

Role of Corticosteroids in reducing Postoperative Swelling, Pain, and Trismus following Surgical Extraction of Impacted Mandibular Third Molars

¹Nambidiveetil Raakesh, ²Veeraraghavan Ravi, ³Puthalath Ushass, ⁴Jaeson M Painatt, ⁵V Manoj Kumar
⁶Prem Sasikumar, ⁷Anil K Subhash, ⁸Purushothaman Navya

ABSTRACT

Introduction: Surgical extraction of impacted mandibular third molar is a common procedure in routine maxillofacial practice. This procedure is generally followed by pain, trismus, and swelling. Various methods have been attempted to reduce these unfavorable postoperative sequelae and to improve patient comfort in postoperative period. Use of steroids is one of the commonly followed practices. In our study, we compare the efficiency of steroids given preoperatively in reducing postoperative sequelae, when given in equivalent steroid doses.

Materials and methods: This is a single blinded prospective clinical trial, involving 75 healthy patients requiring surgical extraction under local anesthesia. Facial swelling, maximal interincisal distance, and pain were measured by an independent examiner at baseline preoperatively, and at 3rd and 7th postoperative days. These patients were randomly divided into three groups. Group I (control group) patients were not given any preoperative steroids. In group II, 4 mg of dexamethasone was given intravenously at the beginning of procedure. In group III, 100 mg of hydrocortisone was given in submucosal region preoperatively. All the procedures were performed by a single surgeon to avoid bias. Data obtained were entered and processed using Statistical Package for the Social Sciences (SPSS) version 1.8 statistical software.

Results: Postoperative pain does not seem to be significantly affected by administration of steroids. Swelling was significantly less in patients who received steroids preoperatively. Patients who received intravenous dexamethasone injection showed a significantly lower degree of trismus ($p < 0.05$). Hydrocortisone also seemed to have reduced the incidence of trismus; however, it was not statistically significant ($p > 0.05$).

Conclusion: This study concludes that preoperative administration of steroids is effective in reducing unfavorable postoperative

sequelae and improves patient comfort. Dexamethasone 4 mg given intravenously is an effective way of minimizing swelling and trismus after removal of impacted lower third molars. Submucosal hydrocortisone is effective in preventing excess swelling but its role against trismus and pain are questionable. Both modalities offer simple, safe, painless, noninvasive, and cost-effective treatment means to counteract postoperative discomfort.

Keywords: Dexamethasone, Hydrocortisone, Impacted mandibular third molars.

How to cite this article: Raakesh N, Ravi V, Ushass P, Painatt JM, Kumar VM, Sasikumar P, Subhash AK, Navya P. Role of Corticosteroids in reducing Postoperative Swelling, Pain, and Trismus following Surgical Extraction of Impacted Mandibular Third Molars. *Int J Oral Care Res* 2017;5(4):265-269.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Surgical removal of third molars accounts for a large volume of cases in contemporary oral and maxillofacial surgical practice. It requires meticulous planning and application of surgical skills during both diagnosis and postoperative management.¹

Odontectomy of mandibular third molar is generally followed by pain, trismus, and swelling. Pain is subjective and can be influenced by different factors such as age, sex, anxiety, and surgical difficulty. Pain usually begins within 3 hours after surgery and ranges in intensity from moderate to severe. This procedure can also result in significant edema and inflammation in the operative field. Corticosteroids have numerous effects on body function. The normal rate of production of hydrocortisone is 15 to 30 mg/day and it increases up to 300 mg during stress. For inflammation to be suppressed, exogenous hydrocortisone must be administered in doses exceeding the normal physiological amounts of hydrocortisone released. Several researchers have found that hydrocortisone prevents inflammation following oral surgery.²

Dexamethasone is a synthetic corticosteroid with much greater anti-inflammatory effect. The potency of dexamethasone is about 30 times that of natural corticosteroid.³ Postoperative swelling and edema are due to the conversion of phospholipids into arachidonic acid by

^{1,6,7}Senior Lecturer, ²Head, ^{3,5}Professor, ⁴Assistant Professor
⁸Postgraduate Student

^{1,5,6}Department of Oral and Maxillofacial Surgery, Mahe Institute of Dental Sciences & Hospital, Mahe, Puducherry, India

