INTRAMUSCULAR VERSUS SUBMUCOSAL DEXAMETHASONE INJECTION IN SURGICAL EXTRACTION OF IMPACTED MANDIBULAR THIRD MOLARS: A NARRATIVE REVIEW

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Abstract

The aim of this narrative review is to compare the results of different studies concerning the intramuscular route versus the submucosal route for injection of dexamethasone in cases of surgical extraction of mandibular impacted third molars. The advantages and disadvantages of the different techniques will be reported. Studies discussed in this paper revealed that the submucosal route featured so many benefits over the intramuscular one by being simple, comfortable, highly bioavailable, painless, less risky and able to reduce trismus.

Keywords: Corticosteroids – dexamethasone – submucosal – intramuscular - third molar surgery.

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INJECTION INTRAMUSCULAIRE VERSUS SOUS-MUQUEUSE DE DEXAMETHASONE DANS L'EXTRACTION CHIRURGICALE DE TROISIEMES MOLAIRES MANDIBULAIRES INCLUSES: REVUE NARRATIVE

Résumé

L'objectif de cette revue narrative est de comparer les résultats de différentes études concernant la l'injection intramusculaire par rapport à l'injection sous-muqueuse pour l'administration de dexaméthasone dans les cas d'extraction chirurgicale de troisièmes molaires incluses. Les avantages et les inconvénients des différentes techniques ont été décrites. Les études présentées dans cet article ont révélé que la voie sous-muqueuse présentait de nombreux avantages par rapport à la voie intramusculaire; elle est simple, confortable, hautement biodisponible, non douloureuse, moins risquée et capable de réduire le trismus.

Mots-clés: corticostéroïdes - dexaméthasone – injection sous-muqueuse - intramusculaire - troisième molaire.

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Introduction

Surgical extraction of an impacted wisdom tooth may lead to several challenges one of which include postoperative complications and morbidity characterized mainly by pain and swelling.

When removing an impacted wisdom tooth, some traumatic procedures are necessary including flap, the removal of bone (guttering), sectioning of the tooth; all of which may result in considerable amount of pain, swelling, edema and trismus since the region of surgery is mostly composed of loose connective tissue that contains blood and lymph vessels [1].

These complications can be controlled by managing the inflammatory process associated with the surgical procedure through different methods. The use of corticosteroids injection is considered as one of these methods because they are anti-inflammatory agents [2].

Corticosteroids are a class of chemicals that includes two types; either natural steroid hormones that are produced in the adrenal cortex of vertebrates or the synthetic analogues of these hormones. The corticosteroids are classified according to their duration of action. The short-acting glucocorticoids include cortisol (hydrocortisone) and cortisone, with duration of action less than 12 hours and anti-inflammatory potency of 1 day. Intermediate acting glucocorticoids have duration of action of 12–36 hours. They include prednisone and prednisolone with anti-inflammatory potency of 4, and 6-methylprednisolone and triamcinolone, both having anti-inflammatory potency of 5. Dexamethasone and betamethasone are long-acting glucocorticoids, with duration of action greater than 36 h and anti-inflammatory potency of 25h [3].

Mechanism of action

These agents act by inhibiting the body's inflammatory response to injury through various mechanisms, with a reduction of fluid transudation and therefore edema. They inhibit both the cyclo-oxygenase pathways chemotaxis by starting the production of lipocortin 1, which inhibits phospholipase A. All this cycle leads to a decrease in the synthesis of prostaglandins and leukotrines. These corticosteroids suppress the immune system by reducing the immunoglobulin and complement concentrations and affecting the antigen- antibody binding [1].

Dexamethasone

Since a considerable time, dexamethasone (Fig. 1) has been used widely in the sector of oral and maxillofacial surgery to decrease post-operative surgical morbidity for having the least adverse effects on leukocyte chemotaxis [4, 5]. Furthermore, dexamethasone is one of the most potent anti-inflammatory drugs and for this reason it has been used following minor oral surgery [6].

The normal hormonal effects associated with prolonged steroid therapy are essentially absent with a single injection. If undesirable hormonal effects do occur, they are reversible and disappear when the steroid is discontinued [7].

Dexamethasone is contraindicated in the conditions of diabetes mellitus, peptic ulcers, active or healed tuberculosis, hypertension, ocular herpes, glaucoma, acute and chronic infections, osteoporosis, Cushing's syndrome, and renal insufficiency. Furthermore, the use of dexamethasone is contraindicated in case of pregnancy.

