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ORIGINAL RESEARCH

Comparative Evaluation of Submucosal and Intravenous Dexamethasone on Postoperative Sequelae following Third Molar Surgery: A Prospective Randomized Control Study

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ABSTRACT

Introduction: Impacted tooth removal is one of the most commonly performed procedures in the oral and maxillofacial surgery department. Following the procedure, patient often experiences swelling, trismus, and pain. Several methods have been employed to reduce the postoperative untoward sequelae.

Materials and methods: A total of 120 patients requiring mandibular third molar extraction was employed in the study and preoperative dexamethasone was given either submucosally or intravenously and compared with control group. Postoperative measurements of swelling, interincisal opening, and pain were compared with preoperative values and subjected to statistical analysis.

Results: Both submucosal and intravenous dexamethasone was found to reduce the incidences of untoward events in the postoperative period. Intravenous route has been found to be superior to submucosal route in reducing edema, pain, and trismus.

Keywords: Dexamethasone, Intravenous route, Submucosal route, Third molar surgery.

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INTRODUCTION

An impacted tooth is the one that has failed to erupt completely or partially into its correct position in the dental arch within the specific time of eruption of tooth, the eruption potential has been lost. They are retained throughout the individual's lifetime unless extracted or surgically exposed. Teeth may become impacted because of factors, such as adjacent teeth, dense overlying bone, excessive soft tissue, or a genetic abnormality. Most often, the cause of impaction is inadequate arch length which reduces the space available for eruption. That is, total length of the alveolar arch is smaller than the tooth arch. The most commonly impacted tooth is the third molars, because they are the last teeth to erupt in the oral cavity.[1] Impacted third molars are generally considered for removal when they cause either considerable pain, or infected, or associated with bone destroying pathology, or carious or adversely affects adjacent teeth. Third molar that interferes with the prosthetic rehabilitation of missing teeth are also removed. The removal of impacted third molars is one of the most common surgical procedure done by oral and maxillofacial surgeons. Surgical management of impacted third molar is a difficult procedure because of its anatomical position, poor accessibility, and potential injuries to the surrounding vital structures during surgeries. Surgical removal of impacted third molars is associated with trauma to soft and bony tissue and can result in considerable pain, swelling, and trismus.

The postoperative sequelae, such as pain, trismus, and swelling can cause distress to the patient and affect the patient's quality of life after surgery. To control postoperative inflammation and associated symptoms, it is essential to provide an adequate antiinflammatory therapy. Several types of medications have been used to control the postoperative inflammatory reactions after third molar impaction. These agents act by inhibiting the body's inflammatory response to injury due to various mechanisms, with a reduction of fluid transudation and therefore edema.

Postoperative swelling and edema is due to inflammation. In inflammation, there is conversion of phospholipids into arachidonic acid by the enzyme phospholipase A2 (PLA2), and it results in the synthesis of prostaglandins, leukotrienes, or thromboxane related substances which act as mediators of the inflammatory response. These symptoms are not observed immediately after surgery but rather begin gradually, attain the peak in 2 days after the extraction. Over several decades, many studies have shown the effectiveness of corticosteroids given before or just after removal of third molars in improving recovery.

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Fig. 1: Measurement of trismus

Fig. 2: Measurement of facial edema (tragus to corner of mouth)

