

Minimising and managing nerve injuries in dental surgical procedures by Tara Renton

The most significant complications from dental surgical interventions are iatrogenic trigeminal nerve injuries, which can result in permanent altered sensation and pain, causing considerable functional and psychological disability. This paper provides some useful tips on minimising the risks of these injuries. By understanding the risk factors and modifying the resulting intervention, more of these injuries may be prevented.

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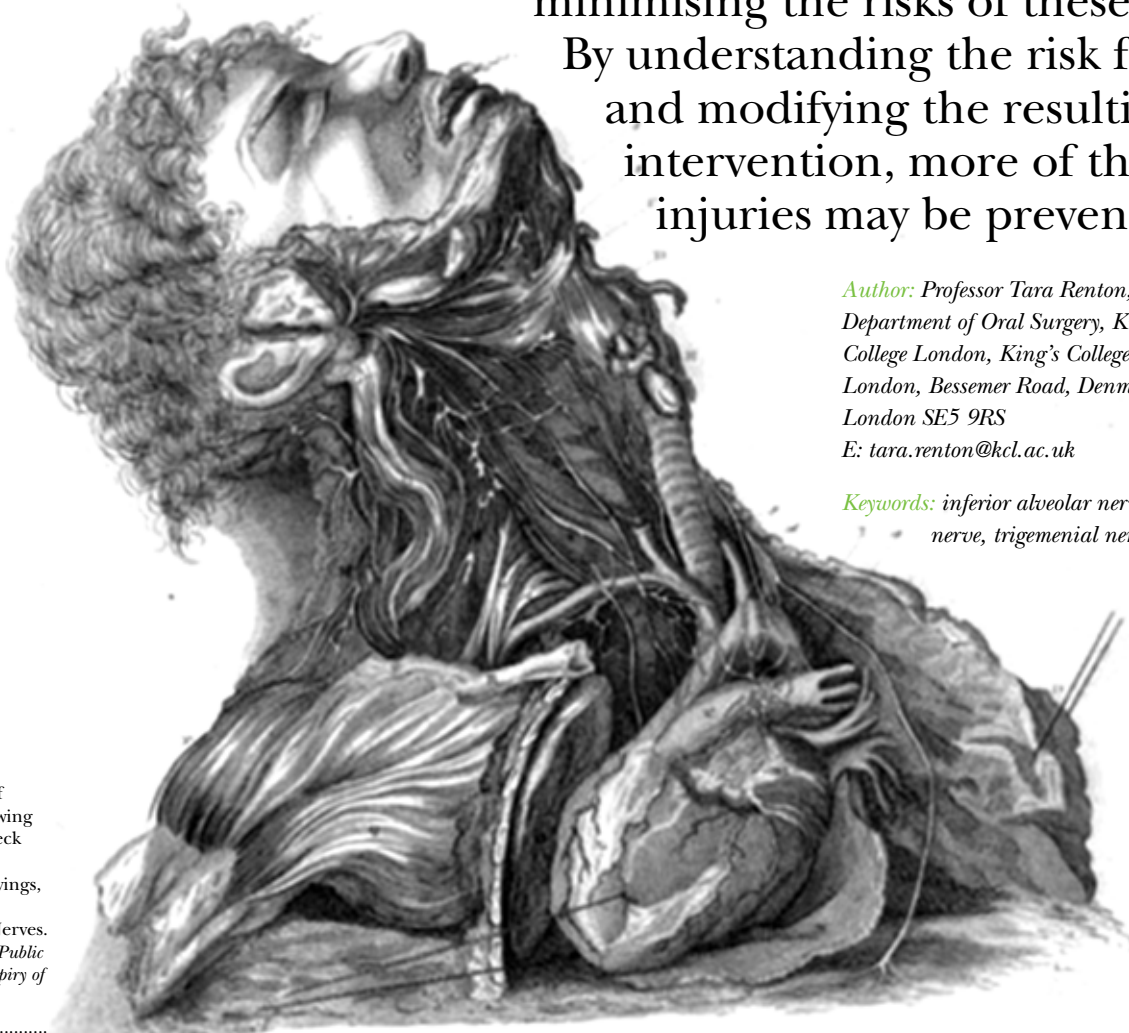