Different methods exist for the administration of dexamethasone. One of these is the intramuscular injection method. Other methods include the submucosal injection methods [10].

Intramuscular dexamethasone injection

Few are those studies who have objectively discussed the effect of dexamethasone given through an intramuscular injection (Fig. 2) in third molar surgery [11]. That is despite the fact that this route is the most familiar one when a steroid injection is prescribed in outpatients. Studies revealed that intramuscular route for administering dexamethasone can be effective if a single dose is given either preoperatively or postoperatively [5]. Different studies reported variable results concerning the use of this route for third molar surgery [7]; this technique's effect could be dose-dependent. Some authors suggested using dexamethasone 8–12 mg for optimum results [12, 15].

In a study by Majid et al. [11], intramuscular dexamethasone lead to significant reduction in swelling on the first and third postoperative days besides significant reduction in pain scores, but had no notable effect on trismus in comparison with the controls. This suggests the effectiveness of this route of administration to decrease postoperative swelling and pain after third molar surgery. The result of this study confirmed previous

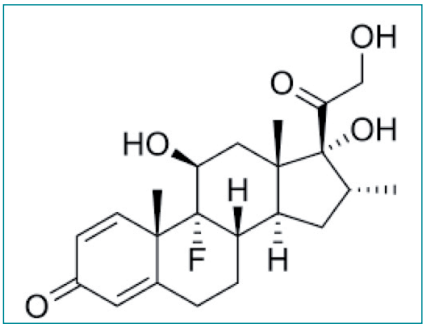

Fig. 1: Dexamethasone structure.

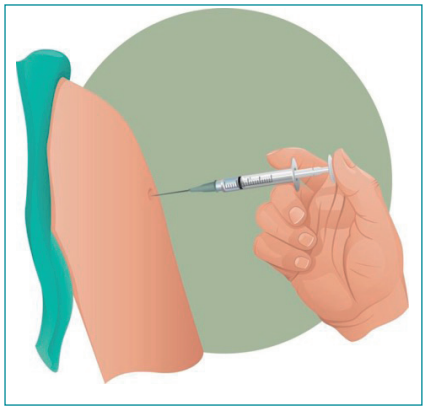
Fig. 2: Intramuscular injection of dexamethasone.

Fig. 3: Submucosal injection of dexamethasone.

study results concerning the effectiveness of this route to administer dexamethasone after wisdom tooth surgery [7, 13-15].

Furthermore, a study by Klongnoi et al. [16] revealed that a single-dose intramuscular injection of dexamethasone can decrease postoperative facial pain and swelling without having an effect on trismus following the surgical extraction of a lower impacted third molar.

Submucosal dexamethasone injection

To administer dexamethsone through the submucosal route, the needle of the syringe should be directed into the buccal vestibule close to the site of surgery (Fig. 3).

The submucosal injection is a way of administering dexamethasone orally in cases of surgical removal of impacted third molars. Many studies confirmed the efficiency of this technique to deliver this type of corticosteroid locally into the surgical site and to decrease the postoperative morbidity. Several studies will be reviewed concerning that efficiency.

A study done by Nair et al. [17] to evaluate submucosal injection of intraoperative dexamethasone (4mg) to decrease postoperative discomfort after third molar surgery resulted in a comparable or greater reduction of postoperative edema in cases where submucosal route was used instead of other routes of administration. The study suggested that the submucosal route offers a higher effective drug concentration at the surgical site without loss due to distribution to other compartments as in intramuscular injection. Furthermore, the submucosal route is considered convenient for both the surgeon and the patient.

Another study by Ehsan et al. [18] affirmed that the submucosal route for injection of dexamethasone is considered a reliable technique for reducing postoperative swelling and trismus following third molar surgeries.

A third study by Moraschini et al. [19] suggested that the submucosal injection of dexamethasone presents a reduction in the postoperative symptoms and signs resulting from surgical extraction of impacted third molars, mainly those associated with edema and pain.

Warraich et al. [20] concluded in their study about submucosal dexamethasone injection in relation to postoperative discomfort following third molar surgery that patients receiving dexamethasone showed a significant reduction in pain, swelling, trismus, a tendency to less neurological complaints and improved quality of life.

