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Coronectomy: not just for Wisdom Teeth

Abstract: Coronectomy is most commonly associated with the management of impacted lower third molars where complete removal poses a high risk of inferior alveolar nerve damage. However, coronectomy may be indicated for the management of other teeth with a significant risk of morbidity. A case of a LL6 extended coronectomy is presented. The aim was to prevent inferior alveolar nerve damage, and ensure adequate crown and root removal to facilitate orthodontic alignment of the teeth. Surgery was aided by cone beam CT, and a piezo-surgical technique.

CPD/Clinical Relevance: This case demonstrates the novel application of a coronectomy to manage an infra-occluded lower left first molar, facilitating orthodontic treatment, where complete removal posed a high risk of inferior alveolar nerve damage.

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Standard coronectomy is the technique where the crown of a tooth is sectioned and removed just below the amelo-cemental junction, leaving a substantial portion of roots *in situ* and untouched. It is frequently indicated for the management of impacted lower third molars, which carry a high risk of inferior alveolar nerve injury (IANI).¹ IANI can cause altered sensation, such as numbness or pain to the lower lip and chin.² This can have a profound effect on an individual's ability to eat and speak, their social

interactions and, as a consequence, their quality of life.^{3,4}

Case selection for coronectomy is important and should be limited to vital teeth with a high risk of IANI, in patients who are not immunocompromised and have good healing potential. Mobilization of roots at the time of surgery indicates need for extraction of the whole tooth, and is important for patients to understand during the consent process. Renton *et al* reported a 38% failure rate of coronectomy.⁵ Appropriate follow up, and ability to manage any complications such as infection, root migration and need for further surgery, is also important.⁶

Root migration is frequent following coronectomy. A 2015 systematic review reported an incidence of 2%–85.3%. Re-operation rates due to infection or migration varied from 0.6–6.8%. It was also reported that, if a second surgical procedure is indicated, safer surgery may be possible as the roots generally migrate away from the IAN.⁷

This is a case report of an 'extended' coronectomy of a mandibular first molar which was considered to pose a high risk of IANI. The aim of treatment

in this case was to prevent nerve damage, and also facilitate orthodontic alignment of the teeth by extending the degree of tooth structure removed.

Case report

On examination

A 13-year-old female was referred to the orthodontic department by her General Dental Practitioner (GDP) regarding an unerupted LL6. The patient attended with her father, who was deaf, and so communication throughout was aided with the use of British Sign Language. The patient and parents were concerned about the appearance of her front teeth, as well as being aware of a 'stuck' tooth resulting in a gap between the teeth. The patient had well controlled asthma and was otherwise fit and well. She had a dental history of trauma to her UR2, and previously had restorative treatment under local anaesthetic.

On examination, the patient had an Angle's Class II division 1 malocclusion, on a Class II skeletal pattern with an increased lower anterior face height. The malocclusion was complicated by bimaxillary crowding, an unerupted LL6 and an uncomplicated crown fracture of

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Figure 1. OPT demonstrating the position of the unerupted inferiorly displaced LL6.



Figure 2. (a, b) CBCT demonstrating the position of the IDC in relation to the LL6.

the UR2. In centric occlusion, the overjet was 6 mm with reduced overbite, and the molars were a half unit II on the right side. The oral hygiene was satisfactory and there were occlusal restorations in the UR6, LR6, UL6 and UL7.

An Orthopantomogram (OPT) revealed an unerupted, inferiorly displaced LL6 with apices at the inferior border of the mandible; the adjacent LL7 was erupted and tipped mesially over the LL6 and in close proximity to the LL5. The roots of the LL7 showed an intimate relation to the LL6 crown, although there was no obvious evidence of root resorption (Figure 1). The inferior dental canal (IDC) was closely related to the roots of the LL6, with darkening of the mesial root, and interruption of the white lines of the IDC.

The patient was seen on a multidisciplinary clinic, including a consultant orthodontist, and an oral surgeon. Due to the position of the LL6 and the risk factors relating to the IAN identified on the OPG, the patient was referred for a cone beam CT (CBCT) (Figure 2). The CBCT revealed that the four apices of the LL6 extended to the inferior cortex. The IAN was encircled by the apices of the LL6 with signs of notching of the mesio-lingual root. There was also suggestion of a slightly

enlarged follicle surrounding the LL6. The patient was diagnosed with an infra-occluded LL6, possibly due to a mechanical failure of eruption.