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current prevention and management of these nerve injuries is inadequate. There is commonly only discussion of surgical correction with no consideration given to medical or counselling intervention

The removal of mandibular third molars (M3Ms) is a common surgical procedure and – as with all surgical procedures – there is a risk of operative and postoperative complications. Overall, the rate of complications is reported to be 3.47%,¹ though these vary in severity. Known risk factors for poor surgical outcomes in relation to M3M surgery are: surgical difficulty,² older age,³ poor oral hygiene and smoking.⁴

Trigeminal nerve injury is the most problematic consequence of dental surgical procedures with major medico-legal implications.⁵ The incidence of lingual nerve injury has remained static in the UK over the last 30 years; however, the incidence of inferior alveolar nerve injury has increased, probably due to increase or advances in implant surgery and endodontic therapy.⁵ The risk factors associated with nerve injury in relation to third molar surgery include age and ethnicity of patient, length of surgery (difficulty), operator (junior) and, most importantly, lingual access.⁶

Iatrogenic injuries to the third division of the trigeminal nerve pose complex clinical problems. Altered sensation and pain in the orofacial region may interfere with speaking, eating, kissing, shaving, applying make-up, toothbrushing and drinking; in fact just about every social interaction we take for granted.⁷ Usually after oral rehabilitation, the patient expects and experiences significant improvements, not only regarding jaw function but also in relation to dental, facial and even overall body image. Thus, these injuries have a significant negative effect on the patient's self-image, quality of life and may lead to significant psychological effects.⁷

There are specific features of trigeminal nerve injuries associated with dental procedures:

- Both lingual and inferior alveolar nerve injuries are closed injuries, unlike the open wounds seen on traumatised limbs, which are amenable to immediate exploration and repair by orthopaedic or plastic surgeons. Paradoxically our profession has a 'sit and wait' policy for resolution of trigeminal

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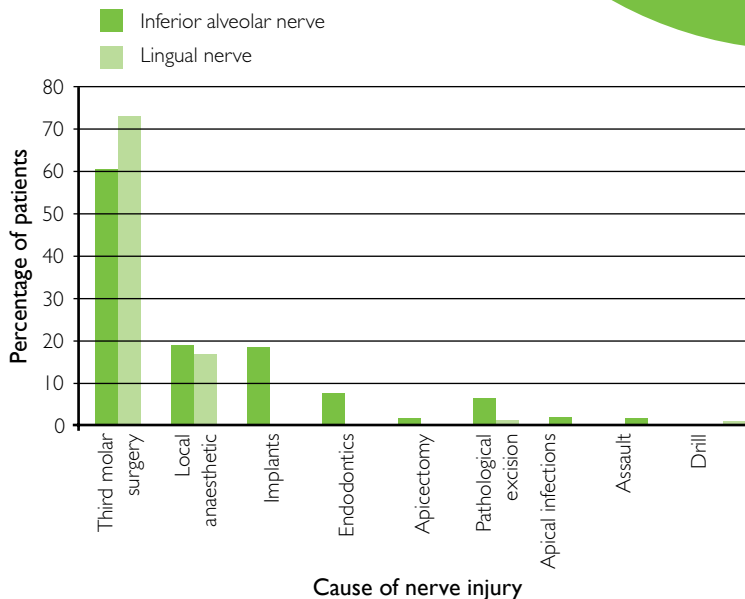


Fig 1 Graphic illustration of the frequency of causes of nerve injury. †

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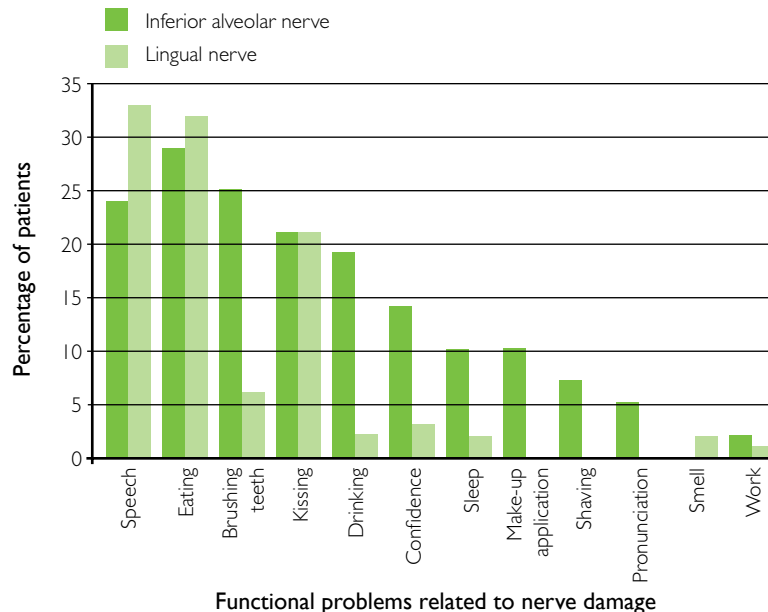


