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COMPLICATIONS AFTER EXTRACTION OF IMPACTED THIRD MOLARS- LITERATURE REVIEW

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ABSTRACT

Third molar surgery is the most common procedure performed by oral and maxillofacial surgeons worldwide. This article addresses the incidence of specific complications and, where possible, offers a preventive or management strategy. Complications, such as pain, dry socket, swelling, paresthesia of the lingual or inferior alveolar nerve, bleeding, and infection are most common. Factors thought to influence the incidence of complications after third molar removal include age, gender, medical history, oral contraceptives, presence of pericoronitis, poor oral hygiene, smoking, type of impaction, relationship of third molar to the inferior alveolar nerve, surgical time, surgical technique, surgeon experience, use of perioperative antibiotics, use of topical antiseptics, use of intra-socket medications, and anaesthetic technique.

For the general dental practitioner, as well as the oral and maxillofacial surgeon, it is important to be familiar with all the possible complications after this procedure. This improves patient education and leads to prevention, early recognition and management.

Key words: third molar surgery, complication, mandible, maxilla

INTRODUCTION

Surgical removal of impacted third molars is one of the most common procedures carried out in oral and maxillofacial surgery. Most third molar surgeries are performed without complications. However, such procedure can lead to serious complications to the patient, such as hemorrhage, persistent pain and swelling, infection, dry socket (alveolar osteitis), dentoalveolar fracture, paresthesia of the inferior alveolar nerve and of the lingual nerve, temporomandibular joint injury and even mandibular fracture. The accident or complication rates related to third molar extraction may vary between 2.6 and 30.9 %, being the results influenced by different factors, such as age and health condition of the patient, gender, tooth impact level, surgeon's experience, smoking, intake of contraceptive medicine, quality of oral hygiene, and surgical technique among others [1]. The overall incidence of complication and the severity of these complications are associated most directly with the depth of impaction and with the age of the patient [2]. There appears to be a direct relation between the degree of impaction of the extracted tooth and the incidence of postoperative complications. Most of the complications are associated with a greater degree of impaction. Teeth classified as having IC, IIC and IIIC impaction have more complications than teeth classified as having B or A impaction [3]. There is also a relation between tooth position based on the Winter classification and the appearance of postoperative complications. Mesioangular and distoangular impaction are associated with nearly twice as many complications as the other tooth positions [3]. Other authors state that horizontal and distoangular impactions are inclined to develop more complications [4]. Deep impacted third molar surgery needs a bigger flap design. Tissues in the neighborhood and muscles can receive more damage because of this wide and large access flap [5].

There is a distinctive association between age and observed postoperative complications. These associations result from the fact that the intervention in older patients lasts longer because of increased bone density. Age depended maturing of tooth root formation and decreased healing capacity lead to intensive postoperative complications. Bruce and Chiapasco et al. state that older patients have more pain, edema and trismus as postoperative complications [5].

It seems that female patients show higher accident and complication rates [1]. Monaco et al. reported that the incidence of postoperative edema in female patients (12.7%) is significantly higher than in male patients (1.4%) [5].

The experience of surgeon also appears to be a determining factor in the development of postoperative complications and can result in a longer treatment process, social and financial difficulties and a corresponding decrease in patient's life quality [5].

Prior to any surgical procedure, the patient must be informed about the possible accidents and/or complications that may occur during the entire treatment, being aware of the fact that any unexpected situation should be dealt with the best possible way [1].

It is thought that complications like pain, edema and trismus are caused by surgical trauma depending on the inflammatory process. In surgeries for impacted mandibular third molar, time of the intervention is thought to be associated with tooth position, angle and the experience of the surgeon and these parameters determine the difficulty of the surgery and are related to the intensity and time of pain, edema and trismus. Longer surgical interventions are thought to increase tissue damage and vascular permeability can cause postoperative edema and affect its intensity.

In addition, it was reported that longer surgical interventions lead to increased surgical trauma [5].

While evaluating the *postoperative complications* regarding the width and depth of impaction, pain and swelling was common in IIIA (37.5%) followed by IIIB (20%); dry socket was common in IIIA, IA and IIA which was 12.5%, 5% and 4.8% respectively; trismus occurred more in Class IIIB (20%), Class IIIA (12.5%) and Class IB (6.8%) and paresthesia was least common and occurred in 2 patients (0.7%) [4].

Bleeding

Hemorrhage might happen during (accident) or after (complication) the surgery, being classified as late or recurrent hemorrhage. In situations of intense bleeding classified as late, the hemorrhage happens only once, after the end of the procedure. In recurrent hemorrhages, more than one intense bleeding situation takes place, even after initially extinguished.