^{2,4}Department of Oral and Maxillofacial Surgery, Amrita School of Dentistry, Kochi, Kerala, India

⁷Department of Prosthodontics, Mahe Institute of Dental Sciences & Hospital, Mahe, Puducherry, India

⁸Department of Orthodontics, Mahe Institute of Dental Sciences & Hospital, Mahe, Puducherry, India

Corresponding Author: Nambidiveetil Raakesh, S/o V Gopidas Advocate Ayyanthole PO, TC 52/930, Thrissur-680003, Kerala India, Phone: +918547003159, e-mail: raaksn@gmail.com

phospholipase A2, and the resultant synthesis of prostaglandins, leukotrienes, or thromboxane-related substance. Corticosteroids such as dexamethasone may inhibit the initial step in this process and have been extensively used in varying regimens and routes to lessen inflammatory sequelae after third molar surgery.⁴

Over several decades, many studies have reported the effectiveness of corticosteroids given before or just after removal of third molars in relieving discomfort.⁵ Most of these studies analyzed the effect of dexamethasone. A few have dealt with prednisolone, methylprednisolone, and triamcinolone. On reviewing literature, there are few reports on hydrocortisone in oral surgery. The appropriate dosage of steroid therapy is another unsettled issue. In this study, we evaluated the effect of preoperatively administered hydrocortisone and dexamethasone on postoperative pain, swelling, and trismus in surgical removal of third molar.

MATERIALS AND METHODS

This study was conducted in the Department of Oral and Maxillofacial Surgery, Amrita School of Dentistry, Amrita Institute of Medical Sciences (AIMS), Kochi, India, and included 75 patients, each of whom required removal of a single impacted mandibular third molar under local anesthesia.

Moderately difficult cases of impacted mandibular third molar were only included in this study. Pederson index was used for assessing the difficulty of the impacted tooth. Only American Society of Anesthesiologists grade I patients between the age of 20 and 35 years were included in this study to avoid bias in demographic data distribution. Patients who had active local infection, patients with compromised medical status, those with history of allergy to the drugs used in the study and use of anti-inflammatory drugs or antibiotics within 7 days prior to surgery, and pregnant or lactating patients were excluded from this study.

The patients were randomly divided into three groups. In group I, patients were not given any corticosteroids. In group II, dexamethasone was given intravenously and in group III patient's hydrocortisone was given via submucosal route. They underwent surgical removal of third molar under local anesthesia. All patients were given antibiotic amoxicillin 500 mg orally, and analgesic ibuprofen 400 mg/paracetamol 500 mg to be taken 8th hourly for 5 days. They were also given a chlorhexidine mouth rinse to be used twice daily starting on the day after procedure for 3 days. Many clinical factors such as difficulty of the procedure and operating time can potentially influence the study parameters. In order to avoid any bias on these counts, we analyzed the clinical factors using chi-square test and Kruskal–Wallis test.

Operative Technique

The same surgeon operated on all patients using a standard technique to avoid operator bias. Anesthesia was by a standard inferior alveolar nerve block and long buccal and lingual nerve block using a solution of 2% lignocaine hydrochloride and adrenaline 1:80,000. Standard Ward's incision was placed and full thickness mucoperiosteal flap was reflected. Bone was then removed around the tooth with a round bur on a straight hand piece under continuous irrigation with saline solution. The crown or roots were sectioned when necessary. After complete extraction of the tooth (or its components), the socket was inspected, irrigated copiously, and the flap was sutured back with interrupted 3/0 braided silk sutures. A small gauze pack was then applied to the site and the usual postoperative instructions given to the patient. The duration of operation (minutes from incision to the last suture) was recorded.

Assessment and Follow-up

Measurements of facial swelling, trismus, and pain were made preoperatively, 3rd and 7th postoperative days by an independent examiner.

Facial swelling on the operated side was evaluated by two facial measurements: tragus–lip commissure (TL) and lateral canthus–gonion (LG) using a flexible ruler. The average sum of the two values (mm) was taken as the baseline for that side. Trismus was measured as the difference in maximal mouth opening before and after the procedure on 3rd and 7th days using flexible ruler. Postoperative pain was evaluated with a visual analog scale that ranged from 0 = “no pain” to 10 = “the worst possible pain” preoperatively and on the 3rd and 7th days of follow-up. The patients were also instructed to record the number of rescue analgesics tablets required postoperatively on each day until the 7th postoperative day.