Fig 2 Graphic illustration of the relative functional problems related to lingual and inferior alveolar nerve injuries. †

† Data for Figures 1 and 2 from Renton T, Yilmaz Z. Profile of patients presenting with post-traumatic neuropathy of the trigeminal nerve. *J Orofac Pain* 2011; in press.

Fig 3 Dental panoramic tomography showing high risk M3M.



Fig 4 High risk M3M with proximal IAN positioned lingually (as is usual) to the M3M root.



nerve injuries unless known section has taken place.

- 88% of lingual nerve injuries associated with conventional lingual-access third-molar surgery resolve,^{8,9} thus lulling our specialty into a false sense of security believing that all nerve injuries will recover. This misconception has also led to the assumption that most inferior alveolar nerve injuries resolve, whereas in fact they are predominantly permanent^{10,11} (Figure 1).
- The complexity of nerve injury was previously classified by Seddon and Sunderland in the 1940s and focused on trying anatomically to differentiate nerve injuries; essentially they showed that the subtypes of injury bear no relationship to clinical presentation. It would be difficult to traumatise a nerve with a drill without causing a multitude of events including: i) direct mechanical trauma (tear, section, crush, stretch); ii) neural chemical trauma due to intracellular components released during trauma, eg haemoglobin, which irritates neural tissue; and iii) ischaemic injury due to entrapment within a bony canal (inferior alveolar nerve (IAN)) due to continued bleeding or scar formation. Thus it is unlikely that damage to a nerve is due to a simple cut. It is more likely that these nerve injuries incorporate a combination of mechanical, chemical and ischaemic events providing a complex therapeutic challenge.

- The type of patient often provides additional difficulty in that patients have a complication arising from elective treatment that was supposed to improve their quality of life, not detract from it. These iatrogenic injuries cause understandable distress to both patient and surgeon and the patient's frustration is often compounded by poor management by the surgeon involved (avoidance of contact after the injury, poor consent procedures, continued reassurance that the injury will resolve over months and years rather than referring the patient to a specialist at the appropriate time).
- Additional distress arises as sensory nerve injuries frequently cause pain rather than numbness. As the neuropathic area invariably involves the mouth and face, the patients' ability to eat, speak, drink, sleep, kiss, shave or apply makeup is often severely functionally compromised (Figure 2). Due to the chemical and neurophysical changes in the injured sensory nerve, light touch or drafts of air can cause debilitating neuralgic pain (allodynia) or in some instances the patient might experience constant background pain.
- Complaints to the General Dental Council are predominantly related to dental implants and often involve IAN injury. Neuropathic pain can be very debilitating and when compounded by poor management may result in subsequent litigation. Litigation is often based on

an inadequate consent procedure, inadequate planning and assessment, causation of avoidable nerve injury and poor management of the patient once the nerve injury has occurred.

Current management of these nerve injuries is inadequate. There is commonly only discussion of surgical correction with no consideration given to medical or counselling intervention. In part the fault rests with how we assess these patients, which results in a substandard evaluation of pain and functionality and a total focus on basic mechanosensory assessment that is not necessarily reflective of the patients' difficulties. A recent review of publications pertaining to trigeminal nerve repair highlights that the average time from injury to nerve exploration was 16 months, which is far too late to prevent central neural changes due to altered peripheral input (neuropathic pain).¹²

Injuries to the oral cavity nerves

Long buccal nerve: Anatomical studies carried out on the long buccal nerve show that it is at risk during the initial incision for many M3M procedures. Branches of it are probably frequently cut during the incision process but the effects are generally unnoticed. A search of the literature reveals no specific reports of long buccal nerve involvement, although one report did note involvement due to aberrant anatomy, where the

nerve branched off the IAN after it had entered the IAN canal and emerged from a separate foramen on the buccal surface of the mandible.

