Avoiding common problems in tooth extractions

Author: Dr Kamis Gaballah, UAE

The last two decades have seen significant advances in restorative techniques and materials for dentistry. The latter, along with community-based preventive measures that aim to reduce the incidence of caries, have resulted in many patients living with functional teeth for a longer period. Yet, extraction of teeth forms the considerable bulk of the workload in oral surgeries owing to several factors, including the late presentation of patients with advanced dental disease, the presence of symptomatic impacted teeth, such as third molars, and the need to extract teeth for orthodontic or orthognathic treatment.

The extraction of teeth varies greatly based on the type of patient who is undergoing the procedure. For example, elderly patients with significant co-morbidities and on a complex combination of medications as compared with young healthy individuals render the procedure complicated and require much more preparation with modifications during and after patient management. Additionally, extractions can range from a single, fully erupted tooth with favourable morphology to multiple misaligned, impacted teeth or teeth with challenging morphology. Local anatomy, such as tooth proximity to the nerve, maxillary sinus and tuberosity, also plays a significant role. These variations usually dictate who is to perform the extraction, as many general practitioners deal with less complicated cases of dental extraction in individuals regarded as healthy patients and may not feel comfortable operating on medically complex patients.

Complex extraction cases have been linked to a higher rate of postoperative complications; therefore, a cautious and systematic approach should be adopted that includes a detailed preoperative assessment to predict the potential difficulties that might arise during extraction. The documentation of all complicating risk factors along with their potential postoperative morbidities is crucial and should be included in the informed consent. In the following article, other useful tips will be provided that are not usually included in traditional textbooks or lecture notes to help general practitioners to perform safer extractions.

During clinical examination, it has been proven useful to observe the patient’s build. Tall and muscular individuals tend to have a long ramus with a higher mandibular foramen, and this increases the possibility of failure of the inferior dental nerve block procedure if the former is not taken into account when determining the height of the injection site. This can be
aided by tracing the inferior dental canal (IDC) to the mandibular foramen in the preoperative panoramic radiograph. The teeth of such individuals may also have longer and more curved roots and be embedded in highly dense, compact alveolar bone, and thus sectioning of the teeth may be required to ease the resistance. Racial differences should also be taken into account, as extractions of teeth from individuals of Afro-Caribbean descent tend to be more challenging owing to the hardness of their bone and divergence of roots in their molars.

The resistance of hard tissue should be expected, particularly if maxillary second and third molars are being extracted, as the potential for fracture of both the buccal plate and the tuberosity is relatively common when excessive force is applied with dental forceps. Fracture of the tuberosity may produce irregular sharp bony boundaries, significant soft-tissue laceration and potentially an oroantral fistula. If such risk factors are identified, tooth sectioning should be followed by elevation of roots with dental luxatomes instead of traditional elevators or forceps, which are known to deliver much higher force to the alveolar bone.

The indications for the extraction of impacted lower third molars (LM3) have been the subject of long-standing debate. Surgical procedures for the extraction of unerupted LM3 are associated with significant morbidity. This includes pain, swelling and the possibility of temporary or permanent nerve damage, resulting in altered sensation of the lip, chin, gingiva or tongue. Damage to the inferior dental nerve (IDN) is a well-known complication of surgical extraction of deeply impacted LM3. It should be acknowledged that this is not simply a loss of sensation; the damaged nerve can be responsible for a number of abnormal sensations, including sharp pain and abnormal response to stimuli, such as the perception of a light touch as a sharp stab. This can have a significant impact on quality of life for many patients.

Injury to the IDN may occur from compression of the nerve, either indirectly by forces transmitted by the root and surrounding bone during elevation or directly by surgical instruments, such as elevators. The nerve may also become transected by rotary instruments or during extraction of a tooth whose roots are notched or perforated by the IDN. The risk factors for IDN injury during extraction of LM3 are shown in Table I. They cannot actually prevent the nerve injury if the tooth is to be extracted. The effective strategies that may avoid or minimise the risk of injury to the IDN can be collectively categorised into two main sets. The first is the preoperative workup, which should include critical assessment of the need to extract the third molar, clinical examination and radiographic investigation, and the second is intra-operative measures, including proper selection of local anaesthetic agent, the injection technique, modification of the surgical procedure and measures to reduce the degree of potential injury to the nerve.

Most literature published in the last decade has given us sufficient evidence to suggest a significant risk of damage to both the inferior dental and the lingual nerve owing to the nerve block procedure.

This injury may be related to the pharmacological properties of the agent itself or the injection technique. Studies have shown that the lingual nerve is affected approximately twice as often as the IDN, and one reason for this may be the fascicular pattern in the region where the injection is given. It also appears that about half of patients feel an electric shock sensation during injection.

