Review Article

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Use of Corticosteroids in Third Molar Surgery: Review of Literature

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ABSTRACT

Background: Surgical removal of impacted tooth is one of the common proceduresdone by oral and maxillofacial surgeons in their day to day practice. Surgical removal of impacted tooth produces swelling, pain and trismus post operatively. Corticosteroids have been used in effectively reducing these post operative sequelae after surgical removal of impacted third molars. Various doses and types of steroids are used. Here a systematic search of literature was carried out using various doses, types and routes of administration of steroids in mandibular third molar impaction as key words. Only most relevant articles were included (n= 24). Administration of corticosteroids improves the postoperative experience of patients and has a significant impact on trismus and inflammation. Dosage of steroids should be more than the physiological amount produced in body. The duration of action of the steroid administered also affects the results. Long acting steroids give better results than short acting one. If short acting steroids are given they have to be supplemented for a minimum of 2 days to a maximum of 5 days. Preoperative administration of steroids is found to be more effective than post operative administration. Submucosal administration of steroids produces similar effects to IV and IM routes.

Keywords: Steroid, Third Molar Impacted Tooth, Route of Administration of Steroids, chymotrypsin.

INTRODUCTION

Surgical removal of impacted teeth is one of the most common procedures performed by oral and maxillofacial surgeons in day to day practice. It involves intentional trauma to the bone and soft tissues which leads to inflammatory reaction. Patient may have pain, swelling, and trismus post operatively. Reduction of these post operative sequelae seems to be a logical goal. When there is tissue injury leading to inflammation, there is conversion of phospholipids to arachidonic acid under the influence of phospholipase A2 and forms prostaglandins, leukotrienes or thromboxane related substances which are mediators of inflammation. Drugs which can prevent the formation of these mediators of inflammation can reduce the symptoms of inflammation. Corticosteroids fall under the category of these drugs and they are used widely nowadays to reduce the post operative sequalae following impaction surgeries. Here we discuss the pharmacological actions and benefits of using steroid drugs pre and post operativelyin third molar impaction surgeries, their modes of administration,and comparison with other drugs used to reduce the post operative sequalae following third molar removal.

Corticosteroids

Corticosteroids (CS) belong to an important class of naturally occurring and synthetic steroid hormones that affect almost all systems of the body. Corticosteroids are produced in the adrenal cortex.

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Their secretion is regulated by adrenocorticotrophic hormone (ACTH), produced in anterior pituitary and released in secretory bursts throughout day and night. ACTH production is in turn driven by corticotrophin releasing hormone (CRH) released from the hypothalamus. Corticosteroid therapy affects endogenous corticosteroid production and has a suppressive effect on hypothalamo-pituitary adrenal(HPA) axis.[1]

Mechanism of action

Inflammatory reaction is the response of the body to tissue damage. It involves leakage of plasma like fluid out of capillaries into damaged area, migration of polymorphonuclear leucocytes into the area followed by healing by fibrous scar tissue formation. Normal or physiological amounts of glucocorticoids do not affect inflammation and healing. Increased number of glucocorticoids inhibit the inflammatory processes. More specifically, corticosteroids stabilize lysosomal membranes and thereby prevent the release of inflammatory proteolytic enzymes. It decreases capillary permeability and thereby increase leakage of fluid and proteins into damaged tissue. It decreases the accumulation of neutrophils and macrophages at the site of inflammation and thereby impair phagocytosis of pathogenic microorganisms. The most important action is the reduction in production of inflammatory mediators, such as interleukin- 1, prostaglandins, and leukotrienes, by injured cells by inhibiting the release of arachidonic acid from phospholipids. It reduces Immune response of the body. The immune system normally protects the body from foreign invaders, and several immune responses overlap inflammatory responses, including phagocytosis. In addition, the immune response stimulates the production of antibodies and activated lymphocytes to destroy the foreign substances. [1](Fig No 1)

Steroids in third molar impaction surgeries

In a 1969 study by Hooley and Francis,26 patients who received prophylactic oral betamethasone immediately before surgery experienced much less edema,50% less pain and used 50% less analgesics after surgery than the control group.[2]In 1975, Messer and keller conducted study in 500 patients by using 4 mg of intramuscular dexamethasoneimmediately after third molar impaction surgery and found that dexamethasone reduced swelling, trimus and pain post operatively.[3]Huffman reported a statistically significant decrease in early edema in patients who were given 125 mg of intravenous methylprednisolone immediately before third molar surgery, but they noted no difference after 1 week.[4] They also conducted study using 40mg Methylprednisolone given immediate preoperatively. It produced reduction in swelling, pain and trismus following surgical mandibular 3rd molar removal.

