

# COMPARATIVE EVALUATION OF THE EFFECT OF SUBMUCOSAL VERSUS INTRAVENOUS ADMINISTRATION OF DEXAMETHASONE INJECTION AFTER SURGICAL REMOVAL OF IMPACTED LOWER THIRD MOLARS

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**Background:** The purpose of this study was to clinically compare the relative effectiveness of a single dose Dexamethasone administered by two different routes of administration, intravenous or the submucosal route in preventing impacted mandibular third molar surgery sequelae.

**Method:** This prospective study was piloted on 90 patients. The selection was done randomly from the outpatient department requiring surgical extraction of impacted mandibular third molars. The patients were then erratically allotted to any of the three groups- the intravenous, the submucosal or the control group. The intravenous group received 4mg Dexamethasone intravenously, the submucosal group received 4mg Dexamethasone submucosally in the mucosa adjacent to the surgical site, and the control group received no dose of steroid. Maximum mouth opening (interincisal distance), measuring of facial swelling was done at postoperative days 1, 3 and 7.

**Results:** The submucosal mode proved more successful in preventing swelling and mouth opening over the study period. There was no substantial improvement in pain perception in the study groups over the control group.

**Conclusion:** This study results provide a basis for the submucosal administration of corticosteroids such as Dexamethasone sodium phosphate in a single dose to accomplish reduction of postoperative sequelae similar to other routes of administration. Moreover, there is an accessibility for the surgeon to use the submucosal route due to familiarity with the surgical site.

**Keywords:** Third molar surgery, Dexamethasone, Intravenous route, Sub-mucosal route.

## Introduction

In oral and maxillofacial surgery clinics the third molar surgery is the most frequently performed dento-alveolar surgical procedure. The mandibular third molar appears to be the most commonly impacted tooth in the oral cavity.

Anderson et al has reported that the frequency of mandibular third molar impaction has been found to be 20 – 30%. Impacted third molar removal is often traumatic because it is surrounded by thick buccal cortical plate, external oblique ridge and posteriorly by ascending ramus. The muscles surround the third molar are anteriorly by the buccinators, distally by the temporalis, laterally by masseter and medially by medial pterygoid muscle. Apart from this it is closely related to the inferior alveolar neurovascular bundle, lingual nerve and long buccal nerve.

Removal of impacted mandibular molars involves the surgical manipulation of both soft and bony tissues as well as exposure of vulnerable tissues to a infected environment<sup>2</sup>. The sequelae of this surgical procedure often include pain, swelling and trismus.<sup>3</sup>

A many therapeutic measures have been used to reduce the incidence of these sequelae. There is convincing evidence that anti-inflammatory agents such as corticosteroids effectively reduce the severity of these moans after third molar surgery.<sup>4</sup>

## Aims and Objectives

The purpose of the study is to compare the effect of submucosal versus intravenous administration of Dexamethasone on patient's quality of life after surgical

removal of impacted lower third molars in terms of pain, swelling and trismus.

## Inclusion Criteria

1. Patients in the age group between 20 to 35 years with impacted mandibular third molar.
2. All patient should be free of pericoronitis and infection at surgery.
3. Patient willing to participate in the study.

## Exclusion Criteria

1. Pregnant and lactating women were not included in the study.
2. Medical compromised patient.
3. A history of allergy to the drugs used in the present trial, the recent use of Anti- Inflammatory Drugs or Antibiotics.
4. Chronic use of any medication.
5. Any systemic disease

## Materials and Methods

This comparative study includes 90 patients and was conducted in the department of oral and maxillofacial surgery teerthanker dental college and research centre. The study was described to the patients in detail and informed consent was obtained. All cases included were young adults in the 20-35 years age group with bony impactions and were free from pain and other inflammatory symptoms including pain swelling and trismus at the time of surgery.

Patients were then randomly allocated into three groups:

- **Group A** patients were administered Dexamethasone Sodium Phosphate

Injection 4mg submucosally in the buccal sulcus around the site of operation after the surgery.

- **Group B** patients were administered Dexamethasone Sodium Phosphate Injection 4mg intravenous after the surgery.

- **Group C** patients were the control group, and were not administered any steroid.

Three criterions were assessed in the study:

- a. Mouth opening
- b. Swelling
- c. Pain

A comparison was made in all the three criterions in between the preoperative measurements and subsequent immediate postoperative, day 1, day 3 and day7 measurements.