Mylohyoid nerve: Damage to this nerve has been reported to be as high as 1.5% following lower M3M removal but this is probably due to the use of lingual retraction.

Lingual nerve: The incidence of lingual nerve involvement one day after third molar surgery (excluding the use of lingual flap elevation) varies from 0.4% to 1.5% while the incidence of persistent involvement (still present at six months) ranges from 0.5% to 20% with the use of a lingual flap. The overriding lesson of the last 20 years with regard to lingual nerve injury during M3M surgery is that the incidence of injury is increased if a lingual flap access approach is used. Thus it is reduced if a buccal-only approach is adopted.^{13,14}

There are other causes of lingual nerve injury such as dental local anaesthetic injections, intubation, ablative surgery and submandibular gland surgery but third molar surgery, with a reported incidence of 1–20% temporary and 0–2% permanent⁸ is by far the most common. Persistence of any peripheral sensory nerve injury depends on the severity, increased age of the patient, the time that has elapsed and the proximity of the injury to the cell body (more proximal lesions having a worse prognosis).

Recovery is reported to take place at 8 weeks for 85–94% of cases.¹⁵ IAN injuries may have a better prognosis than lingual nerve injuries and if the duration of nerve injury is greater than eight weeks then permanency is a risk. However, the true incidence is difficult to gauge without large population surveys. The problem with these injuries is that the nerve will remain grossly intact and surgery is not appropriate as the clinician is unable to identify the injured region. The management indicated is thus for pain control if the patient has chronic neuropathic symptoms. A recent settlement of \$1.4m (in the US) for lingual nerve injury caused by local analgesic IAN block highlights

the recognition of the associated disability and social repercussions of these injuries.

Complete neural transection of the lingual nerve requires immediate nerve repair by an experienced surgeon. Where there is partial damage, gentle debridement and the maintenance of good apposition of the ends is normally undertaken. The patient should be informed of the situation. One recent study has shown that significant improvement in nerve function can be achieved by specialist surgical investigation and repair when undertaken within three months.¹⁶

Late recognition of nerve damage may require further surgical exploration but persistence of symptoms beyond three months indicates that a return to normal function is unlikely and that consideration should be given to nerve repair. Thus this author advocates a surgical intervention should be performed before 12 weeks, which implies that if recovery has not been achieved by 8 weeks the clinician should consider referral.

Inferior alveolar nerve: The incidence of IAN involvement 1–7 days after third molar surgery is around 1–5%. The incidence of persistent IAN involvement (still present after six months) varies from a high of 0.9% to a low of 0%.¹⁷

A mean figure from all studies is approximately 0.3%. Damage to the inferior alveolar nerve, leading to persistent hypoesthesia/dysaesthesia in its sensory distribution, is less amenable to surgical repair although the prognosis for spontaneous nerve regeneration after six months is poor.

Causes of inferior alveolar nerve injury include local anaesthetic injections, third molar surgery, implant placement, endodontic therapy, ablative surgery, trauma and orthognathic surgical procedures. IAN neuropathy related to third molar surgery or inferior alveolar block injections is usually temporary. There are rare reports of resolution of implant-related IAN neuropathies after four years¹⁸ but these do not comply with normal reports of

peripheral sensory nerve injuries.¹⁹ Although there are numerous reports recommending referral of IAN injuries after six months²⁰ current thinking is that this may be too late for many peripheral sensory nerve injuries to effect a recovery. It is now clear that after three months, permanent central and peripheral changes occur within the nervous system subsequent to injury that are unlikely to respond to surgical intervention.²¹

Prevention of nerve injuries

Local analgesic-related trigeminal nerve injuries

Injuries to inferior alveolar and lingual nerves caused by local analgesia block injections have an estimated incidence of between 1:26,762 to 1:800,000. There are reports of incidences of 1/588,000 for prilocaine and 1:440,000 for articaine which is 20–21 times greater than for equivalent lignocaine injections.²² 'Perhaps every full time practitioner will recall that he or she encounters one patient during his or her career who has suffered a permanent nerve injury following an inferior alveolar nerve block for which there are no means of prevention'.²² These injuries are associated with a 34% to 70% incidence of neuropathic pain,²² which is high when compared with the other causes of peripheral nerve injury.