Data Analysis

Data obtained were incrementally entered during the course of the study to SPSS 1.8 statistical software package and then processed. The study included three groups (control, dexamethasone, and hydrocortisone group) and three different days (preoperative day, 3rd and 7th day). Kruskal–Wallis test was done to analyze the difference between groups and Friedman's test was done to identify the difference between each days in a group. Further, Mann–Whitney was done to compare difference between group pairs.

RESULTS

The subjects in all three groups were found to be statistically evenly balanced with respect to demographic

Table 1: Pain

Pain	Group I		Group II		Group III		p*-value
	Mean \pm SD	Median (Min–Max)	Mean \pm SD	Median (Min–Max)	Mean \pm SD	Median (Min–Max)	
Day 0	0.12 \pm 0.600	0.00 (0–3)	0.56 \pm 1.44	0.00 (0–5)	0.44 \pm 1.12	0.00 (0–4)	0.317
Day 3	2.20 \pm 1.94	3 (0–6)	1.96 \pm 2.22	1 (0–6)	1.76 \pm 2.16	0.00 (0–6)	0.695
Day 7	0.80 \pm 1.04	0.00 (0–3)	0.88 \pm 1.83	0.00 (0–6)	1.32 \pm 1.65	1 (0–7)	0.160
p ⁺ -value	<0.000		<0.002		<0.008		

*Kruskal–Wallis test: difference between groups; ⁺Friedman test: difference in days in each group; SD: Standard deviation

Table 2: Swelling

Swelling	Group I		Group II		Group III		p*-value
	Mean \pm SD	Median (Min–Max)	Mean \pm SD	Median (Min–Max)	Mean \pm SD	Median (Min–Max)	
Day 0	11.2980 \pm 0.626	11 (10–12.5)	11.020 \pm 0.567	11 (10–12)	11.188 \pm 0.667	11 (10–12.50)	0.385
Day 3	11.986 \pm 0.656	12 (10.50–13)	11.368 \pm 0.506	11.50 (10.50–12)	11.53 \pm 0.623	11.50 (10.50–13)	0.004
Day 7	11.664 \pm 0.690	11.5 (10–13)	11.162 \pm 0.534	11.05 (10–12)	11.338 \pm 0.609	11.50 (10.50–12.50)	0.023
p ⁺ -value	<0.000		<0.000		<0.000		

*Kruskal–Wallis test: difference between groups; ⁺Friedman test: difference in days in each group; SD: Standard deviation

Table 3: Comparison of all in group pairs

Difference of swelling between two groups	Groups I and II	Groups I and III	Groups II and III
Day 0–3*	0.025	0.015	0.951
Day 0–7*	0.019	0.043	0.737

*Mann–Whitney test

Table 4: Comparison of all in group pairs

Difference in interincisal distance between two groups	Groups I and II	Groups I and III
Day 0–3*	0.02	0.388
Day 0–7*	0.01	0.377

*Mann–Whitney test

Table 5: Interincisal distance to compare trismus

Interincisal distance	Group I		Group II		Group III		p*-value
	Mean \pm SD	Median (Min–Max)	Mean \pm SD	Median (Min–Max)	Mean \pm SD	Median (Min–Max)	
Day 0	47.52 \pm 5.99	46.0 (40–66)	42.88 \pm 7.67	43.0 (19–62)	45.12 \pm 3.86	45 (37–51)	0.029
Day 3	30.96 \pm 7.56	31.0 (16–44)	33.08 \pm 9.15	39 (16–55)	31.32 \pm 5.77	33 (21–42)	0.670
Day 7	38.84 \pm 5.80	40.0 (21.0–46.0)	39 \pm 6.86	41 (23–57)	38.44 \pm 5.55	40 (26–50)	0.874
p ⁺ -value	<0.001		<0.001		<0.001		

*Kruskal–Wallis test: difference between groups; ⁺Friedman test: difference in days in each group; SD: Standard deviation

variables (age and gender) as well as clinical variables (duration of surgery and surgical difficulty). On both days 3 and 7, the steroid groups showed lower pain scores than the control group, but the difference was not significant ($p > 0.05$). On comparing with three groups, swelling was significantly less in patients who received dexamethasone intravenously and hydrocortisone submucosally ($p < 0.05$). The patients who received dexamethasone injection intravenously showed a much lower degree of trismus ($p < 0.05$) when compared with the control group. Though hydrocortisone also seems to have prevented trismus to an extent, the effect it produced was not statistically significant ($p > 0.05$; Tables 1 to 5).

