

## Effectiveness of Different Routes of Administration of Methylprednisolone on Trismus after Impacted Lower Third Molar Surgery

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### Abstract

### Original Research Article

**Background:** Lower third molar removal is common in oral surgical practice, since impacted molar rates of up to 40% have been reported. **Aim:** To compare the effectiveness of different routes of administration of methylprednisolone on trismus after impacted lower third molar surgery. **Methods:** The patients were randomly divided into five groups: Group 1 (control; no steroids), Group 2 (Local injection), Group 3 (oral tablets), Group 4 (i.v. injection) and Group 5 (Intramuscular Injection). Trismus was evaluated on day 2 and day 7. Trismus was recorded by measuring the inter-incisal opening at maximum opening of the jaws. **Results:** At the end of day 2, mean trismus score was found to be maximum in Group 1 ( $38.63 \pm 6.02$ ) whereas minimum in Group 5 ( $36.75 \pm 4.03$ ). At the end of day 7, mean trismus score was found to be maximum in Group 1 ( $44.07 \pm 5.72$ ) whereas minimum in Group 4 ( $41.14 \pm 4.52$ ). There was no statistically significant difference in mean trismus score at day 2 between the study and test groups. **Conclusion:** All the routes of administration showed better results as compared to control. Oral administration and i.v. injection of methylprednisolone achieved similar results, while local administration provided better results.

**Key words:** Methylprednisolone, impacted molar, intramuscular.

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## INTRODUCTION

Impaction means failure of tooth to reach normal occlusal and functional position following completion of chronological age and two-thirds root formation. Since it does not reach normal functional position, an impacted tooth is considered pathologic and requires treatment [1, 2]. Lower third molar removal is common in oral surgical practice, since impacted molar rates of up to 40% have been reported [3]. Since the removal of impacted third molar teeth is a surgical procedure, it carries with it inherent risks and complications. Trismus following surgical extraction is secondarily due to pain and swelling. Trismus is defined as a limitation in maximum oral aperture, and constitutes an important postoperative complication caused by the edema and swelling associated to surgical trauma [4].

Corticosteroids have an inhibitory action on the enzyme phospholipase A<sub>2</sub>, which reduces the release of arachidonic acid to the site of inflammation [5]. Thus, the synthesis of prostaglandins and leukotrienes and also the accumulation of neutrophils are reduced. Various corticosteroids such as

betamethasone, triamcinolone, prednisolone, hydrocortisone, dexamethasone, methylprednisolone, etc., are prescribed to control pain, trismus, and swelling[6].

Surgical removal of impacted third molar is considered as a minor surgical procedure done mostly as an out-patient basis under local anesthesia. Patients are usually subjected to exogenous corticosteroids for not more than 2–3 days at lower doses, which must have negligible side effects as stated earlier. Moreover, corticosteroids are usually administered as a single dose just before starting the procedure or given as a single dose immediate postoperatively. This also substantiates their usage in minor surgical procedures [7]. Thus, this study was planned to compare the usefulness of different routes of administration of methylprednisolone on trismus after impacted lower third molar surgery.

## METHODS

The study was conducted at a tertiary care teaching dental hospital of northern India. In this study one hundred adult patients from both sexes in whom removal of an impacted lower third molar was required.

An additional requirement for inclusion in the study was not having inflammatory symptoms.

Impacted mandibular third molars of class C, 1, 2, and 3 as per standard classification, age between 18-45 years and subjects with no systemic disease were included in this study. Exclusion criteria were pregnant or lactating women, smokers and use of medications interfering with the healing process. Our dental hospital performed the removal of an impacted tooth on the basis of evidence; teeth were extracted for various indications, such as pre-orthodontic preparation, prevention of post-orthodontic relapse, preparation for orthognathic surgery, prevention of second molar damage, and follicular expansion to rule out possible odontogenic cyst or tumour formation.

