RESEARCH PAPER

Comparison of Pre-emptive Dexamethasone and Methylprednisolone for Control of Pain, Swelling, and Trismus Following Mandibular Third Molar Surgery

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Received: 25th June 2026; **Revised:** 28th July 2026; **Accepted:** 10th October 2026; **Available Online:** 15th October 2026

ABSTRACT

Background:
Surgical extraction of impacted mandibular third molars is commonly associated with postoperative pain, facial swelling, and trismus. Pre-emptive corticosteroid administration may reduce these inflammatory complications and improve postoperative recovery.

Aim:
To compare the effectiveness of pre-emptive dexamethasone and methylprednisolone in controlling postoperative pain, swelling, and trismus following mandibular third molar surgery.

Materials and Methods:

This prospective, randomized, double-blind comparative study was designed to include 86 patients undergoing surgical extraction of impacted mandibular third molars. Patients were allocated into two groups of 43 each. Group A received 8 mg dexamethasone, while Group B received 40 mg methylprednisolone intramuscularly 30 minutes before surgery. Postoperative pain was assessed using the Visual Analog Scale at 6, 12, 24, 48, and 72 hours. Facial swelling and maximum interincisal mouth opening were evaluated preoperatively and on postoperative days 2 and 7. Statistical significance was set at $p<0.05$.

Results:
In the illustrative dataset, postoperative pain scores were significantly lower in the dexamethasone group at all assessment intervals ($p<0.05$). Rescue analgesic consumption was also lower with dexamethasone (2.42 ± 1.12 versus 3.35 ± 1.28 tablets; $p<0.001$). Facial swelling on postoperative day 2 was significantly lower in the dexamethasone group ($6.1 \pm 2.4\%$ versus $9.1 \pm 3.2\%$; $p<0.001$). Reduction in mouth opening on day 2 was also significantly lower with dexamethasone (9.2 ± 3.6 mm versus 12.3 ± 4.1 mm; $p<0.001$). Both groups demonstrated progressive postoperative recovery.

Conclusion:
The illustrative findings suggest that pre-emptive dexamethasone may provide better postoperative pain control, reduced facial swelling, and improved mouth opening compared with methylprednisolone following mandibular third molar surgery. Confirmation through analysis of actual patient data is necessary.

Keywords: Dexamethasone; Methylprednisolone; Mandibular Third Molar; Pre-emptive Corticosteroids; Postoperative Pain; Facial Swelling; Trismus.

How to cite this article: *Dushyantsinh Vala1 Dr. Jigisha Jain2 Dr. M. Rajasekar3 Dr. Jambu Jain4 Dr. Ashok Yadav5 Dr. Raksha Thakur6*. Comparison of Pre-emptive Dexamethasone and Methylprednisolone for Control of Pain, Swelling, and Trismus Following Mandibular Third Molar Surgery. Int J Drug Deliv Technol. 2026;16(88s):1820-1826. DOI: 10.25258/ijddt.16.88s.182.*

Source of support: Nil.

Conflict of interest: *None*

INTRODUCTION

Surgical extraction of impacted mandibular third molars is among the most frequently performed procedures in oral and maxillofacial surgery. Postoperative pain, facial swelling, and trismus are common complications resulting from tissue trauma and the associated inflammatory response. These complications may adversely affect patients' quality of life and delay their return to routine activities. Corticosteroids are widely used to minimize postoperative inflammation and improve recovery following third molar surgery [1].

Dexamethasone and methylprednisolone are commonly administered corticosteroids because of their potent anti-inflammatory properties. Both agents inhibit inflammatory mediators, reduce vascular permeability, and limit postoperative edema. However, differences in their pharmacological potency, duration of action, and tissue distribution may influence their clinical effectiveness [2,3].

Pre-emptive administration of corticosteroids before surgical trauma may suppress the inflammatory cascade at an early stage, potentially providing better postoperative pain control and reducing swelling and trismus. Previous studies have demonstrated beneficial effects of preoperative corticosteroids, particularly when combined with standard analgesic protocols [4].

Postoperative swelling and restricted mouth opening remain important concerns following impacted mandibular third molar surgery, emphasizing the need for effective perioperative management strategies [5]. Comparative clinical studies evaluating dexamethasone and methylprednisolone have reported reductions in postoperative discomfort, although differences in administration routes, dosages, and assessment methods have produced variable findings [6,7].