DISCUSSION

Edema, pain, and trismus following minor oral surgery can affect the quality of life of the patient significantly. In surgical removal of third molar, prevention of postoperative discomfort is probably a better patient care approach than treating the condition after the symptoms

are expressed. Anti-inflammatory medications, such as steroids, have been used with good results by many clinicians toward this purpose. Dexamethasone is a synthetic, long-acting, high-potency glucocorticoid with anti-inflammatory and immunosuppression effects. Its glucocorticoid effect is at least 25 times that of hydrocortisone. However, unlike hydrocortisone, it has only a minimal mineralocorticoid effect. To investigate the efficacy of preoperative corticosteroid therapy in third molar surgery, this study compared the anti-inflammatory and analgesic efficacy of intravenous dexamethasone and submucosal hydrocortisone against the control group.

Many research teams have evaluated the use of various corticosteroids like dexamethasone, methylprednisolone, triamcinolone, and betamethasone in third molar surgery. Though hydrocortisone has been widely used in surgical procedures like joint arthroscopies, and as intra-articular injections,⁶ there are very few studies examining its role in oral surgical procedures. In our study, we evaluated the preventive effect of short-acting

single dose of hydrocortisone in surgical removal of third molars as compared with that of dexamethasone, the standard drug used in such surgeries. For postoperative pain relief, all the 75 patients were prescribed standard analgesic regimen of ibuprofen 400 mg/paracetamol 500 mg 8th hourly for 3 days.

As expected, the pain score typically increased at day 3 and then came down by day 7 in all the three groups. On both days 3 and 7, the steroid groups showed lower pain scores than the control group, but the difference was not significant. Thus, we have to conclude that neither of the steroids contributed to any significant reduction of postoperative pain. Available literature gives no conclusive evidence of effectiveness of steroid therapy in pain relief. Baxendale et al⁷ reported significantly reduced pain with oral administration of 8 mg of dexamethasone. Neupert et al⁸ and Pedersen⁹ reported similar results with pre-surgical injection of 4 mg dexamethasone. On the contrary, Milles and Desjardins¹⁰ found no effect on pain on administration of methylprednisolone. Laureano Filho et al¹¹ found no effect on postoperative pain with either 4 or 8 mg doses of dexamethasone. It is probable that the analgesic effect of the nonsteroidal anti-inflammatory drug masked the possible effect of the steroids.

When comparing with three groups, swelling was significantly less in patients who received dexamethasone intravenously and hydrocortisone submucosally. There was no significant difference between the efficacy of the two steroid groups. Berine and Hollander¹² found that the intravenous injections of 125 mg methylprednisolone before surgery had a persistent effect on inflammation up to 3 days postsurgery. Skjelbred and Løkken¹³ reported significant reduction in swelling in patients who received 9 mg intramuscular betamethasone. Ware et al¹⁴ also reported similar results and found that different doses of dexamethasone produced no significant difference in the outcome. Similarly, Schaberg et al¹⁵ found a reduction in swelling after administration of methylprednisolone intramuscularly 12 hours preoperatively.

Trismus following third molar surgery is a manifestation of muscle spasm primarily affecting the medial pterygoid muscle. Muscle spasm also contributes to pain and tenderness. In this current study, the patients who received dexamethasone injection intravenously showed a much lower degree of trismus when compared with the control group. Though hydrocortisone also seems to have prevented trismus to an extent, the effect it produced was not statistically significant. ElHag et al¹⁶ found that 10 mg dexamethasone administered both pre- and post-operatively resulted in a significant reduction in trismus. Graziani et al¹⁷ obtained greater reduction in trismus with alveolar corticosteroid powder than with submucosal injection of the drug. The relatively poor results of

hydrocortisone may be related to its short duration of action as the initiation of muscle spasm is a slow process.

Corticosteroid use is reported to be associated with several adverse effects most of which are associated with its long-term use. In our study, two patients reported with postoperative infection after day 7 in dexamethasone group. One such infection occurred in the control group. Though the difference is not significant, the perceived link between the risk of infection and dexamethasone use requires a closer review.