Group 1 subjects (control group) received no preoperative or postoperative anti-inflammatories or steroids. Group 2 subjects received a single dose of injection methylprednisolone 20 mg/ml into the masseter muscle after suturing of the surgical wound. Group 3 subjects received a single 20-mg dose of methylprednisolone in the form of an oral tablet taken 1 hour before the procedure. Group 4 subjects received a single dose of methylprednisolone 20 mg/ml i.v. in the immediate postoperative period. Group 5 subjects received a single dose of methylprednisolone 20 mg/ml i.m. in the immediate postoperative period.

Subject's fulfilling these inclusion criteria were included in the study. The treatment was then divided into following groups.

Group 1: Controls

Group 2: Local injection of methylprednisolone

Group 3: Oral methylprednisolone

Group 4: Intravenous injection of methylprednisolone

Group 5: Intramuscular injection of methylprednisolone

Study subjects were operated by the same standard technique; mouthwash with 0.2%

chlorhexidine was given prior to local anaesthesia. Local anaesthesia of the inferior alveolar nerve and lingual nerve, and terminal infiltration of the buccal fold was performed using 2% lidocaine hydrochloride and 1:200,000 adrenalines. Only one third molar was removed from each patient. Surgical access was standardized and involved a linear incision on the alveolar ridge aligned with the buccal region of the second molar, combined with a 1 cm vertical incision. A standard triangular flap and the retentive bone around the third molar were removed under irrigation with 0.9% saline solution. After the extraction was completed, irregular bone borders were removed, and the alveolus was irrigated with 10 ml 0.9% saline solution. The surgical site was sutured with 3-0 silk. All subjects received standard post-operative instructions. Antibiotics and 0.2% chlorhexidine gluconate solution were given for 5 days. The intraoral sutures were removed on postoperative day 7. Trismus was evaluated on day 2 and day 7. Trismus was recorded by measuring the inter-incisal opening at maximum opening of the jaws.

Written and informed consent was obtained from study subjects. Permission of ethical committee was obtained from the Institutional Ethics Committee. All the questionnaires were manually checked and edited for completeness and consistency and were then coded for computer entry. After compilation of collected data, analysis was done using Statistical Package for Social Sciences (SPSS), version 21 (IBM, Chicago, USA). The results were expressed using appropriate statistical variables.

## RESULTS

At the end of day 2, mean trismus score was found to be maximum in Group 1 ( $38.63 \pm 6.02$ ) whereas minimum in Group 5 ( $36.75 \pm 4.03$ ). There was no statistically significant difference in mean trismus score at day 2 between the study and test groups (Table 1).

**Table-1: Comparison of mean trismus scores among groups at 2<sup>nd</sup> day**

Groups	Mean $\pm$ S.D.	P value
Group 1: Controls	$38.63 \pm 6.02$	>0.05
Group 2: Local injection of methylprednisolone	$37.08 \pm 4.76$	
Group 3: Oral methylprednisolone	$37.97 \pm 4.53$	
Group 4: Intravenous injection of methylprednisolone	$37.24 \pm 4.88$	
Group 5: Intramuscular injection of methylprednisolone	$36.75 \pm 4.03$	

At the end of day 7, mean trismus score was found to be maximum in Group 1 ( $44.07 \pm 5.72$ ) whereas minimum in Group 4 ( $41.14 \pm 4.52$ ). There

was no statistically significant difference in mean trismus score at day 2 between the study and test groups (Table 2).

**Table-2: Comparison of mean trismus scores among groups at 7<sup>th</sup> day**

Groups	Mean $\pm$ S.D.	P value
Group 1: Controls	$44.07 \pm 5.72$	>0.05
Group 2: Local injection of methylprednisolone	$42.36 \pm 3.14$	
Group 3: Oral methylprednisolone	$42.95 \pm 3.85$	
Group 4: Intravenous injection of methylprednisolone	$41.14 \pm 4.52$	
Group 5: Intramuscular injection of methylprednisolone	$41.63 \pm 4.16$	

## DISCUSSION

In our study, Group 1 subjects (control group) received no preoperative or postoperative anti-inflammatories or steroids. Group 2 subjects received a single dose of injection methylprednisolone 20 mg/ml into the masseter muscle after suturing of the surgical wound. Group 3 subjects received a single 20-mg dose of methylprednisolone in the form of an oral tablet taken 1 hour before the procedure. Group 4 subjects received a single dose of methylprednisolone 20 mg/ml i.v. in the immediate postoperative period. Group 5 subjects received a single dose of methylprednisolone 20 mg/ml i.m. in the immediate postoperative period.