Iatrogenic nerve lesions may produce symptoms ranging from next to nothing to a devastating effect on quality of life. Only a few studies, however, describe the range of neurosensory disturbance in terms of signs and symptoms related to impaired nerve conduction and neurogenic affliction and there is a need for better standardisation and documentation of sensory deficits resulting from such nerve injuries and their recovery.²³ Owing to the low incidence of nerve injuries in relation to dental anaesthesia, warning of patients is not routinely considered and in the UK these iatrogenic injuries are not currently considered negligent.

Nerve injury due to the administration of local anaesthetics (LA) is complex. The injury may be physical (needle, compression due to epineu-

ral or perineural haemorrhage) or chemical (haemorrhage or LA contents). Thus the resultant injury may be a combination of peri-, epi- and intra-neural trauma leading to haemorrhage, inflammation and scarring, resulting in possible demyelination (loss of nerve lining).²² There may be elements of direct mechanical trauma by the needle, which has been the focus of most papers (no matter what type of bevel or, indeed, method used for LA administration).

Some authors infer that the direct technique involving 'hitting' bone before emptying the cartridge and the subsequent withdrawal of needle, may inflict additional deformity at the needle tip thus 'ripping' the adjacent nerve tissue.²² Only 1.3–8.6% of patients report an electric shock sensation during an IAN block and 57% of patients who suffer from prolonged neuropathy have not experienced any discomfort during the injection, reducing the predictive specificity of this symptom. Analysis also reveals that 81% of IAN block injuries are reported to resolve at two weeks post injection.⁷

Chemical nerve injury may also be related to specific chemical agents²⁴ and the LA components (type of agent, agent concentration, buffer, preservative). The variety of local anaesthetics available in the UK include: 2% lidocaine, 2% mepivacaine, 3% mepivacaine, 3% prilocaine, 4% prilocaine and 4% articaine. It has been proposed that it may be the concentration of the local anaesthetic agent that relates to persistent post-injection neuropathy. This is based on evidence provided in studies where increasing concentration of local anaesthetic agent significantly affected the survival rate of neurons *in vitro*.²⁵ Epidemiologically several reports have highlighted the increased incidence of persistent nerve injury related to IAN blocks with the introduction of high-concentration local anaesthetics such as prilocaine and articaine (both 4%).

Articaine is an amide analgesic, which was introduced to dentistry in 1998; however, lidocaine (also an amide analgesic) remains the gold standard in the UK. Articaine has been the most widely used local an-

algesic in many countries for over 20 years²⁵ and is said to have a number of advantages, namely, low toxicity due to its rapid breakdown to an inactive metabolite (articainic acid), rapid onset of surgical analgesia (2.5 minutes \pm 1.1 minutes) compared with Lidocaine and better diffusion through both soft and hard tissues.²⁶ The conclusion drawn therefore is that articaine is a safe and effective local anaesthetic for use in clinical dentistry. However, it has also been demonstrated that there is no significant benefit in using 4% articaine compared with 2% lidocaine for IAN blocks.²² Indeed there is some concern with regard to using articaine 4% for inferior alveolar and lingual nerve blocks. It has been proposed that reported persistent post-injection altered sensation may be due to the high concentration of the local anaesthetic; albeit that the technique cannot be excluded as a cause.²² Another report even suggests that it is the type of anaesthetic that dictates the degree of inflammatory reaction, lidocaine being the least irritant compared, in ascending order with articaine, mepivacaine and bupivacaine.²⁷

Persistence of any peripheral sensory nerve injury depends on the severity of the injury, causality, increased age of the patient, the time elapsed since the injury and the proximity of the injury to the cell body (more proximal lesions have a worse prognosis). Many authors recommend referral of injuries before four months but this may be too late for many peripheral sensory nerve injuries (see Table 1). We now understand that after three months, permanent central and peripheral changes occur within the nervous system subsequent to injury that are unlikely to respond to surgical intervention.²⁸ Thus the author recommends referring for opinion no later than eight to ten weeks.