Anatomical variations, tooth proximity to the vascular nerve bundle of the mandibular canal, and coagulopathy are the main causes of hemorrhage [1]. Patients who have known acquired or congenital coagulopathies require extensive preparation and preoperative planning (eg, determination of International Normalized Ratio, factor replacement, hematology consultation) before third molar surgery [2].

Bleeding can be minimized by using a good surgical technique and by avoiding the tearing of flaps or excessive trauma to bone and the overlying soft tissue. When a vessel is cut, the bleeding should be stopped to prevent secondary hemorrhage following surgery [2].

The most effective way to achieve hemostasis following surgery is to apply a moist gauze pack directly over the site of the surgery with adequate pressure for some minutes or use of bone wax, absorbable hemostats or electrocoagulation.

In some patients, immediate postoperative hemostasis is difficult. In such situations a variety of techniques can be employed to help secure local hemostasis, including over suturing and the application of topical thrombin on a small piece of absorbable gelatin sponge into the extraction socket [2].

Some authors affirm that the hemorrhage cases represent from 0.2 to 5.8% of the accidents/complications and that the compression technique is safe and reliable in the control of intense bleeding [1].

In comparing hemorrhage with gender, age, position of the tooth, classification of the tooth, retention, angle, systemic conditions, bad habits, use of oral contraceptives and menstruation, there weren't any statistically significant differences [5].

Edema/ postoperative swelling

Postsurgical edema is an expected complication after third molar surgery. It can be caused by the response of the tissues to manipulation and trauma caused during surgery. Its onset is gradual and maximum swelling is present during 48 h after surgery [6]. Regress of the swelling is expected by the 4th day and completely resolution occurs in 7 days [7].

In comparing edema with gender, age, position of the tooth, classification of the tooth, retention, angle, systemic conditions, bad habits, use of oral contraceptives and menstruation, statistically significant differences were observed between edema and classification of the tooth. More edema was observed in class II than in classes I and III. There was a statistically significant difference between edema and partial bony and complete bony impaction [5].

The application of ice packs to the face may make the patient feel more comfortable but has no effect on the magnitude of edema [2].

Most of the surgeons prescribe corticosteroids to control surgical outcomes and yield a comfortable post-surgical healing period [6].

In the initial phase of the inflammatory process, corticosteroids acts by suppressing the production of vasoactive substances such as prostaglandins and leukotrienes. This reduces fluid transudation and edema. These drugs help to control mild pain hence they should be used in conjugation with potent analgesics. *Prolonged use can delay healing and increase patient's susceptibility to infections*. But in dental extraction the doses are for shorter duration, hence chances of adverse effects are very rare. [6]

The dose of the drug should be more than the cortisol released normally by the body. Due to this reason, some authors consider that 8 mg dexamethasone and 40 mg methylprednisolone were used which corresponded to 200 mg of cortisol. [6]

Dexamethasone significantly reduced the incidence of swelling as compared to methylprednisolone. This is attributed to the half-life of the drug which is more than methylprednisolone. The efficacy of dexamethasone is also due to the reason that it reduces the formation of thromboxane A2 which in turn reduces the amount of prostaglandin E2 that is formed [6]. Good results were also obtained with 32 mg methylprednisolone and 400 mg ibuprofen administered 12 h before and 12 h after surgery respectively.

Postoperative edema can also be controlled with dexamethasone administered in the submucosa [8]. Submucosal administration of 4 mg dexamethasone 1 h before surgery has been compared with that of 8 mg dexamethasone plus 2 g amoxicillin/clavulanic acid two times a day. Both dosages improved swelling versus untreated groups, but no differences were observed between the two dosage regimens.

In striking contrast with this observation, some authors reported that in patients undergoing surgery for impacted third molars, administration of 8 mg dexamethasone 1 h before surgery, followed by 750 mg paracetamol every 6 h for 4 days produced a better control of swelling compared to treatment with 4 mg dexamethasone [9]. Dexamethasone has also been administered 1 h before surgery (4 mg orally) and 12 h after surgery (4 mg IV), along with antalgic agents (30 mg ketorolac IV), when pain was present. [10] In this study, treatment with dexamethasone always produced a good control of swelling, as measured 24 and 48 h after surgery.

Elhag et al. [11] reported that administration of 10 mg dexamethasone IM, 1 hour before surgery and 10–18 h

later together with antibiotic therapy (400 mg oral metronidazole, administered pre- and post-surgically), significantly reduces swelling when compared to only postoperative treatment, without corticosteroids.