### Operative technique

A standardized approach to the surgical removal of the impacted mandibular third molars using Buccal Guttering technique was followed:

1. Local analgesia was obtained by inferior alveolar, lingual and long buccal nerve block injections using 2% lignocaine with 1:80,000 adrenaline.
2. Wards' or Modified Wards' incision was placed (Figure: A).



*Figure: A: Ward's Incision*

3. A full thickness mucoperiosteal flap was then raised (Figure B).
4. Bone was removed with burs with a clinical straight handpiece with copious saline irrigation (Figure C).
5. The delivery of the tooth was accomplished by the tooth splitting technique, as and when needed (Figure D).
6. The flap was repositioned and sutured using silk in interrupted pattern (Figure E).
7. Patient was recalled in the department at interval of 1,3,7 days to record the reading.

8. All sutures were removed on the 7th post-operative day.



*Figure B: Full Thickness Mucoperiosteal Flap Raised*



*Figure C: Buccal Guttering*



*Figure D: Extraction Socket*



Figure E: Suturing With 3-0 Black Silk

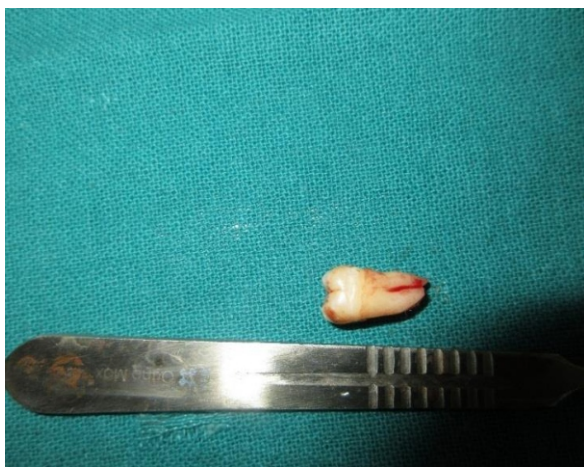


Figure F: Extracted Tooth

#### Evaluation of Trismus

A stainless steel scale was used to measure the maximum inter-incisal distance between the maxillary and mandibular incisors. The reference points used were the incisal edges of the teeth at the maximum comfortable mouth opening possible.

#### Evaluation of Swelling

The reference lines used were the tip of the tragus of the ear of the operated side to the corner of mouth and gonion to lateral canthus of eye of the operated side. The distance from the tragus to the corner of mouth was added to the distance between the gonion and lateral canthus of eye over the maximum convexity of the soft tissues. The same operator, repeating the procedure three times on each patient, made the measurements. The average of measurements was then taken (in mm) and recorded.

#### Evaluation of Pain

All measurements of pain were designated with a subscript. Pain intensities were evaluated by a visual analogue scale (photo) with horizontal line that ran from “no pain” (0 mm) to “worst pain” (10 mm). The patients recorded this

measurement themselves in triplicate and the average recorded.

Immediately after the surgery, all patients were prescribed Amoxicillin 500mg and Ketorolac 10mg. All patients were discharged with the usual post-operative instructions and were called on post-operative days 1, 3 and 7.

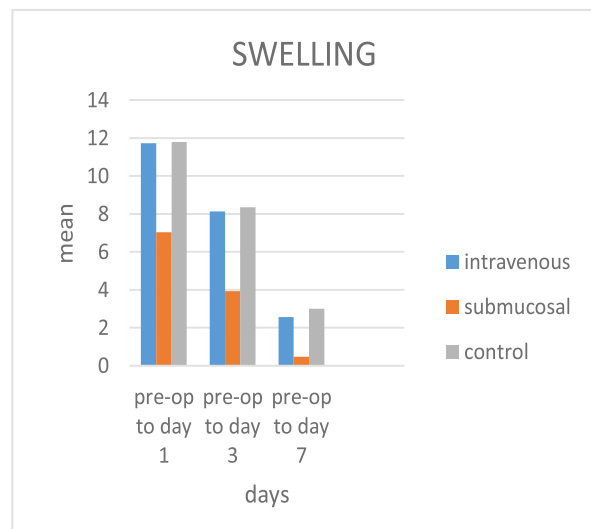
#### Results

Ninety patients were included in the study. These patients were randomly allocated to either of the three groups- intravenous, submucosal and the control groups. Data collected was analyzed using Student’s paired- t test.

**Swelling (graph 1& tables 1, 2, 3)** Day 1 postoperative; there was less swelling in the submucosal group (mean= 7.03) than the intravenous (mean=11.73) or the control group (mean=11.8).

- Day 3 postoperative; the amount of swelling was least in the submucosal group (mean=3.93) as compared to the intravenous group (mean=8.13) and control group (mean=8.36).