The nerve that is more likely to be damaged during inferior alveolar nerve block injections is the lingual nerve (70%).²² One suggestion is that this is the result of trauma and that over-reporting of such injuries occur when a new drug formulation, such as 4% articaine, is introduced. There is another possible explanation as to why the lingual nerve is

more likely to suffer damage, which relates to its structure. At the region of the lingula the lingual nerve is composed of very few fascicles and in some individuals it is unifascicular.²² In comparison the inferior alveolar nerve is multifascicular at the same point. This structural difference may explain why the lingual nerve is more susceptible to injection damage than the inferior alveolar nerve.

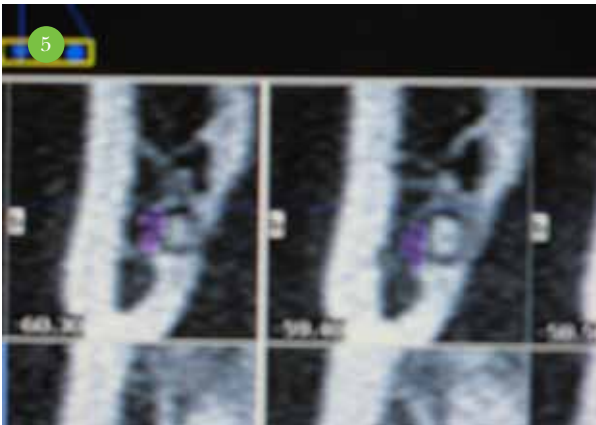
More recently, articaine buccal infiltrations have been reported to possess similar efficacy to lidocaine inferior alveolar blocks enabling mandibular-based dentistry and therefore obviating the necessity for block anaesthesia altogether.^{29,30} It has become routine practice during paedodontic extractions to use articaine infiltrations and many practitioners are routinely undertaking restorative treatment of premolars and molars in adults using articaine infiltrations rather than inferior alveolar nerve blocks. This may reduce the incidence of these troublesome untreatable injuries.

Prevention of LA-related nerve injuries is possible and some simple steps may help:

- Avoid high-concentration LA for inferior alveolar nerve blocks (use 2% lidocaine as standard).
- Avoid multiple blocks where possible.
- Avoid IAN blocks completely by using high-concentration agents (articaine) infiltrations for most dental procedures.

Prevention of inferior alveolar nerve injuries during third molar surgery²⁴ may be possible by:

1. A clinical decision based on National Institute for Health and Clinical Excellence guidelines that the tooth needs to be extracted (ie do not undertake prophylactic surgery unless indicated).
2. Identify high-risk teeth (specific consent) by identifying radiographic risk factors for IAN injury, which include:
 - tooth crossing **both** lamina dura of IAN canal
 - juxta-apical area
 - deviation of canal
 - narrowing of roots.



If the tooth is in close proximity to the IAN on plain film (Figure 3) then cone-beam computed tomography (CBCT) scanning may further elucidate the relationship between IAN and tooth roots (Figure 4). If the tooth is vital and the patient non-compromised, consideration should be given to coronectomy of the tooth. If the tooth is non-vital, or has associated pathology, then tooth removal has to proceed and based on the CBCT findings, the roots should be sectioned appropriately to minimise trauma to the adjacent IAN after patients have been warned of increased risk of damage, which may be as high as 2% for permanent and 20% for temporary IAN injury.

Coronectomy

Coronectomy is an alternative procedure to complete extraction when a M3M is deemed ‘high risk’ (crossing both lamina dura of the inferior dental canal (IDC)) but vital in a patient whom is not medically compromised. Coronectomy reduces the likelihood of nerve injury by ensuring retention of the M3M vital roots when they are close to the inferior alveolar canal (as estimated on radiographs or CBCT). The method aims to remove only the crown (all enamel) of an impacted M3M while leaving the root undisturbed, thereby avoiding direct or indirect damage to the IAN.³¹

Based on the author’s experience, using CBCT has an explicit role in preoperative assessment for removal of third molars in a unit that regularly undertakes coronectomy procedures. In less than 33% of cases the M3M is very proximal to the IAN canal and/or the lingual plate may

be absent (Figure 5). This author would only consider undertaking an intentional M3M coronectomy when the IDC is intricately involved with the M3M roots or if the roots are proximal and lingual to the IDC in association with a missing lingual plate (Figure 5). If the IDC is just proximal to the M3M tooth roots the author would plan the surgery based on the CBCT with the intention of removing the roots with retention only when the roots are completely immobile on initial elevation. In those cases where the root is distant to the IDC (Figure 4), or the patient is compromised or the tooth non-vital, then the M3M should be removed and then CBCT may play a role in assisting the surgeon to plan the tooth section in order to minimise damage to the IAN.