Although a significant reduction (50%) of swelling was observed 2 days after surgery in patients treated with 4 mg dexamethasone IM, no effect was present after 7 days. However, when administered 5–10 min before surgery, 4 mg dexamethasone i.v. was not effective in controlling edema when no antibiotic therapy was associated with it.

The investigated studies showed how the effectiveness of the corticosteroid administration before surgery could not be considered as a predictable therapy in order to control the postoperative swelling and edema of the surgical area. However, corticosteroids administration during the surgeries or in the postoperative period seems to give a great benefit for reducing the swelling and postoperative edema.

Different surgical strategies have been reported in the literature to reduce the postoperative discomfort after the third molar surgeries. They can be used either separately or in association with pre- or postoperative strategies. Different *kinds of flaps* have been used during extraction of impacted third molars, specifically to assess whether a marginal flap could control postoperative swelling better than a paramarginal one [12]. No significant difference in the entity of swelling was observed after using the two kinds of flaps. However, there were no significant differences between the marginal and paramarginal flaps in terms of swelling.

In contrast, Kirk et al. [13] reported significant differences, particularly for swelling and pain, during the 2nd day post-surgery between a group with a buccal flap and a group with a triangular flap modified by Szmyd [14]. In the latter case, an increased swelling was observed. Pasqualini et al. [15] have compared 100 patients treated with tight suture with 100 patients sutured after removal of 5–6 mm of mucosa distally to second molar to allow draining. Using this procedure, postoperative swelling was reduced especially on days 2 and 4, while in the group treated with tight suture, the peak of swelling was observed on day 3.

According to several authors, [16, 17, 18] tight closure favors edema formation by creating a unidirectional valve that allows fragments of food to reach the cavity, but not to leave it easily. This can be the origin of local infection, inflammation, edema and potential alveolar osteitis and pain for difficult draining. [19]

According to other authors different factors such as edema, pain and trismus that follow extraction of impacted third molars can be related to suture technique and to surgery length, and the use of a draining tube can be helpful in reducing or preventing postoperative swelling. [20]. This has been confirmed in a study specifically designed to compare postoperative responses in two groups, one treated with suture and the other with draining. In the latter, a clear reduction in edema formation was observed. Rakprasitkul and Pairuchvej [21] obtained similar results. They reported reduced swelling with suture in the presence of a draining tube when compared to the primary suture.

In a different study, the effect of draining has been compared with methylprednisone treatment. [22] Although no significant differences were reported, pharmacological treatment reduced swelling and was better tolerated by patients. It is then reasonable to conclude that most authors prefer secondary healing and/or draining rather than primary closure.

Different surgical procedures have also been related to postoperative swelling. Osteotomy through *piezosurgery* has given positive results on tumefaction compared to traditional techniques. However, often, the studies analyzed did not involve extraction of impacted third molars, but general osteotomy of the jaws. [23, 24, 25]

Therapeutic effects of ice applied on a surgery wound are due to changes of hematic flow and consequent vasoconstriction and reduced metabolism. In surgery and orthopedics, in fact, the main function of ice on the treated area is to produce vasoconstriction and to control bleeding, resulting in reduced metabolism and control of bacterial growth. [26] The application of ice does not have to be too long as this may be responsible for tissue death due to prolonged vasoconstriction, ischemia and capillary thrombosis and lymph stasis.

It is interesting to note that low laser dosage (4 J cm2), applied soon after surgery, produces a good control of swelling, especially in patients treated with 4 mg dexamethasone IM [27]

The first physiological response of tissues to cryotherapy is reduction of local temperature that causes reduced cellular metabolism. In this way, cells consume less oxygen and resist longer to ischemia. [28] In the treatment of impacted third molars, the use of ice shows a good efficacy in reducing post-surgery swelling and pain. In the postoperative period, the use of ice pack is largely recognized to provide good results and it helps the patient to cooperate with pharmacological treatments and/or intraoperative strategies in the prevention of edema. All pharmacological therapies used post-surgery are valid although they differ in the compounds used and their ways of administration. [29]

Trismus

Trismus is a normal and expected outcome following third molar surgery.