- Day 7 postoperatively; the swelling observed was least in the submucosal group (mean=0.466) than the intravenous group (mean= 2.56) or the control group (mean= 4.7).



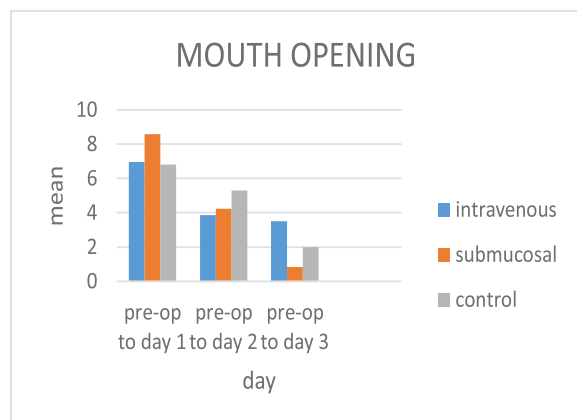
Graph 1. Bar graph showing the data on swelling collected for all three groups on different days

**Mouth opening (graph 2 & tables 4, 5, 6)** Day 1 postoperative analysis showed that the patients in the submucosal group had maximum mouth opening (mean= 8.59) compared to the intravenous group (mean= 6.96) or the control group (mean= 6.8).

- Day 3 postoperative analysis showed that the patients under the control group had the maximum mouth opening

(mean= 5.3) compared to the submucosal group ( mean= 4.23) or the intravenous group(mean=3.86).

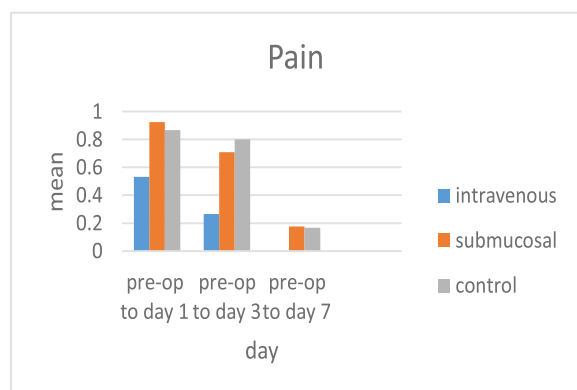
- Day 7 postoperative analysis showed nearly equivalent mouth opening across all the groups, with the submucosal group patients displaying slightly better mouth opening ( mean= 0.83) compared to intravenous (mean= 1.133) or control group (mean= 2).



Graph 2: Bar graph showing the data collected for mouth opening in all three groups on different days

**Pain (graph 3& tables 7, 8, 9)** Day 1 postoperative values revealed that the intravenous group had improvement (mean= 0.53) when compared to control group (mean= 0.866) or submucosal group (mean= 0.925)

- Day 3 postoperative analysis showed that the pain values were significant improvement in the intravenous group (mean= 0.266) or the control group (mean= 0.8) compared to the submucosal group (mean= 0.708)
- Day 7 postoperative analysis revealed that the values were significant improvement in the intravenous group (mean= 0) or the submucosal group (mean= 0.175) compared to the control group (mean= 0.166)



Graph 3: Bar graph showing the data collected for pain in all three groups on different day

A statistically significant difference was observed in all parameters except in:

- Mouth opening parameter in the intravenous group on day 7 postoperative ( $p > .001$ )
- Pain parameter in intravenous group on all days ( $p > .001$ )
- Pain parameter in the submucosal group on day7 post-operative ( $p > .001, p > .01$ )
- Pain parameter in control group on post-operative period ( $p > .001$ ) and on day 3 post- operative ( $p > .001$ )

### Discussion

Although the inflammatory process is an essential part of postsurgical healing after oral and maxillofacial surgery procedures, once initiated it may exceed the necessary physiological limits and result in excessive swelling, pain, and trismus. There has been a constant search for ways to control the inflammatory process, starting with the use of pressure dressings and thermal agents and extending to the use of various pharmacological agents. Enzymes such as hyaluronidase, streptokinase/streptodornase, trypsin / chymotrypsin, papase and ananase were among the earliest agents used. Another pharmacological approach to control the inflammatory process after oral surgery involved the use of oral anti-histamines.<sup>42</sup> After the discovery by Hench et al in 1949 that corticosteroids have an anti-inflammatory action, their use in oral surgery patients was described in a large number of journals.<sup>5</sup> Pharmacologically controlling the extent of the inflammatory process may reduce the intensity or severity of postoperative sequelae such as pain, swelling and trismus. One technique that has been suggested for reduction of post-surgical inflammation is the administration of corticosteroids.<sup>3,4</sup> Although initially there was some concern that this could result in adrenal suppression and impaired wound healing, subsequent studies confirmed not only that steroids were effective for reducing postsurgical pain and swelling but also that they could be used with minimal threat in maximum patients<sup>4</sup>.

