed lines* represent the occlusal plane and the *arrow* shows the measured distance.

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Antibiotics were prescribed postoperatively. Radiographs were taken preoperatively and immediately after an operation. All patients were invited to return for appointments at 6, 12, and 24 months for clinical and radiographic assessment of the retained root fragments. The root remnants were clinically examined for infection, and the amount of movement was measured. For this purpose, a line parallel to the occlusal plane was extended to the ramus, and a longitudinal line in the middle of the root remnant was drawn from the tooth apex (Fig 1). If the tooth had 2 completely separate apices, the longitudinal line was drawn in the middle of them. The distance between the root apex and the intersection point of the 2 lines was measured at 6, 12, and 24 months, to obtain the amount of movement of the root remnants.

In one patient (female, 25 years old), the crown could not be totally separated from the roots, and the tooth was displaced as we tried to remove the crown. Thus, the coronectomy was abandoned, and the tooth was extracted in the usual way. The patient experienced moderate paresthesia for 5 months. This patient was excluded from the study, and her parameters are not included in the above-mentioned values.

Results

The mean follow-up period was 9.3 months (range, 1 to 48 months). The mean total amount of movement of the root remnants of 47 teeth was found to be 3.4 mm in 6 months (range, 2.0 to 4.8 mm) (Fig 2). Nine patients could not return for their appointments at 12 and 24 months for various reasons, and thus the amount of movement of the root remnants could not be calculated for those 9 patients at 12 and 24 months. For the remaining 38 patients, the mean total amount of movement at 12 and 24 months was 3.8 mm (range, 0.1 to 0.9 mm) (Fig 3) and 4.0 mm (range, 0.0 to 0.3 mm) (Fig 4), respectively. None of the patients reported any problems associated with the root fragments. In all cases, an examination of radiographs taken at 6 months revealed that the root fragments showed various amounts of movement farther away from the inferior alveolar nerve. None of the retained roots required a second operation (Figs 5A,B).

Discussion

Removal of third molar teeth is a common practice, and inferior alveolar nerve damage is a well-known complication of this procedure, particularly for teeth that have an intimate relationship with the inferior alveolar canal. Risk factors for nerve injury are known to include radiographic proximity, the surgeon's experience, surgical procedures, the patient's age, and preexisting disease.[4] Although the risk of nerve injury can be reduced with careful surgical technique, it cannot be absolutely avoided. Since the beginnings of third molar surgery, surgeons have been aware of the

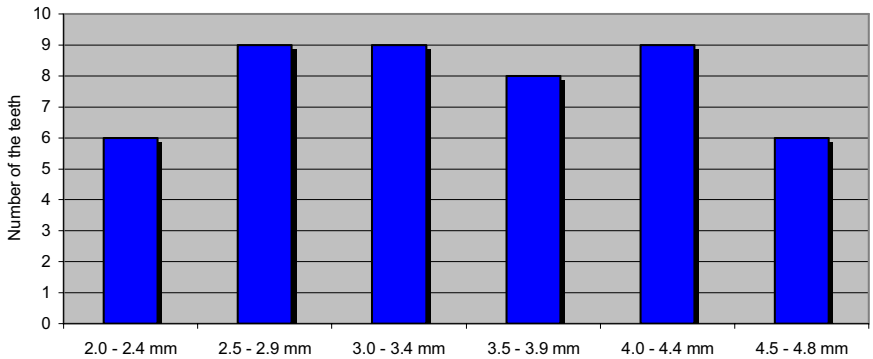

FIGURE 2. Distribution of root movements during postoperative month 6 for 47 teeth.

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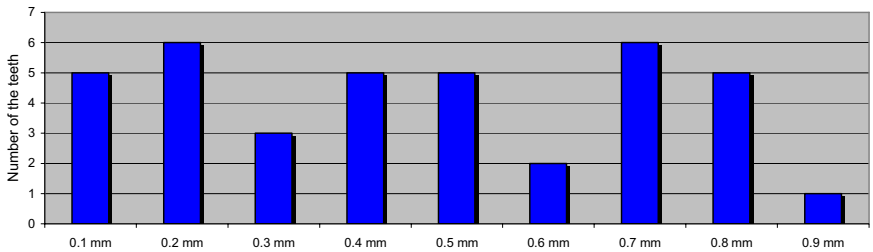

FIGURE 3. Distribution of root movements during postoperative month 12 for 38 teeth.