There is a higher incidence of reports of nerve injury after the use of articaine and prilocaine. Although the reason for this remains unknown, it has been suggested that this may be because they are 4 % solutions, whereas the other commonly used local anaesthetics have lower concentrations. Others associate the damage with the neurotoxicity potential of 4 % articaine and 3–4 % prilocaine. Hence, it is rec-

### Risk factors for IDN injury during LM3 extraction

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### Overall risk factors for IDN injury

- Full bony impactions
- Horizontal impactions
- Use of burs for extraction
- Radiographic risk markers
- Clinical observation of the bundle during surgery
- Excessive bleeding into the socket during surgery
- Patient’s age

### Radiographic signs of increased risk of IDN injury

- Apices of the LM3 located inferior to the lower border of the IDC
- Darkening of the root
- Abrupt narrowing of the root
- Interruption and loss of the white line representing the IDC
- Displacement of the IDC by the roots
- Abrupt narrowing of one or both of the white lines
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trends & applications tooth extractions

ommended that the use of such anaesthetics be limited to local infiltration. It has been claimed that needle contact with a nerve felt by the patient as an electric shock is related to injection injury. An obvious explanation is that the possibility of mechanical injury to the nerve is more likely in the case of multiple repeated attempts at the inferior dental nerve block procedure. Therefore, it is crucial that the operator achieve optimal pain control with minimal episodes of injection with minimal doses of anaesthetic agent.

The surgery should be planned according to the information obtained from the preoperative assessment process. The procedure itself should aim to minimise the manipulation around the IDC. Both should include the carefully planned access, tooth sectioning and elevation techniques. In many scenarios, the extraction of the whole tooth may carry an unavoidable risk of injury to the nerve, therefore intentional retention of parts of the tooth was proposed via a planned procedure introduced around 20 years ago called coronectomy. This is the removal of the crown of a tooth, leaving the root in situ. It is merely adopted to avoid or minimise damage to the IDN. The rate of complications after coronectomy is comparable to that observed after surgical extraction, except with a significantly low incidence of injury to the IDN.

It should be noted that both sectioning and coronectomy can be performed with a shorter incision, as the amount of bone removal required is minimal, thus minimising the postoperative morbidity. However, it cannot be performed in all cases in which the LM3 is close to the IDC and is certainly contra-indicated when the LM3 is decayed or its roots are associated with a pathology and should be considered with caution in severely inclined mesio-angular and horizontal impaction cases. The author does not recommend distal bone removal or retraction of the lingual flap with the intention of protecting the lingual nerve, as these may increase the risk of damaging the lingual nerve. It should be emphasised that incision may not extend beyond the distobuccal aspect of the tooth.

The other important aspect of the dental extraction procedure is the future replacement of the tooth to be extracted. The current trend of tooth replacement for both functional and aesthetic reasons is the placement of dental implants. The success of this treatment largely depends on the availability of healthy bone in sufficient volume. Therefore, it is crucial for the dental practitioner not to compromise the alveolar bone during extraction of the teeth. Changes in the alveolar bone ridge after an extraction are inevitable. After all dental extractions, bone height and width always undergo dimensional changes. Bone does not regenerate above the level of the alveolar crest, that is, its height will not increase during healing. The buccal plate tends to shrink, shifting the crest of the alveolar ridge lingually, and often forms a concavity. Such changes are proportional to the amount of trauma to the soft- and hard-tissue during the extraction.

An additional unfavourable change that may take place is the slow remodelling of the bone formed to fill up the extraction socket owing to lack of functional stimulation. The presence of poorly remodelled alveolar bone may compromise the stability and function of the future implant. Furthermore, studies show that the stripping and elevation of mucoperiosteal tissue produce a higher number of osteoclasts within the alveolar ridge and hence greater resorption and shrinkage are seen after the classical surgical or the traumatic extraction of teeth.

The preservation of alveolar bone for future implant placement may be achieved by avoiding unnecessary bone removal and stripping of the periosteum during surgery, as well as performing a surgical alveolar bone preservation procedure. Bone removal can be largely avoided or minimised through modification of the traditional extraction technique.

The first such modification is the use of dental periodontal ligament fibres and widen the socket without causing cracks or fracture of the cortical plates, as commonly encountered when using dental forceps or the bulky elevators. The use of such gentle instruments also eliminates the need for elevation of mucoperiosteal tissue. However, it should be noted that the safe use of these instruments requires adequate training and should be encouraged during undergraduate clinics. Clot stabilisation through light packing of the socket with collagen sponges may help to minimise clot dislodgment, as well as accelerate the healing process and bone regeneration.

The second strategy is the alveolar bone preservation procedure. This includes packing the extraction socket with different fillers, such as osteoinductive or osteoconductive materials, like autogenous, natural or synthetic bone grafting materials that support the alveolar socket walls, thus preventing their collapse and shrinkage. It should be noted that this intervention can only slow down the post-extraction changes to improve the success of the dental implant, but cannot stop them altogether.

Finally, post-extraction care should include an explanation of the healing process and potential symptoms encountered after such procedures. The prescription of medications should be limited to non-steroidal anti-inflammatory drugs in most cases and imprudent use of antibiotics or socket dressing should be avoided.

Dr Kamis Gaballah
Educated in the UK and Ireland, Dr Kamis Gaballah is currently an associate professor and senior specialist in oral and maxillofacial surgery at the Ajman University of Science and Technology in the United Arab Emirates. He can be contacted at kamisomfs@yahoo.co.uk.