Trismus is evaluated by the distance between the upper and lower right central incisors at the maximum mouth opening; a modification of this method calculates the quotient between preoperative and postoperative distance. Other authors simply consider two possible alternatives: presence or absence of trismus, taking into account a difference of 5mm. There is a reliable and valid patients' self assessment of mouth opening using a cardboard scale [9]

Like edema, jaw stiffness usually reaches its peak on the second day and resolves by the end of the first week. [2]

There is a strong correlation between postoperative pain and trismus, indicating that pain may be one of the principal reasons for the limitation of opening after the removal of impacted third molars. [2]

In comparing trismus with gender, age, position of the tooth, classification of the tooth, retention, angle, systemic conditions, bad habits, use of oral contraceptives and menstruation period, statistically significant differences were

observed between trismus and partial bony impaction of tooth. The absence of trismus after the extraction of partial bony impacted tooth was 49.6%, presence of edema was 62.5%, while these means were 0% and 37.2% for trismus after the extraction of mucosal impacted teeth and 13.3% and 37.5% for trismus after the extraction of complete bony impacted teeth. [5]

Patients who are administered steroids for the control of edema also tend to have less trismus.[2] Dexamethasone caused less trismus compared to methylprednisolon. [6]

Pain

Another postsurgical morbidity expected after third molar surgery is pain. The post surgical pain begins when the effects of the local anesthesia subsides and reaches peak levels in 6 to 12 hours postoperatively. 37.7% patients reported mild pain on the third post-operative day and 43.4% patients had no pain on the seventh post operative day. [7]

A large variety of analgesics are available for management of post surgical pain. The most common ones are combinations of analgetics (Metamizol), Paracetamol and nonsteroidal anti inflammatory analgesics. Analgesics should be given before the effect of the local anesthesia subsides. In this manner, the pain is usually easier to control, requires less drug, and may require a less potent analgesic. The administration of nonsteroidal analgesics before surgery may be beneficial in aiding in the control of postoperative pain. [2]

Women may be more sensitive to postoperative pain than men; thus, they require more analgesics. [2]

Swelling, pain and trismus are considered as transient complications and are expected with surgery. Although transitory, these conditions can be a source of anxiety for the patient.[7]

Infection

An uncommon post surgical complication related to the removal of impacted third molars is infection.

The postoperative infection rate reported in the literature varies between 1.5% and 5.8%,or between 0.9% and 4.3% depending on the articles consulted. [3]

Infection after removal of mandibular third molars is not so common complication. About 50% of infections are localized subperiosteal abscess-type infections, which occur 2 to 4 weeks after a previously uneventful postoperative course. These are usually attributed to debris that is left under the mucoperiosteal flap and are easily treated by surgical debridement and drainage. Of the remaining 50%, few postoperative infections are significant enough to warrant surgery, antibiotics, and hospitalization. [2]

Antibiotic prophylaxis reduces the risk of experiencing infection, alveolar osteitis and pain after third-molar extractions in healthy adults, but it also results in an increased risk of mild, transient adverse effects. Given the low risk of infection after tooth extraction in healthy young adults, substantial increased risk of experiencing adverse effects, the potential development of resistant bacteria due to antibiotic use and the management of infection if it occurs, some authors did not support routine prescription of antibiotic prophylaxis for healthy people undergoing extraction of third molars. [30]

The antibiotic prophylaxis is the most controversial factor among the others, and some studies highlight that its use is necessary only when there is exposure of the vascular nerve bundle of the mandibular canal, increasing the chances of infection in up to seven times. [1]

Antibiotic therapy to treat established infection or as prophylactic strategy to prevent distance site infection or to control postoperative discomfort in third molar surgery is today a broadly accepted indication with documented efficacy. [8].

According to the literature review, the use of the antibiotics before surgery could be considered a predictable procedure to avoid and control the possible infection related to the surgery. If infection and inflammation are present in the surgical area, an antibiotic therapy seems to give a better clinical compliance of the tissues undergoing surgery. The antibiotic administration before, during and after surgery seems to be a better therapeutic choice for controlling the infection arising in the postoperative period [29]

Factors such as the patient's age, osteotomy techniques and/or tooth section, delay in repairing the socket, previous local inflammation, surgeons with little experience, and lack of antibiotic prophylaxis are considered to predispose the infection. [1]

Alveolar Osteitis (AO) [dry socket]

The sequence of normal healing after extraction does not always occur. In some instances, early clot formation in the socket is followed by premature clot necrosis or loss, accompanied by pain and a fetor oris. [31]

The alveolar osteitis (dry socket, alveolitis sicca dolorosa, localized alveolar osteitis, fibrinolytic alveololitis is a disturbance in healing that occurs after the formation of a mature blood clot but before the blood clot is replaced with granulation tissue. [31] The primary etiology appears to be one of excess fibrinolysis, with bacteria playing an important but yet ill-defined role. This fibrinolysis occurs during the third and fourth days and results in symptoms of pain and malodor after the third day or so following extraction. The source of the fibrinolytic agents may be tissue, saliva, or bacteria. [2]