Therefore, the present study was designed to **compare the effectiveness of pre-emptive dexamethasone and methylprednisolone in controlling postoperative pain, facial swelling, and trismus following surgical extraction of impacted mandibular third molars.**

Aim and Objectives

Aim: To compare the effectiveness of pre-emptive dexamethasone and methylprednisolone in reducing postoperative complications following mandibular third molar surgery.

Objectives:

1. To compare postoperative pain intensity between the two groups.
2. To evaluate postoperative facial swelling.
3. To assess postoperative trismus through changes in maximum mouth opening.
4. To compare postoperative analgesic requirements and recovery.

MATERIALS AND METHODS

Study Design and Setting

This prospective, randomized, double-blind comparative clinical study was designed to evaluate the effectiveness of pre-emptive dexamethasone and methylprednisolone among patients undergoing surgical extraction of impacted mandibular third molars in the Department of Oral and Maxillofacial Surgery at a tertiary care dental institution.

Sample Size

A total of **86 patients** were planned for inclusion, with 43 participants allocated to each group. The sample size was calculated assuming a 95% confidence level, 80% statistical power, a standardized effect size of 0.65, and approximately 10% anticipated attrition.

Inclusion Criteria

- Patients aged 18–45 years.
- Patients requiring surgical extraction of impacted mandibular third molars.
- Patients classified as ASA physical status I or II.
- Patients willing to provide written informed consent.

Exclusion Criteria

- Patients with uncontrolled systemic diseases.
- History of corticosteroid allergy or contraindication.
- Pregnancy or lactation.
- Active infection at the surgical site.
- Recent corticosteroid or anti-inflammatory medication use.
- Patients with immunosuppressive disorders.

Randomization and Study Groups

Participants were randomly allocated into two equal groups using computer-generated randomization. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes.

- **Group A (n=43):** Received 8 mg dexamethasone intramuscularly 30 minutes before surgery.
- **Group B (n=43):** Received 40 mg methylprednisolone intramuscularly 30 minutes before surgery.

The medications were prepared and administered by an independent clinician to maintain blinding of the patients and outcome assessors.

Surgical Procedure

All surgical extractions were performed under local anesthesia using 2% lignocaine with adrenaline (1:80,000). A standardized surgical technique involving mucoperiosteal flap elevation, bone removal, tooth sectioning when required, irrigation, and suturing was followed. Operative duration and surgical difficulty were recorded.

Postoperative antibiotics and analgesics were prescribed according to a standardized institutional protocol, with identical regimens in both groups.

Outcome Assessment

1. Postoperative Pain

Pain intensity was assessed using a 10-point Visual Analog Scale (VAS), where 0 represented no pain and 10 represented the worst imaginable pain. Pain scores were recorded at 6, 12, 24, 48, and 72 hours postoperatively.

2. Facial Swelling

Facial swelling was evaluated using a flexible measuring tape and standardized facial reference points. Measurements were obtained preoperatively and on postoperative days 2 and 7.

3. Trismus

Maximum interincisal mouth opening was measured using a digital vernier caliper before surgery and on postoperative days 2 and 7. Reduction in mouth opening was considered indicative of trismus.

4. Analgesic Consumption

The number of rescue analgesic tablets consumed during the first 72 postoperative hours was recorded.

Statistical Analysis

Data were analyzed using **IBM SPSS Statistics version 25.0**. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages.

Independent-samples t-tests or Mann–Whitney U tests were used for between-group comparisons, depending on data distribution. Repeated-measures ANOVA or an appropriate mixed-effects model was used to evaluate changes in pain, swelling, and mouth opening over time. Chi-square or Fisher's exact tests were applied to categorical variables.

A **p-value <0.05** was considered statistically significant.

Ethical Considerations

The study protocol was subject to approval by the Institutional Ethics Committee. Written informed consent was required from all participants before enrollment. The study was to be conducted in accordance with the ethical principles of the Declaration of Helsinki.

Note: This is a proposed methodology. The drug doses, administration route, timing, analgesic protocol, and assessment schedule should be

confirmed against the actual study protocol before submission.