Treatment options

Three management options were considered:

1. Monitoring;
2. Surgical removal of the entire tooth; and
3. 'Extended' coronectomy.

Monitoring would involve periodic radiographic review to monitor any potential cystic change or root resorption; however, this would prevent alignment of the LL7. Alignment of the maxillary dentition would have been possible to an extent, but would not achieve a satisfactory result.

Surgical extraction would allow alignment of the teeth after bony infill, but would carry a significant risk of damage to the IAN, and risk of mandible fracture.

An extended coronectomy was felt by clinicians and patient to be the best option to minimize risk of IANI and enable the patient to pursue orthodontic treatment following bony infill. The concern was to ensure that sufficient space was created to upright the LL7. This was achieved using measurements taken from the CBCT to estimate the LL7 total tooth height against the height of the mandible and relative position of the LL6. This showed that the crown, and the roots beyond the furcation, had to be removed. Risks of the surgical procedure included requirement for extraction at time of surgery should mobilization of the roots occur, damage to the IAN, jaw fracture, or need for further surgery in future if the apices migrate away from the lower border.

Surgery and follow-up

The procedure was undertaken as a day case, under general anaesthetic. A buccal sulcular incision was made and the mental nerve identified intact. Using a piezosaw, a buccal window of bone was removed to access the LL6. The crown of the LL6 was removed, as well as root tissue, to below the level of the

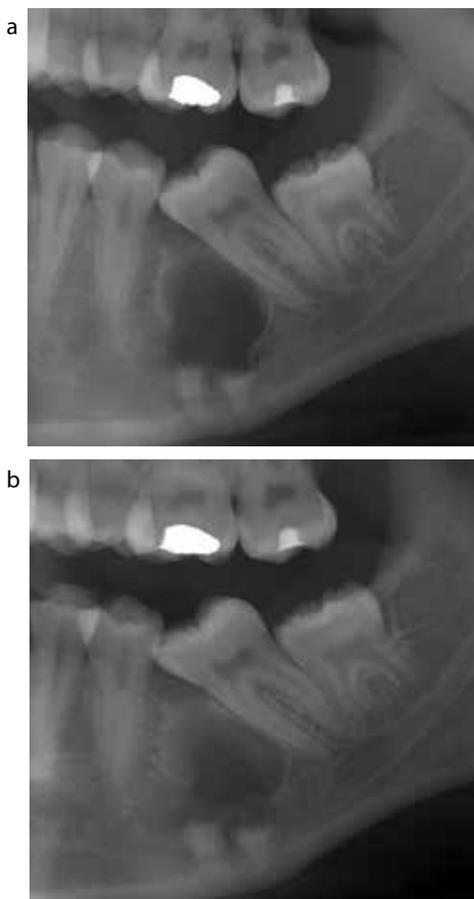


Figure 3. (a) An OPT taken 6 weeks post coronectomy demonstrating the position of the two remaining roots of the LL6. (b) An OPT demonstrating early infill of bone at 5 months post-op.

furcation. Surgicel® (Ethicon) was placed and the surgical site closed with 4-0 Vicryl Rapide™ (Ethicon); a 5-day prophylactic course of co-amoxiclav was prescribed to help reduce risk of post-operative infection. The patient was advised to abstain from any contact sports for 6 weeks.

The patient was reviewed clinically and radiographically 6 weeks later (Figure 3a); no altered sensation, pain or numbness was reported in the distribution of the IAN. The management plan was to review the patient in 6 months to assess the degree of bony infill at the surgical site and investigate the possibility of commencing orthodontic treatment.

Five months post-surgery, the patient attended with pain in the lower left quadrant following an alleged

assault. Clinically, no pathology or signs of mandibular fracture were evident. An OPT excluded infection and fractures; however, it did demonstrate early infill of bone at the site of coronectomy (Figure 3b).

Discussion

Consideration of coronectomy is almost synonymous with high risk mandibular third molars, but it is an important treatment option when any extraction poses a high risk of IANI.

Previous case reports

No high-quality evidence or formal guidance regarding coronectomy to manage non-third molar teeth exists. A report of two cases in which standard coronectomy was used to manage infra-occluded mandibular first permanent molars with close relationships to the IAN is available. However, the position of the remaining roots prevented orthodontic space closure.⁸ A further report is also available regarding the coronectomy of an infra-occluded LR5 and LR6, in which there was deemed to be a high risk of IANI with complete removal; the retained roots also allowed preservation of the alveolar ridge for a prosthesis.⁹ Coronectomy of an infra-occluded deciduous molar has even been reported.¹⁰ In all cases, coronectomy was performed as an alternative to complete removal for the primary reason of minimizing risk of IANI. The reported cases were successful as no IANI was reported.