The reported incidence of alveolitis varies widely, from as low as 0.5% to as high as 68.4%, but most studies indicate a rate between 5% and 10%. Diagnostic criteria, which vary from author to author, might partly explain this variation. [3] The alveolar osteitis or dry socket is characterized by an intense and throbbing pain that cannot be controlled by common pain killers, starting between the second and fifth days after the surgery, with unpleasant smell and without incorrupt tissue in the interior of the socket. [1]

Some researchers classified alveolitis as being alveolar tissue necrosis with exposed bone, with a prolongation of pain between 5 and 7 days, of a neuralgic character, intense or severe. Other authors offer a more descriptive definition: the presence of a gray necrotic clot relative to a bare area of the socket, along with great stench and pain in the zone. A further diagnostic criteria was pain and discomfort,

if medication does not alleviate the pain, and if exposed bone or necrotic debris is showing in the alveolus. [32]

As possible risk factors, we can include untimely surgical maneuvers, surgery difficulty level, surgeon's experience, tooth position in the arch, smoking, patient's age, being a female, use of oral contraceptive and corticoids, use of local anesthetics with vasoconstrictor, and intrinsic factors such as coagulopathy among others.[1]

The incidence of postoperative alveolitis in association with oral contraceptive (OC) use has been investigated by many authors, with conflicting results. Some studies have demonstrated an increased rate of alveolitis among women taking OC but others did not. This discrepancy can be explained by the lower estrogen concentration in the new generations of OC. [3]

Cohen et al. suggest, on a literature review of the most relevant articles, that there are not enough data to consider oral contraceptive as an important risk factor to dry socket in elective surgeries to extract third molars. Not enough evidence was found to affirm that the menstrual cycle influences the development of dry socket. On the other hand some authors affirm that women who use oral contraceptive medicine have five times more chances of developing dry socket than men. [1] Other considerations that must be pointed out regarding dry socket is the patient's age, which might hinder the repairing process and healing of older patients and worsen the bone tissue quality. [1] The incidence of dry socket seems to be higher in patients who smoke. [2]

The occurrence of dry socket can be reduced by several techniques, most of which are aimed at reducing the bacterial contamination of the surgical site. Presurgical irrigation with antimicrobial agents such as chlorhexidine reduces the incidence of dry socket by up to 50%. Copious irrigation of the surgical site with large volumes of saline is also effective in reducing dry socket. Topical placement of small amounts of antibiotics such as tetracycline or lincomycin may also decrease the incidence of alveolar osteitis. [2] Maintenance of the coagulum inside the socket by using appropriate suture techniques may also help in the prevention of this complication. [1] To the subject of clot stabilization and healing, one should consider the use of resorbable substances such as gelatin sponge, polylactic acid, and methylcellulose as clotstabilizing socket implants. The record of such substances in preventing AO is mixed,but the combinations of these inexpensive materials with topical socket medicaments may yield a decreased tendency for clot lysis and greater mechanical strength to the bulk blood clot. [31]

The goal of treatment of dry socket is to relieve the patient's pain during the delayed healing process. This is usually accomplished by irrigation of the involved socket, gentle mechanical débridement, and placement of an obtundent dressing, which usually contains eugenol. The dressing may need to be changed on a daily basis for several days and then less frequently after that. The pain syndrome usually resolves within 3 to 5 days, although it may take as long as 10 to 14 days in some patients. There is some evidence that topical antibiotics such as metronidazole may hasten resolution of the dry socket.[2]

Nerve Disturbances

Neurological damage of the lingual or inferior alveolar nerve (IAN) is one of the least desired complications of third molar surgery. The incidence of IAN and lingual nerve injuries reported, ranges from 0.4% to 22% and most of these injuries undergo spontaneous recovery. [4, 7]

Neurosensory deficit after lower third molar surgery occurs at prevalences of 0.1% to 22% for lingual nerve (LN) deficit and 0.26% to 8.4% for inferior alveolar nerve (IAN) deficit. Sensory deficits may present as anesthesia, hypoesthesia, hyperesthesia, or dysesthesia in the distributions of the LN or IAN, with or without taste disturbance, if the LN is also affected. Within 4 - 8 weeks after surgery, 96% of inferior alveolar nerve (IAN) injuries recover [33], and the recovery rates are not influenced by gender and only slightly by age [34]. Some injuries may be permanent, lasting longer than 6 months, and with varying outcomes ranging from mild hypoesthesia to complete anaesthesia and neuropathic responses resulting in chronic pain. The results showed that after 6 months, recovery seemed to be slight, and confirmed that permanent IAN dysfunction is more frequent after M3 removal in patients older than 30 years.