RESULTS

The proposed study included **86 patients** undergoing surgical extraction of impacted mandibular third molars, randomly allocated into two groups: **Group A (dexamethasone, n=43)** and **Group B (methylprednisolone, n=43)**. The following results are **illustrative data for manuscript preparation**, not findings from actual patient records. The groups were comparable in baseline demographic and clinical characteristics. Both corticosteroids were associated with postoperative improvement, with dexamethasone showing lower pain scores, reduced facial swelling, and less trismus in the illustrative comparison.

Table 1. Comparison of Baseline Demographic and Clinical Characteristics

Parameter	Group A: Dexamethasone (n=43)	Group B: Methylprednisolone (n=43)	p-value
Age (years), mean ± SD	27.4 ± 5.8	28.1 ± 6.2	0.590
Male, n (%)	24 (55.8%)	22 (51.2%)	0.666
Female, n (%)	19 (44.2%)	21 (48.8%)	
BMI (kg/m²), mean ± SD	23.8 ± 2.9	24.1 ± 3.1	0.644
Operative duration (minutes)	32.6 ± 8.4	33.8 ± 9.1	0.527
Preoperative mouth opening (mm)	43.8 ± 4.2	44.1 ± 4.5	0.750
Mesioangular impaction, n (%)	21 (48.8%)	20 (46.5%)	0.829
Vertical impaction, n (%)	13 (30.2%)	14 (32.6%)	
Horizontal impaction, n (%)	9 (20.9%)	9 (20.9%)	

The two groups demonstrated comparable baseline characteristics, including age, sex distribution, operative duration, preoperative mouth opening, and impaction type. No statistically significant differences were observed ($p>0.05$).

Table 2. Comparison of Postoperative Pain Scores Between Groups

Postoperative interval	Group A: Dexamethasone (Mean ± SD)	Group B: Methylprednisolone (Mean ± SD)	p-value
6 hours	3.42 ± 1.18	4.28 ± 1.32	**0.002**
12 hours	3.18 ± 1.12	4.02 ± 1.25	**0.001**
24 hours	2.86 ± 1.06	3.68 ± 1.19	**0.001**
48 hours	2.14 ± 0.92	2.82 ± 1.08	**0.002**
72 hours	1.36 ± 0.74	1.88 ± 0.86	**0.003**
Rescue analgesic consumption	2.42 ± 1.12	3.35 ± 1.28	**<0.001**

Postoperative interval	Group A: Dexamethasone (Mean ± SD)	Group B: Methylprednisolone (Mean ± SD)	p-value
(tablets/72 hours)			

VAS: Visual Analog Scale (0–10).

Postoperative pain scores decreased progressively in both groups. However, the dexamethasone group demonstrated consistently lower pain scores at all assessment intervals. The difference was statistically significant at 6, 12, 24, 48, and 72 hours ($p<0.05$). Rescue analgesic consumption was also lower in the dexamethasone group.

Table 3. Comparison of Postoperative Facial Swelling Between Groups

Parameter	Group A: Dexamethasone (Mean ± SD)	Group B: Methylprednisolone (Mean ± SD)	p-value
Baseline facial measurement (cm)	12.84 ± 0.92	12.91 ± 0.96	0.731
Postoperative day 2 (cm)	13.62 ± 1.04	14.08 ± 1.12	**0.052**
Postoperative day 7 (cm)	12.98 ± 0.94	13.22 ± 1.01	0.257
Increase from baseline on day 2 (cm)	0.78 ± 0.32	1.17 ± 0.41	**<0.001**
Increase from baseline on day 7 (cm)	0.14 ± 0.12	0.31 ± 0.18	**<0.001**
Percentage swelling on day 2 (%)	6.1 ± 2.4	9.1 ± 3.2	**<0.001**

Facial swelling was greatest on postoperative day 2 in both groups and subsequently decreased by day 7. The dexamethasone group demonstrated significantly lower increases in facial measurements on both postoperative days 2 and 7 ($p<0.001$), indicating better control of postoperative edema in the illustrative dataset.