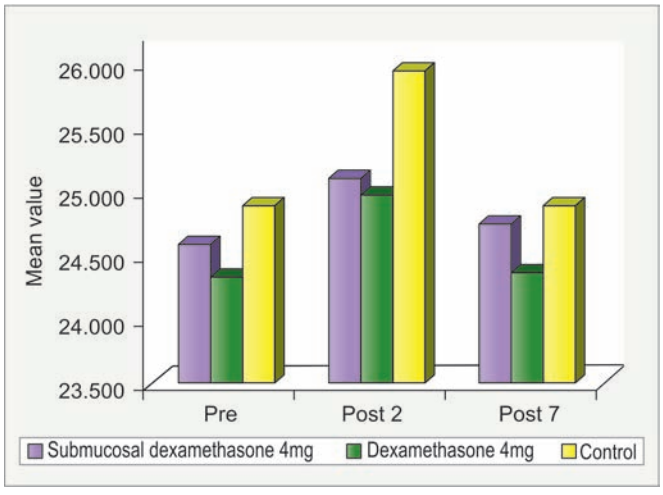
Dexamethasone, a synthetic glucocorticosteroid is a potent anti-inflammatory drug with 25 to 50 times the potency of hydrocortisone and is up to 16 times as potent as prednisolone. Dexamethasone is utilized frequently in the perioperative setting and may be useful in the management of acute and chronic pain.[2] Mechanism of action of corticosteroid includes the inhibition of the enzyme phospholipase A2 (PLA-2), which inhibits the conversion phospholipids into arachidonic acid in the cells of the inflammed focus. This will decrease prostaglandin and leukotriene synthesis, therefore reducing the accumulation of neutrophils and thereby reducing inflammation. Several studies have demonstrated that steroids have better effect in the control of the swelling and trismus than nonsteroidal anti-inflammatory drugs (NSAIDs). Single dose of dexamethasone is not found to be immunosuppressant.[3]

Fig. 3: Measurement of facial edema (tragus to soft tissue pogonion)

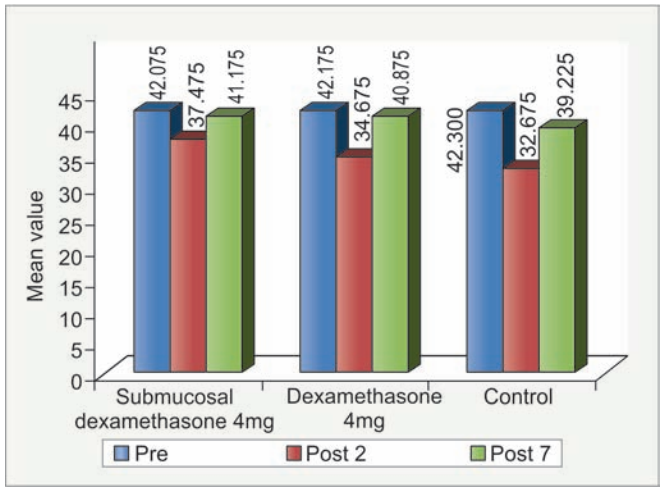
MATERIALS AND METHODS

A total of 120 patients requiring removal of a single mandibular, impacted third molar under local anesthesia who reported to Department of Oral and Maxillofacial Surgery were enrolled in this study after obtaining informed written consent and approval from institutional ethical committee. Patients aged 18 years and above with impacted third molars free of any extensive periodontal disease, pain or other inflammatory symptoms at the time of operation, and molars with the Pederson's difficulty score of 5 to 10 were included.

Preoperative measurements of pain using visual analogue scale of 0 to 10, trismus using interincisal opening (Fig. 1) and edema using extraoral facial measurements with three reference points—pogonion and corner of mouth (Figs 2 and 3) was done. Patients were randomly divided into three groups, wherein group I included 40 patients in whom 4 mg of dexamethasone was given submucosally in the buccal vestibule tissues after the advent of anesthesia. Group II included 40 patients in whom 4 mg of dexamethasone was given intravenously preoperatively after the advent of anesthesia and group III, the control group, included 40 patients who did not receive any drug. All patients received a prophylactic preoperative dose of oral antibiotic—2 gm of amoxicillin before 1 hour of surgery. A total of 15 mL of 0.2% chlorhexidine was used as oral rinse for 1 minute before surgery and immediately after the operation. After 24 hours of surgery, patients were asked to use chlorhexidine mouthwash twice a day for 1 week. At the report of subjective signs of anesthesia, 4 mg dexamethasone was administered either submucosally or intravenously in the test group patients. Only analgesics were prescribed to be taken after the third molar surgery. Preoperative and postoperative assessments on 2nd and 7th days were done by the same examiner. All the patients were operated by a single operator to standardize the surgical procedures.



Graph 1: Facial edema on preoperative day, postoperative days 2 and 7



Grapg 2: Trismus on preoperative day, postoperative days 2 and 7

The patients were instructed to avoid any drugs but those prescribed and not to seek medical help elsewhere for postoperative problems.

