

Coronectomy of Impacted Mandibular Third Molars - Method for Prevention of Inferior Alveolar Nerve Injury

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The development of the lower third molars began in the mandibular ramus about 7 years of age [1]. They are the last erupted permanent teeth. The mandibular third molar tooth germ is usually visible radiographically by age 9, and cusp mineralization is completed approximately 2 years later. At age 11, the tooth is located within the anterior border of the ramus. The crown formation is usually completed by age 14, and the roots are approximately 50% formed by age 16. The roots are completely formed with an open apex by age 18. Third molars are the only teeth in the human dentition that do not strictly specified eruption time. As „normal time" is define every third molar eruption after age 16 [2]. By age 24 95% of all third molars would have completed their eruption.

The possibility of tooth eruption is determined by genetic (size of the facial skeleton, including the size of the jaws and teeth) and social factors (type of diet and utilization of the masticatory muscles) [3]. A tooth impaction is rare in Neolithic era. The high abrasive diet of primitive man caused a dental attrition which has led to a reduction in the mesiodistal diameter of the dentition, medial migration of the teeth and creation of enough space for an eruption of mandibular third molars. With the advent of refined foods in the diet and the subsequent reduction in the load on the masticatory muscles, as well as the size of the jaws, the incidence of mandibular third molars retention significantly increased [4,5]. The prevalence of third molar impaction is variable and has been reported to range from 9.5% to 39% in different populations [6]. The primary cause of third molar impaction is lack of alveolar arch space distal to the second molar [7].

The third molars are frequent source of pathology in the dento-maxillary system either during eruption or while remaining in retention. The most common complications are infections, cysts, rarely odontogenic tumours, nerve impairment, and mechanical damage to the adjacent structures due to the malpositions of the tooth.

Third molars removal is one of the most common procedures in the practice of oral surgeons in the world [8]. The surgical removal of impacted mandibular third molars may be due to complications. The most troublesome complications are nerve injuries, such as the inferior alveolar nerve and the lingual nerve injury, and associated with them hypo- and anesthesia of the innervated areas, and the development of chronic neuropathic pain [9,10].

The risk of this complication depends mainly on the position of the impacted tooth in relation to the inferior alveolar canal before surgery. The literature data suggest that the inferior alveolar and the lingual nerve damage range between 0.4% and 8.4% [11-13]. Iatrogenic nerve damage may be temporary (up to 8%) or permanent (up 3.6%) [8, 14]. Proximity of the Inferior Alveolar Nerve (**IAN**) to the apex of the root can be predicted on the panoramic radiography based on three radiographic features: diversion of the canal, darkening of the root, and interruption of the lamina dura [15]. Narrowing of the root was also found to be a significant radiographic sign that predicts the proximity of the nerve and root [16]. The use of panoramic radiographs, as well as CBCT scans, to assess the relationship between the nerve and the root of the third molar in three-dimensional view during the operation gives the surgeon a better understanding of the position of the IAN.

Injury to the IAN can occur from compression of the nerve, either in directly by forces transmitted by the root during elevation or directly by elevators. The nerve may also be come transected by rotary instruments or during removal of a tooth whose root is grooved or perforated by the IAN [17].

It is known that broken fragments of the root of vital teeth left in place, most common heal uneventfully [18,19]. This is the base to evolve the concept of coronectomy. Coronectomy is an alternative procedure to complete extraction. The technique of coronectomy or intentional partial odontectomy is proposed by Ecuyer and Debien in 1984 [20]. Coronectomy has been defined as a method of removing the crown of a tooth but leaving the roots untouched, which may be intimately related with the IAN, so that the possibility of nerve injury is reduced [21]. The basic six-step technique that can be applied to each angulation of impaction was described by Gleeson et al. [8]: incision, exposure, decoronation, finishing of the root surface, debridement of the socket, and closure.

INCISION

A triangular full thickness mucoperiosteal flap should be designed distal to the lower second molar (figure 1). A distal relieving incision should be extended a few millimetres along the

external oblique ridge. A releasing vertical incision should be created in the anterior part of the flap. The flap should be retracted with minimal injury to the mucosa. The correct designed flap should be minimal in size and should be provided adequate access to the tooth and preservation to the papilla which will facilitate the primary closure.