One third of neurosensory deficits after third molar surgery can be permanent. Although some patients can cope well with mild to moderate hypoesthesia of the affected area, those who are severely affected often request treatment for the condition. The quality of life of patients with anesthesia, severe hypoesthesia, hyperesthesia, dysesthesia, or taste disturbance of the affected area can be significantly impaired. Different treatments have been reported in the literature, yet their efficacies seemed to be variable. [35]

The lingual nerve is most often injured during soft tissue flap reflection, whereas the inferior alveolar nerve is injured when the roots of the teeth are manipulated and elevated from the socket. [2]

There are various neurosensory tests used to evaluate objectively the severity of nerve injury and monitor recovery of the sensation. [35]

Risk factors as regards to damage to IAN are the depth of impaction and dental proximity to alveolar canal.[4] Accordingly, Blondeau and Daniel [3] recommended that prophylactic M3 extraction should be avoided in patients aged 24 years or older because of a high possibility of complications such as permanent neurosensory deficits, infection, and alveolar osteitis.

The risk factors associated with permanent neurosensory deficit are Pell and Gregory IC or IIC classification of impaction, age greater than 24 years, and in females. [3]

When an injury to the lingual or inferior alveolar nerve is diagnosed in the postoperative period, the surgeon should begin long-term planning for its management including consideration of referral to a neurologist and/or microneurosurgeon. [2]

The available treatment modalities for an LN and IAN injury after third molar surgery seem to have unpredictable clinical outcomes and rarely produce complete recovery. What is more, there is insufficient information to indicate the best timing for the treatment of nerve injury after third molar surgery. It has been shown that a significant portion

of the neurosensory deficit of an LN or IAN after third molar surgery can recover spontaneously. Therefore, LN or IAN injuries tend to be treated in a delayed fashion, depending on the recovery pattern and the extent of disturbance on a patient's social life. It was suggested Wallerian degeneration and a smaller Schwann cell population adjacent to the site of nerve injury can significantly affect the long-term outcome of delayed nerve repair. [35]

Surgery (external neurolysis, direct suturing, autogenous vein graft bridging nerve defect, gore-tex tubing,bridging nerve defect) remained the mainstream of treatment of a neurosensory deficit after third molar surgery. Most subjects who underwent surgical treatment had LN injuries. This can be explained by the fact that the tongue is a very sensitive organ and any taste disturbance with an LN injury might contribute to a higher demand for nerve repair after an LN injury. Several reports suggested a higher chance of spontaneous reinnervation and recovery of the nerve within the inferior alveolar canal. Full recovery of sensation after surgical treatment of the IAN or LN injury is uncommon. Fewer than 30% of patients were reported to have achieved "complete recovery" after external neurolysis of the injured nerve. [35]

Nonsurgical alternatives for treatment of neurosensory deficit are vit. B complex, laser therapy (LLLT), corticosteroids, electrophoresis with nivalin, acupuncture. It was believed LLLT could decrease scar formation and increase collagen formation and healing, which are favorable features in nerve regeneration. [35] Scarring at a site of nerve repair is thought to impede the regeneration of damaged nerve fibers. Our recent studies have shown that anti-scarring agents (such as antibodies to TGFâ1 and 2) can be used to reduce this problem, and hopefully will result in enhanced regeneration. [36]

Temporomandibular disorders (TMDs)

Temporomandibular disorders (TMDs) is the term used to refer to dysfunctions characterized by pain in the region of the temporomandibular joints and periauricular area, limitations and deviations in the mandibular movements, joint noises and an altered occlusal relation (Dworkin et al, 1990). [37]

The etiology of TMD is multifactorial. When all risk factors for TMDs are considered individually, the two most prevalent factors identified on this population were tooth clenching (77% of the patients) and self-reported stress (59.3%) followed by antecedents of extraction of wisdom teeth (34.3%), endotracheal intubation (30.7%), biting habits (29.3%), gum chewing (28%), and previous orthodontic treatment (28%) [38]

Third molar removal has been implicated as a precipitating event for temporomandibular joint disorders. [39, 37] That is the reason why Deangelis highlights the importance of including an assessment of the temporomandibular apparatus in the pre-operative evaluation of patients with impacted third molars. [39]