Thus, minimising IAN injuries in relation to M3M surgery includes:

1. Planning for M3M surgery:
 - Is there a NICE guideline to remove the tooth?
 - Is it high risk?
 - Yes – consider CBCT.
 - If vital – consider coronectomy **or** consider referral.
 - If non-vital – consider root section to minimise nerve injury.
2. Procedure:
 - Always use **buccal** approach with **no** lingual retraction and **no** distal bone removal; always section the tooth in preference to removing more bone.
3. Post operative:
 - If tooth is high risk always check on patient postoperatively.
 - If extraction was difficult and roots retained with neuropathy – refer immediately.

Implant nerve injuries

The incidence of implant-related (IAN) nerve injuries vary from 0–40%.³² Preoperative planning must include knowledge and assessment of the IAN route through the mandible to prevent nerve damage, with particular reference to the mental nerve region where the nerve often deviates and can be assessed using tomography or CBCT (Figure 6).

IAN injuries often result from direct breaching of the IDC by the prepartation drill and implant (Figure 7). Bone graft harvesting is also associated with IAN injuries. Again, it is crucial that appropriate training, planning, assessment and training should be undertaken in order to minimise nerve injury. Avoidance of implant nerve injury is sometimes attempted by using techniques including IAN lateralisation and posterior alveolar distraction; however, these high risk procedures are more likely to result in IAN defects regardless of the surgeon’s experience. Clinicians must remember that 25% of edentulous patients present with a degree of altered IAN function, thus reinforcing the guidelines on the necessity of preoperative neurosensory evaluation. Preventing of implant related nerve injuries includes:

1. Planning:
 - Be very wary of planning implants around mental foramen – ensure you check the nerve position using CBCT yourself (Figure 6).
 - Give ample safety zone (minimum 4 mm) above IDC.
 - Use CBCT planning and check position of nerve yourself.
2. Preparation:

Fig 5 Cone beam computed tomography scan of M3M root proximal to inferior dental (ID) canal with additional loss of lingual plate.

Fig 6 CBCT scan showing premolar implant entering mental nerve when apparently above the IDC on periapical film.

Fig 7 CBCT scan showing mental nerve deviation prior to exit through the mental foramen.



Fig 8 Over-filled endodontically treated mandibular molar.

Mechanism	Duration	Treatment
Known or suspected nerve section		Immediate exploration
TMS IANI – retained roots	<30 hours	Immediate exploration
Implant	<30 hours	Remove implant
Implant	>30 hours	Treat patient therapeutically
Endodontic	<30 hours	Remove tooth/overfill
Endodontic	>30 hours	Treat patient therapeutically
TMS IANI – large neuropathic area, pain and disability	<3 months	Consider exploration
TMS LNI – large neuropathic area, pain and disability	<3 months	Consider exploration
TMS IANI	>6 months	Treat patient therapeutically
TMS LNI	>6 months	Treat patient therapeutically
LA, fracture, orthognathic, other surgery		Treat patient therapeutically

Table 1 Proposed treatments for trigeminal nerve injuries.

Key

TMS = third molar surgery
IANI = inferior alveolar nerve injury
LNI = lingual nerve injury
LA = local anaesthetic

- Use light buccal LA and stop proceedings if patient gets pain during preparation.
 - Never use bur longer than implant.
 - If bleeding during preparation – consider delay of placing implant (2–3 days).
 - If there is sudden give – remove implant and check for bleeding, if there is none then ensure the implant is placed at shorter length
3. Placement:
- Delay placement if implant bed is bleeding.
 - Don't rely on back up if patient experiences pain on placement – remove it.
4. Post operative:
- **Always** check on your patient post operatively at 4 hours.
 - If neuropathy presents – recall patient immediately, confirm neuropathy is in IAN distribution and **remove** implant.
 - Place patient on high dose steroids (step down from 20mg prednisolone over 5 days).