Risk assessment

Radiographic assessment

Certain plain film radiographic signs are associated with a higher risk of IANI following third molar removal. This includes: diversion of the inferior dental canal, darkening of the root, interruption of the canal lamina dura, narrowing of the root/canal and interruption of the juxta-apical area.⁶ In the presented case, darkening of the root, interruption of the canal lamina dura, and narrowing of the canal was visible. A CBCT was therefore justified to visualize the relationship of the tooth to the nerve.

Cone beam computed tomography (CBCT)

CBCT is a highly useful diagnostic tool

for the determination of the relationship between teeth and the IAN. CBCT signs of increased risk of IANI includes:⁶

- Loss of canal cortex >3 mm;
- Dumb-bell distortion of IDC;
- Lingual position of canal to roots;
- Perforation of roots by canal;
- Inter-radicular canal with multiple roots.

CBCT enabled the authors to visualize the three-dimensional relationship of the tooth, IAN and surrounding structures to facilitate surgical planning. CBCT can occasionally prove that the tooth and nerve are not as intimate as indicated by plain film alone and avoid unnecessary coronectomy. If mobilization of roots at the time of coronectomy occurs, enhanced information may enable their removal with reduced morbidity.

Furthermore, the information gained from the CBCT helped the patient and family to reach a more informed decision regarding her treatment.

Patient selection

Following radiographic examination, the patient was deemed to be at a higher risk of IANI. Coronectomy was therefore considered as a management option. Standard coronectomy principles for lower third molars were used to guide suitability. In this case, coronectomy was deemed appropriate, as complete removal placed the patient at high risk of IANI, as well as being medically fit and well with good healing potential. The patient also demonstrated good compliance with the ability to attend multiple appointments. Furthermore, the tooth was absent of any significant pathology, such as caries in close proximity to the pulp or periapical pathology.

Selvi *et al* reported that increasing age and females are more at risk of an IANI.¹¹ This may influence the decision-making process for clinician and patient.

Piezosurgery

Piezosurgery was used in this case, since it allows a high degree of surgical precision for the removal of hard tissues whilst helping to spare mechanical and thermal damage to soft tissues.¹² Better wound healing and bone response have been observed in comparison to conventional rotary instruments.¹³ In this case, a need to

preserve the IAN and viability of bone for infill was especially important to facilitate orthodontic treatment, and restore strength to the mandible. Even in cases of direct nerve contact with piezosurgical instruments, the injury is more favourable and has a better outcome in comparison to conventional instruments.¹⁴ Furthermore, the action of the vibrations and irrigant help to wash away debris, improve visibility and decrease heat generation.¹⁵

Multidisciplinary planning and orthodontic tooth movement

This case highlights the benefits of multidisciplinary planning between surgeon and orthodontist to facilitate the patient's and clinician's end goal of tooth alignment with minimum morbidity. A key consideration was the need to ensure that there was sufficient room for mesial apical movement of the LL7 after the coronectomy. Failure to appreciate the vertical space requirements would have resulted in a futile coronectomy, inability to upright the LL7, and potential root resorption. During orthodontic treatment, further radiographic reviews will be undertaken to check that the LL7 apices are clear of the retained roots and ensure that the apices have not migrated following surgery. The authors are confident that the orthodontic uprighting process of the LL7 should be successful and relatively quick, in part due to the effect of the regional acceleratory phenomenon (RAP). RAP describes the process by which noxious stimuli induce increased remodelling and healing of tissues, allowing for temporary accelerated tooth movement.^{16,17}

Interception

Early identification and appropriate referral of problems in the developing dentition is an important role for GDPs. Early management can often help negate the need for complex invasive treatment. In this case, the patient was referred at age 13, around 7 years after the usual LL6 eruption date. It is possible that the position of the LL6 could have been improved with earlier management.

Conclusion

Patients must be presented with all

materially significant treatment options to achieve informed consent. This case illustrates the role of extended coronectomy, assisted with CBCT and piezosurgery, to reduce the morbidity of orthodontic treatment in the developing dentition. Coronectomy is an important consideration where extraction involves a high risk of inferior alveolar nerve injury, and is assisted by CBCT, which can further stratify the level of risk and guide surgical planning. Patients must understand all future implications of this treatment approach. Early identification, management and appropriate referral are important steps in the management of complex problems in the developing dentition.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.
Informed Consent: Informed consent was obtained from all individual participants included in the article.

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