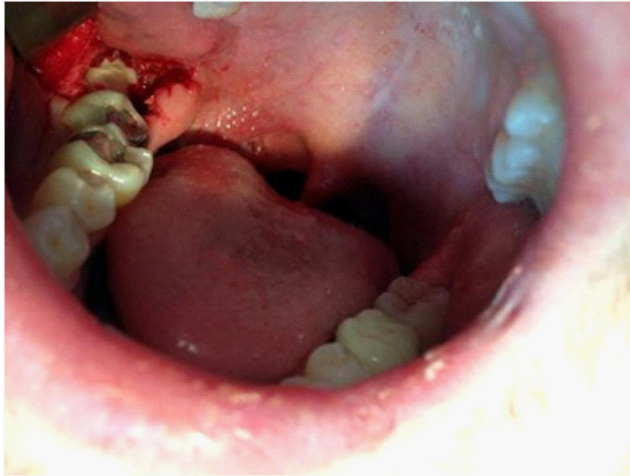


Figure 1: A triangular full thickness mucoperiosteal flap was created around the impacted mandibular third right molar.

EXPOSURE

The tooth should be exposed to the level of the cemental enamel junction using a fissure bur with adequate speed and torque. Alveolar bone should be removed only to facilitate disimpaction of the crown and piecemeal retrieval. A careful planning based on the preoperative radiographs should be preceding this step.

DECORONATION

Only after correct assessment and visualisation of the position of the tooth to ensure perpendicular decoronation, the operator may perform this step (Figure. 2,3,4). The cut should be made with a fissure bur, 1–2 mm below cemented enamel junction and to a depth roughly three-quarters through the tooth. The aim of this incomplete sectioning is to leave the lingual plate intact and eliminating the risk of injury to the lingual nerve. The decoronating cut must be deep enough to ensure removing of the crown without mobilization of the roots of the tooth. If the decoronating cut is deep enough, separation will be possible with minimal force using elevator or chisel and without risk of mobilisation of the entire tooth. A cut that is not deep enough not only increases the risk of mobilising the root and transmitting forces to the nerve, but it can also lead to a suboptimal fracture, which increases the complexity in subsequent stages. Another technique of crown sectioning was described by Pogrel et al. [22] who recommend complete sectioning with lingual retraction.



Figure 2: A decoronated impacted mandibular third left molar.



Figure 3: An occlusal view of the removed tooth crown.



Figure 4: A radicular view of the cutting tooth crown with pulpal remnants.

FINISHING THE SURFACE OF THE ROOT

The surface of the remaining root must be reduced to 2–3 mm below the level of the surrounding alveolar bone, and must have no retained enamel. Reducing the root to 3 mm under the crest is sufficient to encourage deposition of bone. The presence of enamel remnants seems to inhibit healing and they increase the likelihood of failure. Animal [23-25] and human studies [26,27] show that pulpal tissue can retain its vitality and remain free of inflammation. To reduce postoperative discomfort during reduction of the root face Gleeson et al. [8] recommended removing of all remnants of coronal pulp. The endodontic treatment in cases of coronectomy does not affect the success of the method thereby endodontic treatment is defined as „unnecessary” [28]. Specimen et al. [28] treated the root canal of patients with mineral aggregate trioxide after coronectomy and found that the outcome of coronectomy was better in patients who did not receive this treatment. Based on these findings, it is likely that coronectomy with no pulp treatment will remain the standard procedure and that the retained root will not affect the surrounding tissues [29].

DEBRIDEMENT OF THE SOCKET

The distal area of the lower second molar should be curetted to remove any infected soft tissue and then irrigated with copious saline to remove debris. The whole surface of the remaining root should be inspected carefully to detect any fragments or enamel edges and to ensure that it lies at least 2-3 mm below surrounding bony margin.

CLOSURE

Repositioning of the flap aims to provide primary, tension-free closure with simple interrupted sutures (Figure 5).



Figure 5: The flap over the impacted mandibular third right molar was repositioned and sutures were applied.