Table 4. Comparison of Postoperative Trismus and Mouth Opening

Parameter	Group A: Dexamethasone (Mean ± SD)	Group B: Methylprednisolone (Mean ± SD)	p-value
Preoperative mouth opening (mm)	43.8 ± 4.2	44.1 ± 4.5	0.750
Postoperative day 2 (mm)	34.6 ± 4.8	31.8 ± 5.1	**0.010**
Postoperative day 7 (mm)	41.2 ± 4.3	39.4 ± 4.7	0.067
Reduction in mouth opening on day 2 (mm)	9.2 ± 3.6	12.3 ± 4.1	**<0.001**

Parameter	Group A: Dexamethasone (Mean ± SD)	Group B: Methylprednisolone (Mean ± SD)	p-value
Reduction in mouth opening on day 7 (mm)	2.6 ± 1.8	4.7 ± 2.3	**<0.001**
Recovery of baseline mouth opening by day 7 (%)	94.1 ± 4.2	89.3 ± 5.1	**<0.001**

Both groups experienced reduced mouth opening following surgery, with the greatest restriction observed on postoperative day 2. Patients receiving dexamethasone demonstrated significantly less reduction in mouth opening on days 2 and 7 compared with those receiving methylprednisolone ($p<0.001$). Recovery toward baseline mouth opening was greater in the dexamethasone group.

The following discussion, conclusion, and structured abstract are based on the **illustrative results previously prepared for 86 patients**. They are manuscript drafts and should be revised after analysis of actual clinical data.

DISCUSSION

Surgical extraction of impacted mandibular third molars frequently results in postoperative pain, swelling, and trismus due to tissue injury and the subsequent inflammatory response. Pre-emptive corticosteroid administration is an established approach for reducing these postoperative complications. In the present illustrative study, both dexamethasone and methylprednisolone demonstrated favorable postoperative recovery patterns; however, dexamethasone showed comparatively better outcomes in terms of pain reduction, facial swelling, and mouth opening.

The dexamethasone group demonstrated significantly lower postoperative pain scores at 6, 12, 24, 48, and 72 hours compared with the methylprednisolone group ($p<0.05$). These findings are consistent with the anti-inflammatory benefits of locally administered dexamethasone described by Rajendiran et al. [8]. Similarly, Singh et al. [9] evaluated the comparative effectiveness of dexamethasone and methylprednisolone and highlighted the importance of corticosteroid selection in controlling postoperative discomfort. Systematic evidence also supports corticosteroid administration for reducing acute pain following mandibular third molar surgery [10].

Postoperative facial swelling was significantly lower in the dexamethasone group, particularly when assessed as the increase from baseline on postoperative days 2 and 7 ($p<0.001$). This may be attributed to the potent anti-inflammatory activity and longer biological duration of action of dexamethasone. González-Morelos et al. [11] demonstrated the effectiveness of methylprednisolone in controlling postoperative inflammatory complications, although differences in corticosteroid dosage and administration protocols may influence comparative outcomes.

Trismus represents another important postoperative complication that affects chewing, oral hygiene, and overall patient comfort. In the present illustrative analysis, the reduction in mouth opening was significantly lower among patients receiving dexamethasone. Srivastava et al. [12] compared the pre-emptive effects of dexamethasone and methylprednisolone following third molar surgery, supporting the clinical relevance of evaluating these agents. Larsen et al. [13] also demonstrated the role of methylprednisolone in postoperative recovery, emphasizing the importance of controlling inflammation to improve functional outcomes.

The present comparison additionally demonstrated lower rescue analgesic consumption in the dexamethasone group, suggesting improved postoperative comfort. Lau et al. [14] investigated different routes of dexamethasone administration and highlighted the relevance of administration technique in postoperative outcomes. Furthermore, corticosteroid-based pre-emptive analgesic strategies and demonstrated the potential benefits of combining dexamethasone with appropriate analgesic regimens. [15-17]

The major strengths of the proposed study include its randomized, double-blind design, standardized surgical protocol, and evaluation of multiple postoperative outcomes. However, the relatively small sample size, single-center setting, short follow-up duration, and potential variability in surgical difficulty may limit generalizability. Larger multicenter randomized trials with standardized

corticosteroid regimens are required to establish the optimal agent, dosage, and administration route.

CONCLUSION

Based on the illustrative findings, pre-emptive dexamethasone demonstrated better control of postoperative pain, facial swelling, and trismus compared with methylprednisolone following mandibular third molar surgery. Patients receiving dexamethasone showed lower pain scores, reduced analgesic requirements, less postoperative edema, and improved recovery of mouth opening.

Both corticosteroids may be useful for managing postoperative inflammatory complications. However, **the apparent superiority of dexamethasone requires confirmation using actual clinical data**, and treatment selection should consider patient characteristics, contraindications, and established clinical protocols.

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