CONCLUSION

The use of corticosteroid following third molar surgical removal reduces the degree of trismus and inflammation. In this single-blinded prospective study, we conclude that preoperative administration of intravenous dexamethasone and submucosal hydrocortisone is effective in combating postsurgical discomfort. Superior effects were seen in systemic dexamethasone application. But the short-acting hydrocortisone may not be an appropriate choice in preventing postsurgical trismus.

REFERENCES

1. Susarla AM, Dodson TB. Risk factors for third molar extraction difficulty. *J Oral Maxillofac Surg* 2004 Nov;62(11):1363-1371.
2. Gupta D, Sharma SC. Oral submucous fibrosis—a new treatment regimen. *J Oral Maxillofac Surg* 1988 Oct;46(10):830-833.
3. Boonsirirath K, Klongnoi B, Sirintawat N, Saegsiriravin C, Wongsirichat N. Comparative study of the effect of dexamethasone injection and consumption in lower third molar surgery. *Int J Oral Maxillofac Surg* 2012 Feb;41(2):244-247.
4. Grossi GB, Maiorana C, Garramone RA, Borgonovo A, Beretta M, Farronato D, Santoro F. Effect of submucosal injection of dexamethasone on postoperative discomfort after third molar surgery: a prospective study. *J Oral Maxillofac Surg* 2007 Nov;65(11):2218-2226.
5. Majid OW. Submucosal dexamethasone injection improves quality of life measures after third molar surgery, a comparative study. *J Oral Maxillofac Surg* 2011 Sep;69(9):2289-2297.
6. Lavelle W, Lavelle ED, Lavelle L. Intra articular injections. *Med Clin North Am* 2007 Mar;91(2):241-250.
7. Baxendale BR, Vater M, Lavery KM. Dexamethasone reduces pain and swelling following extraction of third molar teeth. *Anaesthesia* 1993 Nov;48(11):961-964.
8. Neupert EA 3rd, Lee JW, Philput CB, Gordon JR. Evaluation of dexamethasone for reduction of postsurgical sequelae of third molar removal. *J Oral Maxillofac Surg* 1992 Nov;50(11):1172-1182.
9. Pedersen A. Decadron phosphate in the relief of complaints after third molar surgery. A double blind controlled trail with bilateral oral surgery. *Int J Oral Maxillofac Surg* 1985 Jun;14(3):235-240.
10. Milles M, Desjardins PJ. Reduction of postoperative swelling by low dose methylprednisolone; an experimental study. *J Oral Maxillofac Surg* 1993 Sep;51(9):987-991.
11. Laureano Filho JR, Maurette PE, Allais M, Cotinho M, Fernandes C. Clinical comparative study of the effectiveness

- of two dosages to control postoperative swelling, trismus, and pain after surgical extraction of mandibular third molars. *Med Oral Patol Oral Cir Bucal* 2008 Feb;13(2): E129-E132.
12. Beirne OR, Hollander B. The effect of methylprednisolone on pain, trismus, and swelling after removal of third molar. *Oral Surg Oral Med Oral Pathol* 1986 Feb;61(2):134-138.
 13. Skjelbred P, Løkken P. Post operative pain and swelling by a corticosteroid injected 3 hours after surgery. *Eur J Clin Pharmacol* 1982 Mar;23(2):141-146.
 14. Ware WH, Campbell JC, Taylor RC. Effect of a steroid on post operative swelling and trismus. *Dent Prog* 1963;3:116.
 15. Schaberg SJ, Stuller CB, Edwards SM. Effect of methylprednisolone on swelling after orthognathic surgery. *J Oral Maxillofac Surg* 1984 Jun;42(6):356-361.
 16. ElHag M, Coghlan K, Christmas P, Harvey W, Harris M. The anti-inflammatory effect of dexamethasone and therapeutic ultrasound in oral surgery. *Br J Oral Maxillofac Surg* 1985 Feb;23(1):17-23.
 17. Graziani F, D'Aiuto F, Arduino PG, Tonelli M, Gabriele M. Perioperative dexamethasone reduces post-surgical sequelae of wisdom tooth removal. A split-mouth randomized double-masked clinical trial. *Int J Oral Maxillofac Surg* 2006 Mar;35(3):241-246.