

# Postoperative pain, edema and trismus following third molar surgery – A comparative study between submucosal and intravenous dexamethasone

S. Sreesha<sup>1</sup>, M. Umamar<sup>1</sup>, S. Sooraj<sup>1</sup>, Sachin Aslam<sup>1</sup>, A. Roshni<sup>1</sup>, Jabir K<sup>1</sup>

<sup>1</sup>Department of Oral and Maxillofacial Surgery, MES Dental College, Perinthalmanna, Kerala, India

## ABSTRACT

**Background:** Third molar surgery always needs primary intervention as it can lead to various complications and pathologies. Considering other ways for postoperative anesthesia it was inferred that submucosal group which showed simple injection technique and direct surgical site administration is more beneficial. It was noticed as a patient comfort method which can be the preferred as the drug of choice over intravenous route of dexamethasone injection. **Introduction:** Impaction of third molar is a common affliction and surgical removal is the only treatment option. The post-operative sequelae following the third molar surgery are pain, edema and trismus. The use of corticosteroids is to counteract it via various routes. Still, controversy exists in the literature regarding the administration of corticosteroids over the routes and time of administration. The purpose of this study was to compare the postoperative pain, edema and trismus following third molar surgery while using preoperative intravenous and submucosal routes of dexamethasone, in terms of pain, facial swelling, and trismus. **Materials and Methods:** This study consisted of 64 patients presented with mesioangular impacted mandibular third molar for surgical removal. Preoperative measurements of edema, trismus were analyzed. Postoperative pain was estimated using visual analogue scale. Edema was assessed by the extra oral facial measurements. Trismus was measured by recording the interincisal opening in millimeters. Dexamethasone was administered intravenously or submucosally according to the choice of operating surgeon and were divided into 2 groups. **Results:** Mean and standard deviation calculated for continuous variables. Changes in parameters was analysed using *t* test and Mann-Whitney U test. Here, submucosal group were reported with increased pain on the second postoperative day. On seventh postoperative day mean value turns to  $0.7 \pm 1$  for submucosal and  $0.6 \pm 1.2$  for intravenous group. On overall observation, intravenous group expressed statistically significant ( $P < 0.01$ ) reduction in pain compared to the submucosal group during immediate and second postoperative days. **Conclusion:** Analyzing the previous studies, and from the experience of the present one, it could be reasonably found out that administration of submucosal dexamethasone is beneficial for overall patient compliance.

**Keywords:** Dexamethasone, edema, pain, preoperative administration, trismus

## Introduction

Impacted third molar and its surgical removal is one of the most inevitable procedure in the routine practice of an oral surgeon.<sup>[1]</sup> Nowadays various queries and confusions exist regarding the postoperative quality of life following third molar surgery. Surgical removal of impacted mandibular third molar is commonly performed to prevent or to treat the pathosis

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**Address for correspondence:** Dr. S. Sreesha,

PG Student, Department of Oral and Maxillofacial Surgery,  
MES Dental College, Perinthalmanna - 679 321 Kerala, India.

E-mail: sreeshas2010@gmail.com

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caused by that tooth. After third molar surgery the common postoperative sequelae are pain, swelling and trismus.<sup>[1]</sup> The factors contributing to these postoperative difficulties are related to the inflammatory process. Inflammatory symptoms differ from patient to patient in occurrence and its severity.<sup>[2]</sup> Various studies have been performed with the administration of wide range of drugs like corticosteroids, NSAIDS and enzymes like chymotrypsin, serratiopeptidase to evaluate the post-operative discomfort of patients after third molar surgery. Local measures like application of cold pack during the immediate postoperative period, placement of surgical drains intraorally and low-level laser therapy have been reported to reduce the postoperative sequelae of third molar surgery.<sup>[2]</sup> Corticosteroids such as dexamethasone has been extensively used in dentoalveolar surgery due to its nearly pure glucocorticoid effects, high potency, low sodium-retaining ability and long half-life.<sup>[3]</sup> The present study is intended to evaluate the effectiveness of preoperative submucosal and intravenous dexamethasone in reducing discomfort following mandibular third molar surgery.