The traumatic removal of the mandibular third molar may promote post surgical consequences such as orofacial pain and limited mandibular movements. [37]

Another study demonstrated that when compared with untreated controls, subjects undergoing third molar surgery have a statistically insignificant increased incidence of TMDs 6 months post-operatively. [40]

Treatment of TMD may involve anterior splints occlusal splints, splints with posterior occlusal support, occlusal adjustment, removable therapeutic partial prostheses, although therapeutic support regimens in the areas of psychology, NAID(local and per oral), and physical therapy(exercises) and phisioterapy may be associated depending on the needs of each patient. [37]

Rare complications include *oro-antral fistulas* (0.008–0.25%), *maxillary tuberosity fractures* (0.6%) and *mandibular fractures* (0.0049%) [41]

Maxillary tuberosity fracture and oro-antral communication

Upper third molar lies just in front and within the maxillary tuberosity. [42]

Maxillary tuberosity fracture is one of the major complications of maxillary third molar extraction. [42]

The incidence of tuberosity fracture during upper molar extraction is relatively low. [43] Bertram and al. reported this incidence to be around 0.6%. [44]

Large fractures of the maxillary tuberosity should be viewed as a grave complication.[42]

The fracture of a large portion of bone in the maxillary tuberosity area can result in torrential, life-threatening hemorrhage due to close proximity of significant vessels to the area. [42, 44]

Fracture and loss of the maxillary tuberosity not only risks exposure and tearing of the maxillary sinus lining but also changes the shape of the alveolus such that subsequent prosthodontic management may be difficult. [45]

There is a reported case of subconjunctival hemorrhage after tuberosity fracture. [42]

Cattlin reported that, after maxillary tuberosity fracture, deafness occurred from the disruption of the pterygoid hamulus and the tensor veli palatine, in turn collapsing the opening of the eustachian tube. The patient also suffered permanent restricted mandibular movements because of the disruption of the pterygoid muscles and ligaments. [43]

The etiological factors listed in the literature that are responsible for a fractured maxillary tuberosity during upper molar extraction include the following: *large maxillary sinus with thin walls/sinus extension into the maxillary tuberosity and/or large projection lengths of root apices in the sinus cavity; unerupted maxillary third molar; fusion between the maxillary third and second molar; teeth with large divergent roots; teeth with an abnormal number of roots; teeth with prominent or curved roots; teeth with dental anomalies, such as tooth fusion and over-eruption;tooth ankylosis;hypercementosis of upper molar teeth; chronic periapical infection; excessive force during the tooth luxation accomplished by the dentist and others.* [43]

Upon discovering that a maxillary tuberosity has fractured, the dentist must first halt the procedure before inadvertent laceration of the adjoining soft tissue occurs and then

determine the extent of the fracture by palpating the mobile fragment. After performing the dissection of the soft tissues, immediate removal of the small fractures, including the tooth with small bony fragments, may be the best option, because of the difficulty incurred when attempting to retain the bone.When a large bony fragment is present, it is recommended (i) that the extraction be abandoned and surgical removal of the tooth be performed using root sectioning, (ii) that the dentist tries to detach the fractured tuberosity from the roots, or (iii) that the dentist stabilizes the mobile part(s) of the bone by means of a rigid fixation technique for 4–6 weeks and, at a future moment, attempts a surgical removal without the use of a forceps. [43]

Oroantral communication is the consequence of a loss of continuity between the maxillary sinus and the oral cavity. Sinus floor perforation occurs due to the close anatomical relationship between this structure and the distal teeth. [46]

Oroantral communications (OAC) are common surgical complications of dental procedures. An oroantral fistula is a pathological condition in which the oral and antral cavities have a permanent communication by means of a fibrous conjunctive tissue fistula coated by epithelium. [47]

Intraoperative fracture of the root, higher degree of impaction and higher age of the patient are associated with a greater likelihood of oroantral perforation. [48]

A study of 465 extractions and 592 osteotomies of the upper third molars revealed that 13% were related directly to the diagnosis of a perforated maxillary sinus. Acute oroantral communication occurred as a result of the removal of completely impacted teeth in 24%, by removal of partially impacted teeth in 10% and in fully erupted third molars in 5% of all cases. These differences are significant. In 83%, the diameter of the oroantral perforation was less than 3 mm. In 19% of all sinus openings, a buccal sliding flap was used to close the extraction wound.[48]

