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Critical review

Avoiding morbidities in third molar surgery: current practice

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Abstract

Surgical removal of mandibular third molars is the most common procedure performed by oral and maxillofacial surgeons. Innovations in radiographic imaging are useful in pre-operative planning and advances in surgical tools and medical therapies are reducing post-operative morbidities. This article provides a review of the available data on the importance of preoperative assessment and means of decreasing post-operative complications.

Introduction

Mandibular third molar (M3) surgery is the most common surgical procedure in oral and maxillofacial surgery and one of the most common surgical procedures performed in a day-case set up[1]. The decision whether to surgically extract or 'wait and see' has always posed a challenge for clinicians and patients, especially in light of increasing medico-legal litigations, the current restricted access to elective surgery, and scarce human and financial resources available to health care providers in many parts of the world. Therefore, surgical excision of M3 has to be clinically and financially effective[2].

The aim of this article is to present an overview of M3 surgery, review the importance of pre-operative assessment with modern imaging and the latter's role in minimizing neurosensory deficit and available means to reduce common post-operative morbidities. This review is not a meta-analysis.

The author has referenced some of its own studies in this review. These referenced studies have been conducted in accordance with the Declaration of Helsinki (1964) and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed.

Indications for mandibular third molar surgery

The most common indication for M3 surgery is pericoronitis, comprising up to 58% cases in one study[1] followed by idiopathic pain that was not attributable to infection, third or second molar caries, orthodontic reasons, associated pathology and periodontal disease[1,3]. The indications for the surgical removal of M3 evolved more than a decade ago; earlier about 71% of M3 were excised without subjective or objective problems and many surgeries were unnecessarily performed[3]. The latter prompted the National Institute for Clinical Excellence (NICE) to publish guidelines on the surgical removal of impacted M3 limiting the indications to severe or recurrent pericoronitis; unrestorable caries; non-treatable pulpal and/or periapical pathology; cellulitis; abscess and osteoyelitis; internal/external resorption of the tooth or adjacent teeth; fracture of tooth; disease of follicle...etc.[4]

Post-operative complications

Pain, swelling and trismus are the most common complications following M3 surgery; they are usually associated with deeper impactions and longer operations; however, these are self-limiting side effects that completely resolve in several days at most[5]. Alveolar osteitis, a very painful and disabling inflammatory condition, has been associated with older age, oral contraceptives and traumatic and difficult extraction[5]; its frequency was estimated at 6.2%–14.4% cases, whereas the more serious post-operative socket infection occurred in 2.0%–6.1% cases[5,6].

Neurosensory deficit of the lingual and/or inferior alveolar nerves are more significant complications; permanent impairment has been reported at 1.1% and 0.6%, respectively[7]. The risk factors for lingual nerve (LN) morbidity from M3 surgery include: older age, male patients, distal impaction, treatment by trainees and operative variables such as inappropriate lingual retraction and lingual split technique[7,8,9]. Kiesselbach and Chamberlain demonstrated a variation in the anatomic location of LN, with 17.6% located at or above the level of the alveolar crest and 62% in contact with the lingual plate; this highlights the importance of a careful surgical technique[7,10]. Regarding inferior alveolar nerve (IAN) morbidity, increased age, deep impaction, horizontal impactions, treatment by trainees and radiographic signs of M3 root proximity to the mandibular canal are known risk factors[7,10]. Jerjes et al. explained that IAN damage may result from indirect trauma

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through compression by M3 root during elevation and luxation by the elevator or directly by the elevator itself, rotating instruments, the root itself when perforated by the nerve, regional anaesthetic block injections and irritation by haemorrhage into the socket during surgery[7].

Pre-operative assessment

Conventional plain panoramic radiography has been the main pre-operative imaging tool for M3 surgery providing information on the level of impaction, angulation, associated pathology and relationship to the mandibular canal. However, with the introduction of digital radiography offering several advantages over conventional plain film radiography, the former has become the mainstay of pre-operative assessment because of speed, image enhancement and a 50%–80% decrease in radiation exposure[11]. A considerable amount of emphasis has been placed on determining the radiographic signs indicating proximity of M3 roots to the mandibular canal. Rood and Shehab demonstrated that interruption of the white line of the mandibular canal wall, darkening of the root and diversion of the mandibular canal were significantly related to IAN injury[12]. Leung and Cheung in their review paper demonstrated that the incidence of IAN deficit was highest when there was a diversion of canal by M3 root, followed by darkening of root and root deflection[8].