Measurements of swelling, calculation of pain and mouth opening showed improvement with lesser dose of Dexamethasone. The result of the drug on swelling, mouth opening and pain was more pronounced on the immediate postoperative period. This effect became less obvious towards the seventh postoperative day, when the data collected from the study groups was very similar to the control group.

The intravenous route offers instantaneous blood heights but requires expertise and additional armamentarium. Studies of submucosal / intramuscular dose suggest that this way of administration can be active in a single dose given either pre-surgical or post-surgical.<sup>25,28</sup> These results imply that with high doses, the repository effect is significant throughout the first seven postoperative days

and that additional doses may not be necessary. In this study, local infiltration of the steroid submucosal at the site of surgery was chosen as it is predictable to provide a repository result in a manner similar to the IM (i.e. slow absorption and prolonged duration of action). In addition, the submucosal infiltration does not require clinician's expertise or additional armamentarium.

The data in decrease of swelling in our study (graph. 1) resembles the results described by other authors. However, on the first postoperative day, the levels of swelling were significantly different between the three groups. The averages between the submucosal and the control groups were significantly different statistically. Least swelling was observed in the submucosal group, compared to intravenous and the control groups.

A similar pattern was observed on the third and the seventh postoperative days, with the submucosal group having the least swelling compared to others, although the severity in swelling is reduced to highly significant differences across all groups.

Postoperative edema due to surgical insult to the soft tissues around the site of surgery results in a protective spasm of the masseter muscle that results in postoperative trismus, and subsequent decreased mouth opening<sup>33</sup>. Trismus has been considered as a one single variable demonstrating the most complete assessment of postoperative inflammatory response.<sup>41</sup>

Complete recovery doesn't occur early, and measurement of trismus during the study period proved to be the one single factor affecting the patient's quality of life the most.

In graph 2, the experimental groups' patients showed a highly significant statistical difference in the amount of mouth opening immediately postoperatively, with the submucosal group having a highly significant statistical difference with the intravenous or the control group. This was in accordance with most of the reported literature.

The amount of mouth opening was least on the postoperative day first and gradually improved on the third and the seventh postoperative days. This observation is in complete agreement with all previous reports in the literature.

Acute postoperative pain following third molar surgery is predominantly a consequence of inflammation initiated by tissue injury.<sup>22,27,29</sup> The role of corticosteroids in preventing post-surgical pain is debated. Corticosteroids alone do not seem to have a clinically significant analgesic effect, but it has been reported that steroids can be related to a decrease in the number of analgesic tablets used after surgical extraction<sup>22, 29</sup>. Dexamethasone particularly appears to decrease pain after surgery.

In graph 3, in the immediate postoperative period, the pain perceived by the control group was highly different from the experimental groups statistically.

This observation is in accordance with the reported literature, and can be attributed to the action of corticosteroids in preventing the release of chemical mediators of pain like histamine, serotonin, kinins,

complement and prostaglandins by synthesizing proteins that prevent the production of these pain mediators.<sup>27, 28</sup>

On days 1, 3 and 7 postoperatively, the intravenous group showed significant difference statistically than the submucosal or the control groups.

A combined steroid- analgesic regimen has been reported using codeine phosphate 30mg (Schmelzeisen and Frölich 1993) and NSAIDs by numerous other writers<sup>18, 19, 25, 26, 27, 30, 35, 36, 40</sup>.

## Conclusion

The use of corticosteroids to reduce postoperative sequelae of third molar surgery is widely documented and highly recommended in the literature, but should be done judiciously. The technique should be used for select cases where severe surgical trauma is anticipated or the patient is judged to be at a higher risk for postsurgical edema. We analyzed two different methods of administration of a Dexamethasone, using the intravenous route and the submucosal injection route in patients undergoing surgical extraction of impacted mandibular third molars. Both the modes of application proved to prevent the postoperative sequelae of third molar surgery to a degree, with the submucosal mode proving more successful in preventing swelling and mouth opening over the study period. The patients also reported a clinically significant but difference in pain perception in the intravenous mode over the study period.

The submucosal mode requires less expertise on the clinician's part, no separate armamentarium, and the familiarity with the site of injection to the operating maxillofacial surgeon makes it more effective mode of administration in preventing third molar sequelae.

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