### Materials and Methods

This prospective study was carried out from June 2018 to August 2019 among patients availing treatment in the Out Patient Department of Oral and maxillofacial surgery, MES Dental College and Hospital, Perinthalmanna. The study was commenced upon obtaining clearance from the institutional ethical committee (IEC/MES/66/2017). Prior to initiation of the study, a written informed consent in accordance with ethical codes adopted by the National Committee for Medical Research Ethics was completed by all participants. Subjects with age greater than 18 years were included in the study. After obtaining an informed consent, patients were thoroughly examined and a detailed case history was taken from each of them as per the attached proforma. The samples were selected according to inclusion and exclusion criteria. Patients between the age group of 18–45 years having mesioangular impacted mandibular third molars were included in the study. Patients with active infections, systemic disorders, long-term steroids, pregnant and lactating women and history of previous impaction were excluded from the study. All the selected 64 cases did not have any signs and symptoms of pain, trismus, and swelling at the time of surgical removal of impacted mandibular third molar. Preoperative measurements of edema, trismus were analyzed. Postoperative pain was estimated using visual analogue scale calibrated 0–10, with 0 being no pain and 10 being worst pain. Edema was assessed by the extra oral facial measurements with the following reference points. Tragus to corner of mouth (In millimeters) [Figure 1]. Tragus to soft tissue pogonion (In millimeters) [Figure 2]. Trismus was measured by recording the interincisal opening in millimeters [Figure 3]. 15 ml 0.2% chlorhexidine was used as oral rinse for 1 min before and immediately after the procedure. Conventional Inferior alveolar nerve block was administered (2% lignocaine with 1:200,000 adrenaline). Dexamethasone was administered intravenously or Submucosally according to the choice of



Figure 1: Horizontal measurement of swelling



Figure 2: Vertical measurement of swelling



Figure 3: Measurement of trismus

operating surgeon. Group 1: Patients who received 4 mg dexamethasone submucosally in the buccal vestibule anterior to incision site after the advent of anaesthesia. Group 2: Patients who received 4 mg dexamethasone intravenously after the advent of anaesthesia. Same antibiotics and analgesics were prescribed following surgery. Postoperative assessments were performed 4 h after the procedure, on second postoperative day and on the seventh day after the surgery by the same examiner.

## Results

Data were coded and entered in MS Excel and analysis was done using SPSS trial version 22. Descriptive analysis was performed. Proportions were expressed in percentage. Mean and standard deviation calculated for continuous variables. Changes in parameters was analysed using *t* test and Mann–Whitney U test. Here, submucosal group reported with increased pain on the second postoperative day. On seventh postoperative day mean value turns to  $0.7 \pm 1$  for submucosal and  $0.6 \pm 1.2$  for intravenous group. On overall observation, Intravenous group expressed statistically significant ( $P < 0.01$ ) reduction in pain compared to the submucosal group during immediate and second postoperative days.

### Comparison of pain between groups at different time interval

On overall observation, intravenous group expressed statistically significant ( $P < 0.01$ ) reduction in pain compared to the submucosal group during immediate and second postoperative days [Table 1].

### Comparison of tragus to corner of mouth distance between groups at different time interval

Statistically significant ( $P < 0.05$ ) difference in swelling was noticed in submucosal group compared to intravenous group on second postoperative day [Table 2].

### Comparison of tragus to pogonion distance between groups at different time

On overall assessment, significant reduction was seen in vertical component of swelling in submucosal group on second post-operative day ( $P < 0.05$ ) [Table 3].

### Comparison of trismus between groups at different time interval

The difference between submucosal and intravenous dexamethasone groups were statistically significant on the second postoperative day ( $P < .01$ ). Thus, submucosal group showed comparatively less restriction in mouth opening following surgical removal of third molar [Table 4].

## Discussion

Surgical removal of impacted mandibular third molar is a commonly performed procedure in oral surgery which affects the postoperative quality of life of the patient.<sup>[4]</sup> This procedure is often associated with postoperative discomfort such as pain, swelling, and trismus. Severity of these postoperative sequelae depends on the handling of soft tissues during the intraoperative period, extent of osteotomy and duration of the surgical procedure.<sup>[5]</sup> Worldwide in oral and maxillofacial surgery, various modalities have been tried to control the extent of postoperative sequelae of third molar surgery. The most efficacious anti-inflammatory agents used are corticosteroid compounds.