Hargreaves and Costello found that there is 62% decrease in immunoreactive bradykinin release 3 hours after surgery by using 125 mg of methylprednisolone.[5] Skejelbred and lokken conducted study using Betamethasone. 9mg of intramuscular betamethasone was given 3 hours post operatively. Their data showed a 55% reduction of swelling on the third postoperative day and a 69% reduction on the sixth postoperative day in 23 of 24 patients in the steroid group.[6]

El Hag et al(1985) conducted study by injecting in10 mg Dexamethasone IM 1 hour preoperatively and another 10 mg 10-18 hours postoperatively. Administration of Dexamethosone produced significant reduction in swelling and trismus following mandibular 3rd molar extractions. It was found that it does not reduce pain.[7]Pederson conducted study using 4mg dexamethasone injected IM preoperatively and showed that there is 50%decrease in swelling on the second postoperative day but noted no significant differences on the seventh day after surgery.[8] By using a single preoperative dose of 20 mg of methylprednisolone, Milles and Desjardins found there is 42% decrease in swelling on the first day after surgery, 34% less on the second day, but only 19% less on the third day after surgery.[9] Sisk and Bennington conducted study using IV 125mg Methylprednisolone used preoperatively. It produced reduction in swelling, pain and trismus following mandibular 3rd molar extraction.[10] Beirne and Hollander noted decreased edema on first day after surgery by using a single intravenous dose of 125 mg of methylprednisolone immediately before surgery, but they noticed rebound increase in edema on the second and third postoperative days.[11]

Neupert et al studied effects of 4 mg of dexamethasone on reducing postsurgical sequelae after mandibular third molar surgeryin sixty patients with bilaterally symmetrical impacted third molars.No difference in swelling was noted but pain and trismus was found to be reduced in dexamethasone group. Patients were recorded with a daily postsurgical increase in incisal opening of 4 to 6 mm over the control group during the examination period.[12] Schmelzeisen R, Frölich JC examined the effects of perioperative oral administration of 6 mg dexamethasone, given once 12 h before and once 12 h after osteotomy of two impacted molar teeth, on postoperative edema, limitation of jaw opening, and intensity of postoperative pain. Swelling was reduced by 54.3% , limitation in jaw opening reduced by 17.7% and pain was reduced by 50%. Amount of analgesics required postoperatively was reduced by 37% following dexamethasone administration.[13]

Baxendale et al evaluated the effect of a single prophylactic dose of 8 mg oral dexamethasone on post operative sequelae after mandibular third molar surgery in a randomised double-blind study of 50 adult patients. Dexamethasone resulted in a significant reduction in pain 4 h postoperatively. The incidence of severe swelling was also reduced significantly, but there was no effect on trismus.[14] Esen et al studied effect of methylprednisolone sodium succinate (MP) on the postoperative sequelae of third molar surgery in twenty patients with bilateral impacted mandibular third molars. Statistical analysis of the data indicated a significant decrease in edema, trismus, and pain in the Methylprednisolone group. Plasma cortisol levels showed a nonsignificant decrease in both the Methylprednisolone and placebo-treated groups. The ACTH stimulation test indicated normal HPA axis function before and after Methylprednisolone administration. [15]

Grossi et al in their study of 61 patients undergoing third molar impaction surgery indicated that use of dexamethasone 4 mg, given as an intraoral injection at the time ofsurgery, is effective in the reducing postoperative edema. Increasing the dose to 8 mg provided nofurther benefit.[16]Jose Rodrigues et al studied effect of two different concentrations (4mg and 8 mg) of dexamethasone to decrease the swelling and trismus after the surgical extraction of mandibular impacted third molars in thirty patients with bilateral impacted lower third molars. Results showed significant difference in the measurements of the degree of swelling and trismus of the treated sample. 8 mg of dexamethasone promoted a greater reduction of symptoms than 4mg of dexamethasone .[17] Klongnoi et al. conducted study toinvestigate the effects of dexamethasone intramuscular injection 1 h preoperatively, in reducing facial swelling, pain and trismus aftermandibular impacted third molar surgery.Preoperative intramuscular injection of single-dose 8 mgdexamethasone significantly reduced postoperative swelling after mandibular impacted third molar surgical extractions on the second postoperative day, but no significant difference was found immediately after surgery and onday 7 after the surgical extraction. Dexamethasone also reduced postoperativepain significantly on postoperative days 2 and 7.There were nosignificant differences in trismus in the study and control groups 7 days after mandibular impacted third molar operations.[18]

Vegas-Bustamante et al studied effects of using methylprednisolone, as a single 40-mg dose, injected into the masseter muscle after impacted mandibular 3rd molar surgery in 35 healthy patients.Patients administered methylprednisolone showed superior results after surgery interms of oral aperture, pain and all the facial swelling parameters. The results obtained shows that40 mg of methylprednisolone injected into the masseter muscle in the immediatepostoperative period reduces swelling, trismus and pain.[19]