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risk of inferior alveolar and lingual nerve injury.[4] Although subject to disagreement, the incidence of temporary injury to the inferior alveolar nerve after third molar surgery is reported to be up to 8%, and the incidence of permanent injury, to 3.6%.[5,6] However, a rate of 5% is usually accepted.[7-10] Techniques that appear to reduce these risks naturally gain the attention of patients and surgeons contemplating elective third molar removal.

The technique of coronectomy, or deliberate vital root retention, avoids the nerve canal by ensuring retention of the roots when they are close to the canal, as estimated using radiographs.[11] It is known that broken fragments of vital teeth generally heal without complications.[2,12] Coronectomy is a procedure based on this idea. If one third of an uninfected tooth can be left in its socket in certain situations, this can be valid for a "larger" part of a similar tooth; but not all third molar teeth are suitable for coronectomy. Teeth with acute infection and mobile teeth should be excluded, because root remnants of those teeth may act like foreign bodies. In addition, teeth that are horizontally impacted along the course of the inferior alveolar canal may be unsuitable, because sectioning of a tooth could endanger the nerve.[13] We tried to separate the crown completely, so that no high forces needed to separate the crown and the root, because those forces could also mobilize the roots. This concern is shared by other authors.[13] However, if a root is broken during extraction of a regular uninfected tooth, and if this root fragment is too difficult to remove or somehow exhibits a risk, it can safely be left.[2,12] Because these "mobilized" root fragments

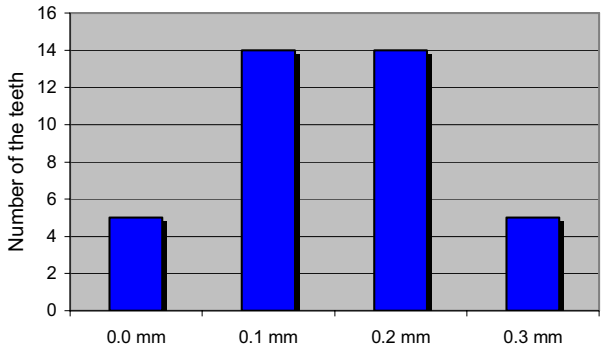

FIGURE 4. Distribution of root movements during postoperative month 24 for 38 teeth.

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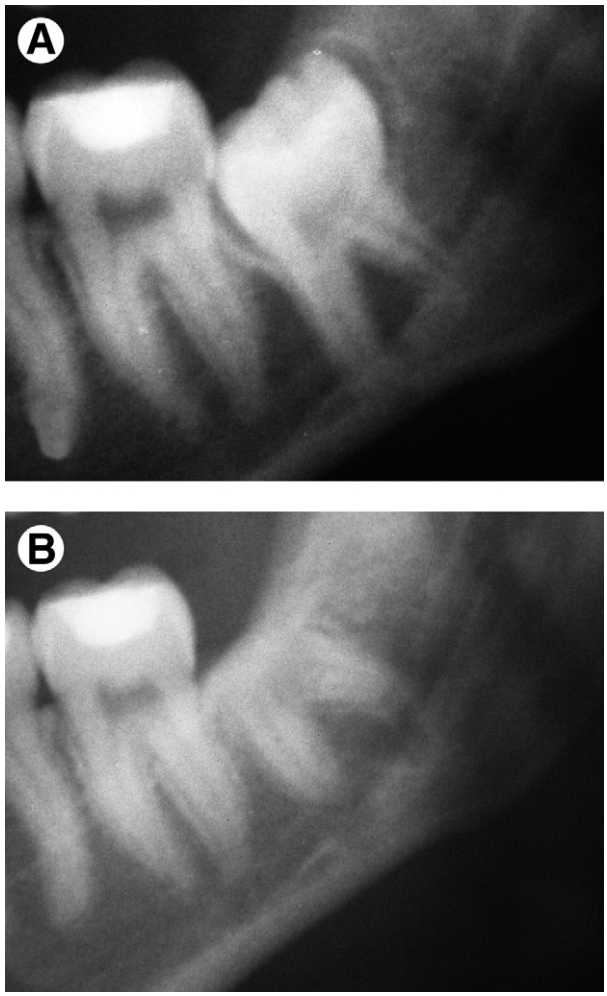