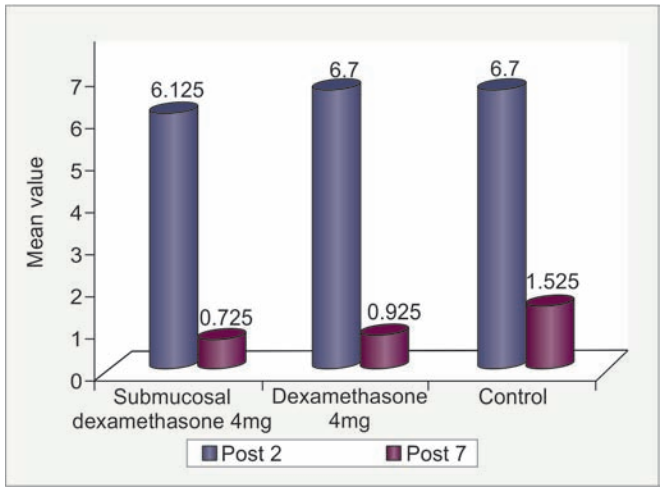
RESULTS

A total of 120 patients of both genders above 18 years with impacted lower third molars comprised the sample of this study. There was no bias towards either of the treatment groups. At follow-up, no patients developed wound infection, or serious postoperative complications.

In all the groups, facial swelling was most severe on the 2nd day after surgery and began to return to normal baseline facial contour by the 7th day postoperatively. Graph 1 shows the differences in edema between 3 groups observed over time. On the 2nd postoperative day, analysis of variance test showed a highly significant difference between the groups receiving 4 mg dexamethasone compared with the control group. The intravenous 4 mg dexamethasone group showed a significant decrease in edema compared with the submucosal group. By contrast, there was no statistically significant difference between all groups when postoperative swelling was evaluated at day 7.

Analysis of the data showed a highly significant reduction in trismus in the submucosal dexamethasone group when compared with the control group ($p = 0.003$). Restriction of mouth opening was significantly less for the intravenous 4 mg dexamethasone group in comparison with the control group. There was no significant difference between the groups on the 7th postoperative day. Complete recovery of mouth opening was not achieved in any group by 7 days (Graph 2).

There was a significant difference in pain experience between the two treatment regimens on the 2nd postoperative day ($p = 0.021$). With respect to pain, the submucosal group showed a highly significant reduction on the 2nd



Grapg 3: Visual analogue scale (VAS) on postoperative days 2 and 7

postoperative day when compared with the control group ($p = 0.003$). No significant differences were noted in the total number of analgesic tablets taken after surgery for both the intravenous group and control group on the 2nd postoperative day. Intravenous group showed a better reduction in the pain on the 2nd day. No significant differences were found in the pain levels on the 7th postoperative day (Graph 3).

DISCUSSION

Surgical removal of impacted tooth is one of the most common minor oral surgical procedure that an oral and maxillofacial surgeon does in his clinical practice. Surgical removal of impacted tooth involves injury to soft and hard tissues. Injury to soft tissue is by manipulation, and to hard tissue is by guttering of bone during the procedure. Any injury to the tissues leads to inflammation. During inflammatory process prostaglandin and histamine levels are found to be elevated. Bradykinin is associated production

of pain associated with inflammation. To make the postoperative period of the patient comfortable, drugs which reduce inflammation can be used. Many drugs have been used in relation to third molar surgery to reduce the inflammation which include NSAIDS corticosteroids, aprotinin, papase, and opioids. Therapeutic ultrasound therapy and low-level laser therapy have been also used in conjunction with impacted mandibular third molar surgery to reduce the inflammation. Drugs like NSAIDS suppresses the cyclooxygenase pathway, whereas glucocorticoids inhibit both cyclooxygenase and lipoxygenase pathways. It acts by inhibiting the activity of phospholipase A2, which results in the inhibition of formation of the end products of both pathways.[4]

It is clear that the type and dose of steroids as well as duration and route of administration can have a significant impact on the efficacy of the agent. Parenterally glucocorticosteroids may be administered intravenously or intramuscularly to rapidly achieve high concentrations in body fluids. Local administration of glucocorticoids can be done through submucosal route. In this study, local infiltration of steroid submucosally around the site of surgery was chosen as it was expected to provide a repository effect in a way similar to the intramuscular route, i.e., slow absorption and prolonged duration of action and in the other group through an intravenous route to achieve faster and higher plasma concentrations.[5]