Endodontic nerve injuries

IAN injuries related to endodontics are a rare complication and seldom reported (Figure 8). If the tooth apex is adjacent to the IDC it is understandable that, even in the most experienced hands, breaching the apical seal can place the nerve at risk of chemical exposure. The chemicals used for endodontics are (on the whole) very high in pH and thus extremely caustic to nerve tissue, causing irreparable damage to the tissue and thus often permanent and painful nerve injury. Preventing endodontic nerve injuries includes:

1. Planning:
 - High risk if teeth are adjacent to IDC.
 - CBCT of tooth apices relationship with ID canal.
2. Preparation:
 - Do not over-prepare IDC and minimise leakage of debris and sodium hypochlorite into periapical tissues.
3. Post operative:
 - Overfilled on long cone periapical radiograph– remove endodontics/tooth
 - Routinely check on patient in early post operative <24 hours.

- If patient has neuropathy immediately after LA has worn off:
 - **remove** endodontics
 - extract tooth
 - apicectomy nerve decompression
 - steroids and NSAIDS
 - refer if necessary.

Dental extraction of non M3M teeth

Be aware that any mandibular tooth that is crossing the IAN canal and displays the appropriate radiographic signs is associated with increased risk of IAN injury as indicated with third molars. Accordingly the patient must be assessed, consented and treated in the same fashion.

Socket medications

With any mandibular tooth in close proximity to the IAN canal, subsequent socket medicaments can effectively expose the IAN to potential neural irritants, which may result in chemical neuritis. If this becomes persistent neuropathy it is likely to be untreatable and often associated with neuropathic pain.²⁴

There are limited available data concerning the relative alkalinity or acidity of various dental compounds used for socket medication including: Alvogel, Whitehead's varnish, Corsodyl® and Surgicel®. However, a previous study highlighted the relative neurotoxicity of Carnoy's solution, Surgicel®, Whitehead's varnish and bismuth Iodoform paraffin paste (BIPP). Such studies have reported that Carnoy's solution is likely to cause permanent nerve damage, and Surgicel® and Whitehead's varnish temporary disturbances, while BIPP was reported to be the least neurotoxic.³¹ Bone wax is a neutral pH; however, excessive packing or pressure can lead to nerve compression and injury.

Post-operative infection

Inferior alveolar neuritis can present as a symptom of local mandibular infection associated with a periapical abscess on a non-vital tooth, which lies in close proximity to the IAN canal or as a sign of osteomyelitis.

Periapical infection may injure the neighbouring nerve due to spreading bone infection and the tooth should be removed or treated

endodontically. Osteomyelitis may present as persistent or recurrent dry socket that has required repeated socket irrigation and redressing. Suspicion should arise after the second or third dressing when accompanied by persistent pain and non-response to antibiotics. More recently with the advent of bone graft surgery for dental implants some patients progress to osteomyelitis associated with non-vital bone grafts that are not removed quickly enough.⁵

Possible nerve injury management protocols

The management of nerve injuries will depend on the mechanism and the duration of the event.^{28,32} The patient's ability to cope with the neuropathy and pain, functional problems and their psychological status will drive the need for intervention. Considering 70% of these patients present with neuropathic pain, most are managed with reassurance and medication. Cognitive behavioural techniques are being developed for these patients. Many injuries have limited benefit from surgical intervention and should be managed symptomatically using medication or counselling. The author believes that, in view of the limited surgical window, immediate advice from a recognised specialist is required following endodontic, implant and third-molar related nerve injuries, which may require immediate referral or at the very least a phone call. The following is a suggested management protocol:

1. Counselling is indicated for irreversible injuries (see Table 1)
2. Medical symptomatic therapy (pain or discomfort):
 - Topical agents for pain.
 - Systemic agents for pain.
3. Surgical exploration:
 - Immediate repair if nerve section is known.
 - Remove implant or endodontic material within 24 hours.
 - Explore IAN injuries through socketless if less than four weeks.
 - Explore LN injuries before 12 weeks.

A proposed management for trigeminal nerve injuries is summarised in Table 1.

In summary, this paper highlights several strategies that can be used to assist the practitioner in preventing and managing complications related to some common dental surgical procedures.

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