

Root migration pattern after third molar coronectomy: a long-term analysis

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Abstract. Coronectomy was introduced as a treatment for impacted lower third molars at high risk of inferior alveolar nerve damage. Root migration is considered one of the common surgical complications of this procedure. This study aimed to investigate the long-term behaviour of retained root(s) after coronectomy. This was a prospective study, with 3–5 years of follow-up, of patients who underwent lower third molar coronectomy. Panoramic radiographs were taken preoperatively and at 1 week, 6, 12, 24, 36, and 60 months postoperative. Root migration patterns were recorded. Factors including age, sex, type and pattern of impaction, and root form were analyzed with respect to the root migration rate. A total of 356 coronectomies were performed in 254 patients. Most root migration was found to occur within 6 months (91.1%) and 12 months (61.4%) postoperative. From 24 months onwards, less than 5% migrated further. Age was found to be a factor affecting root migration: migration decreased with increasing age (by 0.203 mm less per year increase in age). Other factors investigated were found to be unrelated. Therefore, adequate preoperative warning should be given to young patients considering coronectomy as treatment for impacted lower third molars. However, it should also be noted that the incidence of root exposure leading to re-operation is low.

Key words: third molar; coronectomy; root migration; age.

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Lower third molar coronectomy is a surgical treatment for impacted lower third molars at high risk of inferior alveolar nerve (IAN) injury¹. It involves removal of the third molar crown, leaving the root (s) in the alveolar bone, in order to avoid trauma to the IAN. This surgical procedure was first described by Knutsson et al. in 1989². The technique has gained popularity over the past decade, with several

researchers publishing studies proving that coronectomy is effective at preventing IAN injury^{3–9}. The Discipline of Oral and Maxillofacial Surgery at the University of Hong Kong has been monitoring the safety of coronectomy through clinical trials, and the present authors have recently reported that it carries minimal morbidity in the long term^{3,9}. The promising results obtained with this technique show

that coronectomy offers clinicians and patients a safe alternative to the total removal of a lower third molar where there is a high risk of IAN injury for a tooth that requires removal.

While most studies on coronectomy have focused on the clinical safety and effectiveness at preventing IAN injury, there has been insufficient information in these studies on the behaviour of the

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third molar root after coronectomy. In an earlier study reported by the present authors, it was found that the roots tend to migrate forwards during the early post-operative period⁹. Several studies have reported the extent of root migration, but at a cross-sectional time-point^{1,4}. The long-term root behaviour and pattern of migration over time remain unclear and require assessment in a longitudinal manner. It is also unknown whether there are any factors that affect the root migration rate.

The aims of this study were to analyze the 5-year root migration pattern after third molar coronectomy, and to investigate the possible factors that might affect root migration.

Materials and methods

This prospective study formed part of a large project on lower third molar coronectomy. Ethical approval was granted by the local institutional review board. Data on the long-term clinical morbidity and root exposure rate have been published previously, demonstrating coronectomy to be safe during the first 5 years post-operative³.

Eligible patients

Patients presenting to the Discipline of Oral and Maxillofacial Surgery, Faculty of Dentistry at the University of Hong Kong for third molar surgery, with one or more of the radiographic sign(s) showing close proximity of the third molar root to the IAN, were included in this study and scheduled to undergo coronectomy. The radiographic signs were: (1) darkening of the third molar root(s); (2) abrupt narrowing of the third molar root(s); (3) interruption and loss of the white line(s) of the inferior alveolar canal (IAC); (4) displacement of the IAC by the root(s); (5) abrupt narrowing of one or both of the canal white lines representing the IAC(s).

Only patients who underwent coronectomy of a lower third molar and who were followed up for 3 years or more were included in this study.

Patients who did not present with a lower third molar in close proximity to the IAN, those with a tooth that presented a pathology, those with local or systemic factors that might contribute to infection, and those whose third molar roots became mobile during the coronectomy procedure were excluded from the study. All included patients provided signed consent to participate in the study.

Demographic data and radiographic assessment of root migration

The patients' demographic characteristics (age and sex) and tooth status (eruption status, pattern and depth of impaction, root form, and radiographic signs) were recorded preoperatively.

Standardized panoramic radiographs (Gendex Orthoralix 9200; KaVo, Genova, Italy) were taken preoperatively and at the review appointments at 1 week, 6 months, 12 months, 24 months, 36 months, and 60 months postoperative. The measurement of root migration was performed by a separate examiner and was measured as the radiographic distance from the point of interception of the upper white line of the inferior dental canal and long axis of the root, to the apex of the root along the long axis, as described previously⁵. A 1.2× magnification of the radiographs was taken into consideration when obtaining the final measurement.

Surgical technique for lower third molar coronectomy

The surgical procedures were performed by the surgical residents with the patient under local anaesthesia, intravenous sedation with local anaesthesia, or general anaesthesia.

After standard disinfection and draping, a three-sided mucoperiosteal flap was incised and raised. A lingual flap was not raised, but a periosteal elevator was used to protect the lingual tissue. Buccal and distal bone was then removed until the cemento-enamel junction was accessible. The crown was removed along the cemento-enamel junction with a fissure bur. The cut root surface was trimmed down to at least 3–4 mm below the alveolar bone margin. In the case of any mobility, the root(s) were removed and the coronectomy procedure recorded as unsuccessful; such cases were excluded from this study. The wound was then closed primarily with resorbable polyglactin sutures after thorough cleaning and irrigation. Routine analgesics were prescribed. No antibiotics were given.

Outcome measures

The primary outcome of this study was the root migration pattern after third molar coronectomy within the first 5 years postoperative. The secondary outcomes were the possible factors that might affect the root migration after coronectomy.

Statistical analysis

The independent samples *t*-test was used to determine whether there were any differences in the root migration rate in relation to age, sex, type and pattern of impaction, and root form of the lower third molar. Data were analyzed using IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY, USA). The 5% probability level was taken as the cut-off for statistical significance.

Results

A total of 356 coronectomies performed in 254 patients were included in this study (216 coronectomies in female subjects and 140 in male subjects). All patients attended follow-up at 3 years (356 coronectomies); 33.7% of the coronectomies were reviewed at 5 years (120/356). The mean follow-up period was 3.7 years (standard deviation (SD) 0.69 years).

Patient demographic data, the status of the third molar teeth, and the radiographic signs related to these teeth are presented in Table 1. Most third molars were partially erupted or unerupted (99.4%), and most were mesioangularly or horizontally impacted (84.0%). The root form was parallel in the majority of cases (48.0%), followed by the conical root form (32.0%) and the divergent root form (20.0%). With regard to the radiographic signs, most of the third molars showed 'interruption or loss of the canal white line' (96.1%), followed by 'darkening of the root' (31.2%) and 'displacement of the canal white line by the root' (27.8%).

Root migration pattern

The mean total root migration at 6 months, 12 months, 24 months, 36 months, and 60 months postoperative was 1.98 mm (SD 1.2 mm), 2.67 mm (SD 1.5 mm), 2.92 mm (SD 1.7 mm), 2.96 mm (SD 1.7 mm), and 2.80 mm (SD 1.5 mm), respectively (Fig. 1).

It was found that root migration had occurred in 91.1% (317/348) of the cases during the first 6 months postoperative (0–6-month interval). Following this, 61.4% (212/345) presented root migration during the 6–12-month interval and 24.3% (84/345) presented root migration during the 12–24-month interval. The proportion of roots that migrated dropped drastically to 2.5% (9/356) and 4.2% (5/120) during the intervals 24–36 months and 36–60 months, respectively (Fig. 2).

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