A systematic review and meta-analysis done by Chen et al. [21] discussed the effect of submucosal injection of dexamethasone on edema, trismus, and pain during early and late postoperative periods after surgical extraction of third molars. The study suggested that submucosal injection of dexamethasone successfully reduced not only early and late edema but also early trismus in experimental compared with control participants after wisdom teeth extraction, which makes it a good choice for dental clinical use.

An additional study by Grossi et al. [22] was concerned about the effectiveness of submucosal injection of dexamethasone after third molar surgery, besides comparing the efficacy of 4 mg versus 8mg dose of this corticosteroid. Results suggested that the use of dexamethasone 4 mg, given as an intraoral injection (submucosal) at the time of surgery, is effective in the prevention of postoperative edema. Increasing the dose to 8 mg provides no further benefit.

Submucosal dexamethasone versus intramuscular dexamethasone

Many studies were concerned about comparing submucosal route and intramuscular route for injecting dexamethasone. Comparable results obtained reveal that submucosal dexamethasone is a powerful alternative to dexamethasone that is given systemically (intramuscular) [11]. The intramuscular route is characterized by patient's discomfort and the need for specific tools to give the drug; these factors may limit the use of the intramuscular route [23].

Submucosal injection of dexamethasone 4 mg was found to be an effective therapeutic strategy for boosting the quality of life after surgical removal of impacted lower third molars with a similar effect on postoperative morbidity in comparison to intramuscular injection [11].

Furthermore, the rate of absorption is highly dependent on the blood flow to the site [24]. This suggests that a higher absorption and effect of dexamethasone can take place if it is given locally (submucosal). Moreover, injecting submucosal dexamethasone is considered a quite simple procedure, conservative (low invasiveness), suitable for the surgeon and the patient, and offers a low priced solution for the typical discomfort associated with the extraction of impacted lower third molars [11]. Dexamethasone given through submucosal injection has the advantage of being concentrated at the surgical area and thus has less systemic absorption and no further manipulation of the tissues.

Concerning this comparison between the two routes of administration, another study was carried by Sabhlok et al. [25].This study revealed that the oral route is considered superior in comparison to the intramuscular route when administering dexamethasone in cases of surgical removal of mandibular third molars,

Route of injection	Site	Efficiency	Pain	Dose required	Trismus relieving	Technique	Timing
Intramuscular route	Extraoral (systemic)	Effective to a certain extent	Painful	8mg	No	Traumatic and not comfortable for the patient	Postoperative
Submucosal route	Local (intraoral) (Less systemic absorption of the drug)	-better efficacy (high drug concentration at the surgical site) -high bioavailability	Less or no pain	4mg (half dose of the intramuscular) (less systemic absorption of the drug)	Yes	Simple, less invasive, and comfortable for the dentist and the patient	Preoperative or postoperative

Table 1: Comparison between intramuscular and submucosal routes of dexamethasone injection in surgical extraction of mandibular third molars.

with respect to bio-availability, drug dosage, and resolution of trismus [25].

Discussion

All these discussed studies revealed many advantages of submucosal route for injection of dexamethasone over the intramuscular route. Both techniques are effective in reducing pain and edema into similar extents; however, the submucosal technique is considered more reliable. The submucosal route is characterized by having an effective drug concentration at the surgical site and thus a better bioavailability, and as a result, a better efficacy. Besides, injecting submucosal dexamethasone is a quite simple procedure with less or no pain in comparison to the intramuscular one. In addition to that, it is more comfortable for the dentist and the patient. Moreover, this technique is given locally around the surgical site and not systemically as the intramuscular one requiring also a less drug dosage (4mg instead of 8mg), and these two features decrease the systemic absorption of the drug and reduce the risk for systemic side effects. One more important benefit of submucosal technique over the intramuscular one is its ability to relieve trismus which is considered a critical issue following the surgical extraction of mandibular impacted third molars.

Conclusion

Submucosal dexamethasone route of injection (oral) should be preferred over the intramuscular dexamethasone one (systemic) in surgical extraction of mandibular third molars since they are similarly effective in reducing pain and edema as the intramuscular one, and featuring more advantages which include being simple, comfortable, highly bioavailable, painless, less risky , and able to reduce trismus. To be effective, the required dose of submucosal dexamethasone is 4mg instead of 8mg where there is no difference in efficacy between the two doses. Additional studies concerning the timing of injection (preoperative, intraoperative, or postoperative) must be carried to figure out the proper timing of dexamethasone injection for best medical benefits.

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