**Table 1: Comparison of pain at different time interval in both groups**

Pain	Submucosal		Intravenous		Z	P
	Mean±SD	Median	Mean±SD	Median		
PreOP	0±0	0.0	0±0	0.0	0	1.000
Immediate PostOP	5±0.7	5.0	4.1±0.7	4.0	4.35	<0.01
Day 2	3±0.8	3.0	2.1±0.7	2.0	4.43	<0.01
Day 7	0.7±1	0.0	0.6±1.2	0.0	0.72	0.471

**Table 2: Comparison of tragus to corner of mouth distance between groups at different time interval**

Tragus to corner of mouth distance	Submucosal			Intravenous			t	P
	Mean	SD	n	Mean	SD	n		
PreOP	10.7	0.6	32	11.0	0.7	32	1.69	0.096
Immediate PostOP	10.8	0.6	32	11.0	0.7	32	1.69	0.096
Day 2	11.1	0.6	32	11.5	0.9	32	2.27*	0.027
Day 7	10.8	0.6	32	11.1	0.8	32	1.76	0.084

**Table 3: Comparison of tragus to pogonion distance between two groups at different time interval**

Tragus to pogonion	Submucosal			Intravenous			t	P
	Mean	SD	n	Mean	SD	n		
PreOP	13.5	0.7	32	13.8	0.6	32	1.97	0.053
Immediate postop	13.5	0.7	32	13.8	0.6	32	1.69	0.096
Day 2	13.8	0.6	32	14.2	0.6	32	2.16*	0.035
Day 7	13.5	0.7	32	13.8	0.6	32	1.97	0.053

**Table 4: Comparison of trismus between two groups at different time interval**

Trismus	Submucosal			Intravenous			t	P
	Mean	SD	n	Mean	SD	n		
PreOP	41.5	1.8	32	40.9	2.5	32	0.98	0.330
Immediate postop	40.4	1.8	32	40.3	2.0	32	0.06	0.949
Day 2	36.2	0.8	32	35.2	1.2	32	3.73	$P < 0.01$
Day 7	41.4	1.7	32	40.8	2.5	32	1.06	0.294

Pain is the most frequent complication expected after third molar surgery, predominantly as a consequence of inflammation initiated by tissue injury. Pain is attributed due to the pressure on nerve endings resulting from exudation, following the release of various mediators of inflammation such as arachidonic acid metabolites, 5-HT and bradykinin. These mediators increase the responsiveness of local nociceptors and stimulates pain.<sup>[6]</sup> Pain pathway is relayed through dorsal horn neurons in the spinal cord, which relay to the higher centers where the pain is assimilated.<sup>[7]</sup> As the inflammation progress the interstitial fluid accumulation due to transudation from injured blood vessels and obstruction of lymphatic drainage by fibrin and fibrinogen clots derived from plasma and adjacent injured vessels leads to postoperative edema. Facial edema is difficult to quantify accurately because it involves 3 dimensions of measurement with an irregular, convex surface and can manifest itself internally

as well as externally. Trismus or jaw stiffness frequently occurs following third molar surgery and is an important postoperative complication caused by the edema and swelling associated with the surgical trauma.<sup>[4]</sup> Postoperative pain is also a cause of limitation in mouth opening following third molar surgery.<sup>[8]</sup> There are many contributing factors for trismus. The results of this study indicated better pain control in intravenous group compared to the submucosal group which was probably because of the faster optimal plasma level attainment and better local bioavailability. Statistically significant reduction in pain was seen in the intravenous group, during the immediate postoperative time and second postoperative day. Some researchers observed, the mean value of 5.9 for pain on first postoperative day in submucosal group and 4.7 in intravenous group, on second day mean value was 2.8 and 2.4 for submucosal and intravenous groups respectively. On seventh day both groups did not experience any pain.<sup>[9]</sup> On the second postoperative day in this study mean value for pain showed a decrease of 2 scores in both the groups. On seventh postoperative day the mean value was 0.7 for submucosal and 0.6 for intravenous groups, which was comparable to the findings of above-mentioned study. Multiple studies have demonstrated the ability of single dose of dexamethasone to reduce postoperative pain scores. Some study states that dexamethasone did not showed sufficient analgesic effect even though it reduced the PGE2 and TXB2 At the injured site.<sup>[10]</sup> According to a literature there is no benefit after the administration of 4 mg of intravenous dexamethasone immediately before surgery, and such a dose is recognized as subtherapeutic.<sup>[11]</sup> Submucosal administration of 4 mg dexamethasone gives rise to less pain perception compared to intravenous group after second and seventh postoperative days of surgical removal, in another study. But it was not statistically significant.<sup>[12]</sup> A recent study stated that dexamethasone has no role in extending the analgesic effect even it was administered with nerve block.<sup>[13]</sup> There is no significant difference in analgesic effect by dexamethasone injection through IV and perineural routes.<sup>[14]</sup> While assessing edema, mean horizontal and vertical dimensions of swelling was observed in each group at different time intervals. Statistically significant reduction in swelling was observed in submucosal group on second day compared to intravenous group. Similar to our result, according to another study on the third postoperative day reduction of mean value of swelling was marked in intravenous and submucosal group compared to the other routes. ( $P < 0.001$ ) slight reduction in the mean value of swelling was observed in submucosal group than intravenous group. Some studies have shown significant decrease in facial edema after submucosal administration of 4 mg of dexamethasone.<sup>[2,5]</sup> Present study data showed that submucosal and intravenous administration of 4 mg of dexamethasone resulted in significant decrease in edema on the second postoperative day. Local administration of steroids seems to be more advantageous due to the fact that eicosanoids act locally on the tissues from which they are released. The steroids act directly on these eicosanoids and hence prevent inflammatory processes. Dexamethasone administered through submucosal route provides comparable control of swelling and has the