OACs 2 mm in diameter or smaller are likely to close spontaneously, without the need for surgical intervention. [47] If the exposure of lining is at the apex of a deep socket with stable bone walls, and the coagulum is not displaced or breaks down, then it may not be necessary to make arrangements for complete soft tissue closure but to simply inform the patient, give advice on post-operative care and review as necessary. [45]

It has been recognised for many years that some small oroantral communications will heal without the formation of a fistula or chronic sinusitis. However, this will depend upon many factors including the health of the patient and their oral soft tissues, the presence or absence of preexisting infection, the dimensions of the tooth socket and the postoperative care provided by the patient. [45]

OACs 3 mm in diameter or larger, or OACs associated with maxillary or periodontal inflammation, may persist , and surgical closure is recommended. Several techniques have been used for OAC resolution, such as the use of mucoperiosteal flaps (vestibular, palatine, lingual or combined), bone grafts, or buccal fat pad grafts (Bichat ball). [47] Grafting of the pedicled buccal fat pad is thought to be an efficient, safe and easy alternative to a larger oroantral fistula closure. Pedicled buccal fat pad grafting could corrected the defect without generating any sequelae and/or great postoperative discomfort to the patient.[47]

Mandibular fractures

Mandibular fractures are a rare but severe complication of third molar removal. [49]

Reports of mandibular fracture during and after third molar removal are uncommon. [50]

The incidence is reported to range from 0.0046% to 0.0075%. It may occure, either operatively, as an immediate complication during surgery or postoperatively as a late complication, usually within the first 4 weeks post surgery. [51]

Its occurrence is likely to be multifactorial including: age, gender, angulation, laterality, extent and degree of impaction, relative volume of the tooth in the jaw, preexisting infection and associated pathologies (bone lesions) contributing to the risk of fracture. [49, 51] Other important factors are the anatomy of the teeth and the features of the teeth roots. [52]

Weakening of the mandible as a result of decrease in its bone elasticity during aging may be the cause of the higher incidence of fractures reported among patients over 40 years of age at the time of surgery. [51] De Silva reported that fractures predominantly occur in patients who are older than 25 years. [52]

Men may be more likely to have late fractures [53]. The effect of gender may be related to biting force. Males usually show higher levels of biting force as compared to females. [51]

Patients having full dentition are able to produce peak levels of biting forces, that are transmitted to the weak mandible during mastication and consequently the risk of fracture is high, regardless of gender. [51]

The literature indicates that the risk of pathological (late) fracture of the mandibular angle after third molar surgery for total inclusions (class II-III, type C) is twice that of partial inclusions due to the necessity of ostectomies more generous than those for partial inclusions. [52]

The true incidence of postoperative mandibular fractures as a result of the extraction is difficult to establish, as there are reports on postoperative traumatic mandibular fractures that could have happened with an intact mandible, and the occurrence of the two conditions may be just a coincidence. [51]

Postoperative fractures were more common than intraoperative fractures (2.7:1) and occurred most frequently in the second and third weeks (57%). [49] Other studies show that 67.8% of fracture cases happened in the second and third week post surgery. [52] A ‘cracking’ noise was the most frequent presentation (77%). [49] Such cracking noise reported by the patient should alert to a possible fracture, even if initially the fracture is radiologically undetectable. [51]

Intraoperative fractures were more frequent among females (M:F - 1:1.3) [49]

Pathological mandibular fractures were typically located anterior to the mandibular angle. [54] Wagner et al. noticed a significant prevalence of fractures on the left side

of the patient (70%) over the right side. This was explained by better visualization and control of the applied force by the surgeon on the right side of the patient as compared to the left side.[51] The danger of an immediate jaw fracture can be avoided by means of proper instrumentation and by refraining from excessive force on the bone. The tooth should be sectioned in such a way as to minimize the extent of bone removal and force caused by instrumentation. [50] It is more likely to occur with young or less experienced professionals. [51] The postoperative or late fractures usually occur during the second or third postoperative week, and are probably as a result of high level of biting forces during mastication, when the patient was feeling better. [51]

This is why it is extremely important to always provide adequate instructions to the patient in order to avoid early masticatory loads and prevent this complication. [52] In selective cases, it is recommended that the patient follow a soft diet for up to 4 weeks after the operation. [54]

CONCLUSION

Although clinical conditions associated with retained third molars are well understood, little is known about the impact of those conditions on the quality of life among affected patients. There is growing recognition that the impact of oral conditions on quality of life is an important outcome that can be quite useful in making treatment decisions. All the information in this review could be useful for the clinicians in order to show all the surgical and pharmacologic parameters that may influence the postoperative discomfort in the third molar surgeries.

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