There are several circumstances in which a coronectomy is contraindicated. Contraindications related to the tooth are: non-vital third molars, caries with risk of pulpal involvement, tooth mobility, apical disease, association with cystic tissue that is unlikely to resolve if the root is left in situ, tumour. Another contraindications are related to the patients: immunocompromised patients, previous radiotherapy to the head and neck or treatment before radiotherapy, neuromuscular disorders, diabetes mellitus, osteosclerosis/ osteopetrosis of the jaws.

It has been reported that after coronectomy the retained root migrates towards the oral cavity, but the speed of migrations decreases over time. The speed of migration is lower in elderly persons compared with young ones – the migration distance in patients aged below 29 years of age was significantly decreased compared with patients in their 30s and 40s, presumably because of factors such as densification and sclerosis of the surrounding bone and fibrosis of the periodontal membrane [29]. Pogrel et al. reported that 30% of the roots migrated away from the mandibular canal [22]. Dolanmaz et al. reported that the migration distance reached 4 mm during the first 2 years after procedure and 82.2% of the cases showed no root migration between the second and third postoperative years [30]. Leung and Cheung [31] reported that after the second postoperative year, none of the cases required root extraction due to exposure into the oral cavity. It seems that the second postoperative year is the turning point in terms of root exposure due to migration. Kohara et al. [29] and Renton et al. [32] recommended cutting the teeth 3-4 mm below the edge of the surrounding alveolar bone to avoid the risk of root exposure in the oral cavity. In the study conducted by Goto et al. [27], histological findings showed that dentine bridge had formed on the resected surface of the root exposing the pulp. In theory, a root that is vital after coronectomy is in an environment more conducive to healing as it is sealed within the mandible and isolated from the oral cavity. Coronectomy seems to decompress the pulp chamber and provides adequate space to accommodate the pulpal oedema [26]. Coronal bone formation would seem to indicate that no further migration is likely to happen [33] and the risk of infection has decreased [29].

Removal of a coronectomy root should be considered when it has erupted in the oral cavity and is symptomatic or if there is radiological evidence of apical disease. Even in these cases owing to their eruptive process away from the nerve canal they could be removed without injuring the nerve. Leung and Cheung [31] reported 3% cases of reoperation and root extraction after 135 cases of coronectomy. Hatano et al. [34] founded 4% failures after 102 cases of coronectomy that caused extraction of the retained root. Monaco et al. [35] reports that within the first year, a second surgery was needed in 6% of 116 coronectomy procedures to remove migrated root fragments. A potential drawback of this approach is the double surgical procedures. However, the technique compares well with the orthodontic-assisted extraction for which two surgical procedures are often considered.

The incidence of postoperative pain was greater in the coronectomy patients, but all pain had decreased within 1week. One cause might have been the tight primary closure. Another reason

might have been the temporary pulpitis of the resected roots [34]. Conversely Renton et al. [32] found a lower percentage of patients complained of pain after coronectomy than after routine removal of mandibular third molars.

The swelling after coronectomy is rare and was only detected in a study by Monaco et al. [36] in 4.6% of cases.

The rates of the postoperative infection after routine removal of third molars and after coronectomy are similar. Postoperative infection after removal of third molars has been reported to occur in 0.8–7.9% of cases versus 0.98–5.2% after coronectomy [37].

In the case of coronectomy, Pogrel et al. [22] explained that all patients involved in the study were placed on prophylactic antibiotics preoperatively, because it is felt that antibiotics should be in the pulp chamber of the tooth at the time it is transacted. The lack of a postoperative antibiotic therapy leads to greater number of complications [38]. Renton et al. [32] and Zallen and Massoth [39] postulated that antibiotics were unnecessary.

The success after coronectomy requires both right case selection and operator technique. The surgical skills and experience of the operator have been indicated to be one of the main risk factors for developing permanent sensory dysfunction in the distribution of the IAN after coronectomy [40,41]. Surgeons with less than 10 years of training exposed patients to a greater risk of complications [35].

Coronectomy has now been accepted as a standard. It is alternative to the extraction of teeth, which are at a high risk for IAN. If a second operation is needed for extraction of the remnant roots after a coronectomy, they can be removed with a low risk of paresthesia, because the roots would have receded from the inferior alveolar canal.

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