advantage of being injected into previously anesthetized areas and requires less technical skill and better patient compliance.<sup>[15]</sup> Few literatures stated that local application of dexamethasone showed more swelling reduction though not significant than the oral route but exhibited less effect than intravenous and intramuscular routes. A mean variation of 0.3 was observed in submucosal group from first postoperative day to third postoperative day, whereas a mean change of 0.7 was observed in intravenous group.<sup>[16]</sup> Oral route of dexamethasone is superior than the submucosal administration. This difference might have arisen from the fact that oral corticosteroids were given one-hour prior, thus giving it enough time to get circulated into the body in comparison to the submucosal injection of dexamethasone.<sup>[17]</sup> Some studies states oral administration of dexamethasone and prednisolone are equally effective.<sup>[18]</sup> In this study results submucosal group showed comparatively less restriction in mouth opening following surgical removal of third molar. In submucosal group the preoperative mean value of trismus was  $41.1 \text{ mm} \pm 1.8$  and immediate postoperative period there was reduction in mean value by 1.1 mm. On the second postoperative day reduction of mean value by 5.3 was observed. In intravenous group there was a change of 0.5 to 5.7 on immediate and second postoperative days from the preoperative mean value ( $40.9 \pm 2.5$ ). Another study observed the mean value of for mouth opening on first postoperative day in submucosal group and 32.6 in intravenous group. On third postoperative day mean value was 35.05 and 35.5 for submucosal and intravenous groups respectively, it was comparable to the results of present study. A comparative study on the efficacy of steroid was performed and they suggested that oral route is superior than parental routes in controlling trismus.<sup>[19]</sup> Some studies stated that their patients showed significantly less trismus at all times of evaluation in submucosal group, may have been the result of higher concentration of drug at the site of injury.<sup>[20]</sup> However according to literature all different modalities have been shown to be equally effective in reducing trismus, in our study we found trismus to be least in submucosal group and we hypothesize that this could be because of direct injection to the surgical site, ensures the immediate local availability.<sup>[21-23]</sup>

## Conclusion

The postoperative Complications tended to be less severe in both groups receiving dexamethasone, whereas postoperative analgesic medications have similar effects on both groups regarding the reduction of pain, even though the intravenous dexamethasone provided a significant difference in pain perception on Immediate and second postoperative times. Intravenous drug administration provides faster onset of analgesia sametime it is technic sensitive and associated with difficulty of needle prick in apprehensive patients. Thus, we recommend the submucosal administration of dexamethasone, as a more easier and comfortable route of administration which showed significant difference in reduction in swelling and trismus, and on entire assessment it was found superior for the improvement of postoperative quality of life of patient.

## Summary

Third molar surgery always needs primary intervention as it can lead to various complications and pathologies. Considering other ways for postoperative anesthesia it was inferred that submucosal group which showed simple injection technique and direct surgical site administration is more beneficial. It was noticed as a patient comfort method which can be the preferred as the drug of choice over intravenous route of dexamethasone injection.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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