Postsurgical facial edema is hard to quantify accurately because it involves three dimensions of measurement with an irregular convex surface and can manifest itself internally and externally. Most measurements are directly made onto the skin surface. Facial edema was evaluated by measuring the distance of the tragus to the outer corner of the mouth and tragus to the pogonion. When dexamethasone is applied submucosally or at a high dosage as an endoalveolar powder, its anti-edema effects increase. Direct application of steroid in the traumatized tissue may thus reduce the inflammation related events. Methylprednisolone sodium succinate 125 mg or 12 mg dexamethasone sodium phosphate are favored by many for intravenous administration. A minimum preoperative loading dose of 8 to 12 mg has been recommended.[6] In this study, 4 mg of dexamethasone has been used to minimize side effects. Studies have shown that there is no benefit after the administration of 4 mg of intravenous dexamethasone immediately before surgery, and such a dose is recognized as subtherapeutic.[7] Grossi et al[4] and Graziani et al[6] in their studies have shown significant decrease in facial edema after submucosal administration of 4 mg of dexamethasone. Our data also showed that submucosal administration of 4 mg dexamethasone resulted in a significant decrease in edema on the 2nd postoperative day. However, the intravenous administration of dexamethasone 4 mg was associated with a more significant decrease in edema than the submucosal group.

Trismus is a direct sequelae of postoperative swelling, compressing nervous structures, and generating mild to severe pain. Neupert et al reported that mouth opening as measured by the interincisal opening pre- and postoperatively was improved with 4 mg IV dexamethasone in the first few days after surgery.[8] A study conducted by Bamgbose et al[9] indicated a positive clinical association between the adjunct use of dexamethasone and postoperative recovery of trismus in third molar surgery. Steroids do not exert any effects on muscle contractions and reduction in trismus would be secondarily due to the decreased degree of local inflammation. Graziani et al[6] in his study found that submucosal injection of dexamethasone did not produce any beneficial effect when compared with the use of dexamethasone powder and demonstrated that high or low doses of corticosteroid did not affect mouth opening differently.[6] Our study in contrast showed that 4 mg of dexamethasone given submucosally caused a significant reduction in trismus on the 2nd postoperative day when compared to the intravenous group and control group.

Although some reduction of postoperative pain generally accompanies a reduction of edema, steroids alone do not have a clinically significant analgesic effect. In fact, the use of steroids might increase the patient's reaction to pain by suppressing beta-endorphins levels.[4] Dionne et al[10] showed that glucocorticoids at a dose of 4 mg administered intravenously 1 hour before third molar surgery did not suppress prostaglandin E2 release sufficiently to attenuate peripheral sensitization of nociceptors after tissue injury. Bamgbose et al[9] in a prospective study illustrated the enhanced effects of coadministered dexamethasone and diclofenac potassium on short-term postoperative pain compared to diclofenac potassium alone. Due to its anti-inflammatory effects, the administration of dexamethasone may synergize the anti-inflammatory effect of diclofenac and contribute to the reduction of inflammatory exudates as well as edema and pain.[9] Our data reported that submucosal injection of dexamethasone 4 mg reduced pain in comparison with the intravenous and control group on the 2nd postoperative day. No significant differences were found in the pain levels between the experimental groups on the 7th postoperative day but the control group patients complained of a mild pain.

CONCLUSION

Corticosteroid administration in the preoperative period is a potential solution to the patient woes of swelling, pain, and trismus. According to this prospective study,

preoperative dexamethasone provides the most effective therapeutic strategy in preventing inflammatory sequelae of lower wisdom tooth removal and in particular, submucosal administration of 4 mg dexamethasone gives rise to less trismus and lower patient pain perception after both 2nd and 7th days of surgical removal. Intravenous administration of 4 mg dexamethasone was statistically more efficient in controlling facial swelling on day 2 after surgical removal of third molars. The coadministration of dexamethasone and diclofenac sodium on postoperative pain and swelling illustrated enhanced effects. The intravenous dexamethasone was found to be superior to submucosal route in reducing overall patient's discomfort.

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