Effect of corticosteroids on reducing swelling, pain, and trismus is discussed greatly in the literature. However, most of the studies focus on oral or parenteral (intramuscular/intravenous) route of administration. Few studies have discussed in detail the submucosal role and its benefits in reducing the postoperative sequelae of third molar impaction. Noboa *et al.* in their prospective controlled, and crossover study evaluated submucosal effect of dexamethasone with the oral route [8]. They concluded that both routes were effective to control pain, edema, and trismus presenting similar results. In our opinion, oral dexamethasone is not advisable for minor oral surgery procedures like impacted third molar removal. This is because of the fact that plasma half-life of oral dexamethasone is 3–4.5 h and biological half-life is 36–54 h. The onset of action is delayed, and by then surgical edema will set in. As stated widely in literature and textbooks, the most effective period for administration of a corticosteroid is before the edema develops, that is the time of surgical intervention/trauma.

Another study by White RP Jr *et al.* [9] found the symptoms to be more notorious during the first two days, followed by gradual improvement and resolution one week after the operation— but as per López-Carriches C *et al.* [10] the condition may persist for up to 10 days after surgery.

In a prospective, controlled, randomized trial involving 60 impacted third molars comparatively evaluated pain, edema, and trismus following local injection and tablets of dexamethasone [18]. They concluded that both the oral and local injection of dexamethasone is effective and produced similar results [11].

Another study evaluated the efficacy of suprapariosteal injection of 20 mg of methylprednisolone compared with 20 mg oral tablet form and 20 mg i.v. injection in the prevention of postoperative pain and oedema associated with inflammation. All three routes of administration demonstrated best efficacy in comparison to the control regarding trismus. While oral administration and i.v.

injection of MP achieved similar results, masseter injection provided best results in reducing oedema and trismus when compared with the control following lower third molar surgery [12].

An investigation examined the efficacy of a 40-mg injection of methylprednisolone into the masseter muscle compared with a control group (no injection) on trismus, pain, and oedema in third molar surgery. They found pain and swelling to be more greatly reduced on day 2 and day 7 following surgery in the study group when compared with the control group. However, they concluded that pain is subjective evidence for which an objective result cannot be obtained and so was not evaluated during the study [13].

Ngeow and Lim conducted a review involving 34 articles to assess the efficacy of corticosteroids following third molar surgery. Based on their review, the authors concluded that swelling and trismus have a significant impact while reduction of pain following administration of steroids is still debatable [14].

Milles *et al.* conducted an experimental study on reduction of postoperative facial swelling by low-dose methylprednisolone on eleven patients he gave 16mg of MP orally the evening before surgery, combined with 20 mg MP i.v. immediately preoperatively, in a double blind, randomized, crossover study. Facial contour was measured preoperatively and postoperatively and on days 1,2,3,4, and 7 postoperatively. He concluded that the low dose of MP reduces swelling by 42% at 24 hours and 34% at 48 hours postoperatively. By the third day, the difference was only 19%. He also concluded that trismus was not affected by this dose of methylprednisolone [14].

Ehsan *et al.* conducted a randomized controlled trial involving 100 patients to assess swelling and trismus and concluded that submucosal injection of 4 mg dexamethasone is effective [16]. Vivek *et al.* recently conducted a study comparing the efficacy of dexamethasone following all three routes of administration, intravenous, intramassetric, and submucosal. Their results reflected that trismus has better control through intramassetric administration, whereas pain and swelling had better response to intravenous route of administration with dexamethasone [17].

## CONCLUSION

On the basis of findings of this study, it can be stated that all the routes of administration showed better results as compared to control. Oral administration and i.v. injection of methylprednisolone achieved similar results, while local administration provided better results following lower third molar surgery. Further

larger controlled trials are warranted to support our findings.

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