Panoramic radiographs provide an overview of the status of M3 in two-dimensions only; therefore, the exact relation between the roots and mandibular canal is best assessed by three-dimensional (3D) imaging, namely computed tomography (CT). When an intimate contact exists between the M3 roots and mandibular canal on a CT, it is associated with a higher risk of exposure of the neurovascular bundle during surgery[13], with subsequent risk of IAN injury[14,15]. A CT results in a higher radiation exposure and it is costly, which makes it an undesirable diagnostic tool. Nonetheless, a cone beam CT (CBCT) exposes the patient to lesser radiation and is more informative than a panoramic radiograph[16]; this makes CBCT a preferred means of imaging for cases presenting with an intimate relationship between the mandibular canal and M3 roots in a panoramic view. In a prospective study, Ghaeminia et al. compared the influence of two-dimensional (2D)- and 3D-imaging on surgical technique and estimated the risk of IAN injury, thereby demonstrating that the clinical decision to surgically remove M3 changed based on the additional information provided by CBCT. Subsequently, more M3 were reclassified as having a lower risk for IAN injury. In addition, information obtained from CBCT provided the operator with an alternative surgical approach in comparison with that provided by panoramic radiography; the direction of tooth luxation and extraction were also found to be affected. Further, CBCT revealed a buccolingual relation of IAN with the roots of M3 avoiding compression injuries to the nerve[16]. However, till date, there is no evidence in the literature demonstrating any significant decrease in the occurrence of IAN injury resulting from pre-operative 3D-imaging[17]. Therefore, although 2D panoramic radiograph suffices for most cases of M3 surgery, CBCT is required whenever there is a radiographic sign of proximity of roots to the mandibular canal.

Minimizing risks of post-operative complications

Neurosensory deficit

In the presence of a significant risk on IAN, Knutsson et al. proposed coronectomy as an alternative practice to complete tooth excision[18]. In coronectomy, the crown of the tooth is excised at the cement-enamel junction with a fissure bur, leaving the root in situ as long as it has not been luxated. The cut root surface should be at least 3 mm below the bony margin, and after debridement, the wound is closed[19]. Prospective clinical trials have shown that in high risk cases, in comparison with surgical extraction, M3 coronectomy shows significantly lower IAN sensory deficit[19,20]. However, potential complications of coronectomy include the following: failed procedure because of luxation of the root resulting in a need to fully excise the tooth, thereby putting IAN at risk[19]; post-operative infection and upward root migration with subsequent root exposure requiring re-operation to excise the remaining root, the latter occurring in up to 6% cases[20,21,22]. As for avoiding LN injury, adopting a careful surgical technique is essential; this includes carefully planning the incision buccal to the alveolar crest, careful retraction of the lingual tissues avoiding stretching the nerve and cautious use of rotary instruments avoiding the inadvertent violation of the lingual plate[7,9,10].

Pain, swelling and trismus

The use of corticosteroids has been described to reduce post-operative swelling and trismus. In a meta-analysis, Markiewicz et al. demonstrated that perioperative administration of corticosteroids for patients undergoing M3 removal had a mild to moderate effect in reducing inflammatory symptoms post-operatively[23]. Steroids for dentoalveolar surgery are available via oral, parenteral and intramuscular routes. The most commonly used agents are oral dexamethasone and intramuscular or intravenous dexamethasone sodium phosphate, the latter being the most effective[23,24,25]. There is emerging evidence suggesting that locally administered corticosteroids are also effective[23]. Regarding pain, it is accepted that nonsteroidal anti-inflammatory drugs are ideal for controlling post-operative pain in

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dentoalveolar surgery through inhibiting prostaglandin synthesis[26]. Recent data demonstrated that no single drug is suitable for all cases and that other analgesics should be tried in some cases; ibuprofen and paracetamol combination, soluble ibuprofen and potassium salt of diclofenac, etoricoxib and naproxen are among the most efficacious analgesics after M3 surgery[26].

A recent prospective study comparing the surgical outcome after removal of M3 using a piezotome or a conventional rotary instrument showed that the former produced less pain, trismus and facial swelling[27]. However, bone removal requires more time and is more expensive with piezosurgery.

Alveolar osteitis and infection

The results of a meta-analysis of randomized controlled trials indicated that systemic broad spectrum antibiotics and penicillin derivatives were effective in reducing the frequencies of alveolar osteitis and wound infection after surgical removal of M3, especially when commenced pre-operatively[6]. There is sufficient evidence recommending the administration of a single dose pre-operatively, whereas for cases with known risk factors and post-operative complications such as smoking, poor oral hygiene and older age, administration of a single dose pre-operatively followed by few days of post-operative antibiotics provided better results[6].

Conclusion

The surgical removal of mandibular third molar surgery will continue to be the mainstay of oral and maxillofacial surgery. Advancements in imaging, surgical tools and medical therapy may help in modifying the surgical approach, decreasing post-operative morbidity, enhancing patient satisfaction and reducing the cost of sick leave.

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