Comparison of modes of administration

O.W. Majid, W.K. Mahmood compared the effects of dexamethasone sodium phosphate given submucosally and intramuscularly on postoperative complications after removal of impacted mandibular third molars. It was found that both dexamethasone groups showed significant reductions in swelling and pain compared with the control group at all intervals. Dexamethasone 4 mg given submucosally is an effective way of minimising swelling, trismus, and pain after removal of impacted lower third molars, and is comparable with the intramuscular route.[20,21]

Boonsiriseth et al. compared the effect of intramuscular (IM)injection and consumption of 8 mg dexamethasone in patients after mandibular third molar surgery. No significant difference was found in facial swelling and painbetween IM administration and oral administration of 8 mg dexamethasone after lower third molar surgery. The results conclude that IM injection ororal of dexamethasone can be used to control facial swelling, pain and trismus[22]after mandibular Third Molar surgery.

Graziani et al studied effect of endo-alveolar and sub-mucosal administration of dexamethasone sodium phosphate to prevent inflammatory sequelae after surgical removal of lower third molars. Steroid group showed greater reductions in all clinical parameters recorded comparedto the control group. It was found that both sub-mucosal and endo-alveolar administration of dexamethasone is effective in reducing postoperative sequelae after surgical removal of lower wisdom teeth.[23]

Kocer et al. conducted study to evaluate the efficacy of supraperiosteal injection of methylprednisolone compared with an oral tablet form and intravenous (i.v.) injection in the prevention of postoperative pain and oedema associated with inflammation. All three routes of administration demonstratedbetter efficacy in comparison to the control regarding trismus. While oral administration and i.v. injection of methylprednisolone achieved similar results, masseter injection provided better results in reducing oedema and trismus when compared to the control following lower third molar surgery.[24]

Comparison of steroids with chymoptrypsin

Tahani Abdul-Aziz et al studiedthe efficacy of proteolytic enzyme orthtal-forte on the post operative sequelae of impacted mandibular third molar extraction. Study was conducted in 30 patients.Use of orthal-forte, a proteolytic enzyme resulted in better analgesic activity which was statistically significant on day one after third molar removal. It has anti-inflammatory activity, it reduces swelling and increases mouth opening more than conventional therapy. The absorbed enzymes are taken up by circulating enzyme inhibitors i.e. alpha antitrypsin and alpha 2 macroglobulin, levels of which rise steeply following injury and tissue destruction. This rise in inhibitor levels is responsible for the period of operative fibrinolytic shut down and maintenance of inflammatory edema which delay healing. These also facilitate the action of plasmin which is necessary to open up the blocked microcirculation, resolve oedema and initiate healing.[25]

DISCUSSION

Glucocorticoidsexert their action at virtually every step in inflammatoryprocess, which leads to decreased capillary dilatation, decrease in circulating lymphocytes, inhibitingfibroblast proliferation, and inhibiting prostaglandinsand leukotrienes. Suppression of these factorscauses reduction in the inflammatory reaction and are effective inreducing theextent of the common postoperative sequelae of pain,edema, and trismus after dentoalveolar surgery. To beeffective, these drugs must be given in a dose that exceeds thephysiologic amounts released by the body. Normaldaily output of cortisol is 15-25 mg/day, but up to 300mg of cortisol can be released in a time of crisis. A doseexceeding this limit would result in suppression of the inflammatoryprocess to a greater extent than that can be achieved by the body.

Postoperative edema peaks 48-72 h after surgery. So the glucocorticoids used should have a longer duration of action if used in a single dose.To maintain their antiinflammatory efficacy, steroiddoses should be maintained for a minimum of 3days and a maximum of 5 days to maximize theirbenefits and minimize their risk of causing delayedhealing and HPA axis suppression.

Corticosteroids arenot indicated for routine use. Rather, they should beused for more complex oral surgical procedure in whichtrauma is categorized as moderate to severe. Oral surgicalprocedures involving the removal of at least 1partial bony or full bony impacted third molar tooth falls into this category and also long surgical procedureswhich create a considerable amount of soft and hardtissue trauma.

CONCLUSION

Administration of steroids after third molar surgery through any route of administration is found to be helpful in reducing the post operative swelling, pain and trismus. But steroids should not be used in all procedures. The use of steroids should be limited to procedures where extensive trauma to the bone and soft tissues is involved. Doses used should be more than the physiological dose produced in body. Long acting steroids are more effective. If short acting steroids are used, they have to be supplemented to a minimum of 2nd to maximum of 5th post operative day. IV administration produces rapid absorption of the drug.Absorption following IM administration depends on the blood supply of theinjected area. Preoperative administration of steroids is found to be more effective than post operative administration. Submucosal administration of steroids produces similar effects to IV and IM routes. It can be used as an alternative to these routes as it is injected to previously anaesthetised areas and requires less technical skill. Oral route is also effective but the onsetof action is slow. Studies have to be conducted regarding the ideal drug and dosages to be used after mandibular third molar impaction surgeries.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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