FIGURE 5. *A*, Preoperative radiographic view of case 1 (cropped orthopantomograph). *B*, Radiographic view of case 1 after 24 months (cropped orthopantomograph).

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mostly heal uneventfully, it may not be essential to transect the crown totally during intentional root retention, to decrease the risk of perforating the lingual cortex and damaging the lingual nerve.

When making a decision about a coronectomy, it is necessary to determine the correct relationship between the root apices and the inferior alveolar canal. At this point, different radiological imaging techniques can be used. Dental computerized tomography can give very precise information about the root-canal relationship, and would probably be the best choice for this purpose, but it is also rather expensive and not available at every clinic. Plain dental radiographs are more advantageous, and seem more suitable. They offer an opportunity to alter the extraction technique to minimize risk to the nerve. In our study, we assessed lower third molars with a panoramic radiograph, and then made the decision for a coronectomy. The paresthesia that occurred in our "unsuccessful coronectomy" supports the validity of our criteria.

Although some authors used preoperative prophylactic antibiotics,[13] we did not prescribe any preoperative antibiotics, and did not encounter any infections in our study group. We prescribed postoperative antibiotics, but this is not unique to this operation: we routinely prescribe antibiotics after third molar surgery.

There is no need to treat the exposed pulp of the tooth in a coronectomy. Animal studies show that roots remain vital with minimal degenerative changes.[14,15]

The technique of leaving the retained root fragment at least 2 to 3 mm inferior to the crest of the bone seems appropriate, and does appear to encourage bone formation over the retained root fragment. This distance of 2 to 3 mm was validated in animal studies.[15]

The movement of root remnants reached its maximum in the first postoperative 6 months (mean, 3.4 mm). The amount of root movement decreased to 0.4 mm between 6 and 12 months, and to 0.2 mm between 12 and 24 months. Probably this slowdown was attributable to new bone formation above the roots over time.

In agreement with Pogrel et al,[13] we do not advocate seeing the patient after 6 months unless he or she becomes symptomatic. On the other hand, some[16] assert that a follow-up period of 25 months is required to evaluate the incidence of nerve injury, but not of late eruption, which can occur up to 10 years after the initial operation. A longer review period may therefore show that a proportion of these retained roots do eventually erupt, and may cause a late infection or require removal.[11] One possible disadvantage of a coronectomy is the possible need for a second operation, but in the procedure's favor, root remnants can then be removed easily without risk to the nerve.[3] In our series, all root remnants showed migration away from the inferior alveolar nerve, and hence the potential of nerve injury during a second operation is reduced.

We did not establish a "control group" in this study. When the roots were too close to the canal, and if we believed that a routine impacted-tooth operation would jeopardize the inferior alveolar nerve, it would not have been ethical to perform a coronectomy.

This study dealt with teeth that were very close to the inferior alveolar nerve, a situation that can create a high risk of paresthesia after their removal. Ethical reasons made the use of a control group impossible. Root movement was observed in all teeth after coronectomy, and all roots moved away from the inferior canal. We conclude that a coronectomy can be suggested for teeth that are very close to the inferior alveolar nerve, with the risk of a secondary operation. If a second operation is needed for the remnant roots after a coronectomy, the roots can be removed with a low risk of paresthesia, because the roots would have receded from the inferior alveolar canal. Based on the findings in our patients, we agree with others[3,11,13,17] who described the coronectomy as an acceptable technique, and we conclude that it is a valuable option in selected cases. We also plan to examine the long-term clinical outcomes of coronectomies in a larger sample.

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