Original Study

Open Access

Route-Based Evaluation Of Preoperative Dexamethasone Administration For Mandibular Third Molar Removal: A Quasi-Experimental Analysis

M. Nadeem[1], S. Kanwal[2], M. Khalil[3]

[1]CIMS Dental College, CMH, Multan
[2]Muskurahat Foundation Pakistan Trust
[3]CIMS Dental College, CMH Multan

Introduction:
Dexamethasone is widely used to minimize postoperative pain, swelling, and trismus following third molar surgery; however, the optimal route of administration remains debated.
Objective:
To compare the clinical effectiveness of submucosal, intramuscular, and intravenous administration of dexamethasone in reducing postoperative complications after mandibular third molar extraction.
Methods:
This randomized controlled study was conducted at a private hospital in Multan from January to June 2024 after obtaining IRB approval. Thirty patients indicated for surgical removal of impacted mandibular third molars were randomly assigned to two groups (n = 15). Group A received 8 mg dexamethasone via the submucosal route at the surgical site, while Group B received the same dose through the systemic route (intramuscular or intravenous). Postoperative pain (VAS), facial swelling (linear measurement), and mouth opening (interincisal distance) were evaluated at 24 hours, 48 hours, and 7 days postoperatively. Data were analyzed using SPSS 26 with significance set at $p < 0.05$.
Results:
The mean age of participants was 26.8 ± 5.7 years, with an equal gender distribution. Both groups showed statistically significant reductions in postoperative pain, swelling, and trismus ($p < 0.05$). The submucosal group exhibited superior outcomes in pain and facial swelling reduction, particularly within the first 48 hours, though differences were not statistically significant.
Conclusion:
All routes of dexamethasone administration effectively reduced postoperative discomfort following third molar surgery. The submucosal route provided a slight clinical advantage, likely due to its localized anti-inflammatory effect, making it a practical and minimally invasive alternative for routine use.
Keywords:
Submucosal dexamethasone, Intramuscular injection, Intravenous injection, Third molar surgery, Postoperative complications.

Introduction:

The surgical extraction of impacted mandibular third molars is among the most frequently performed procedures in oral and maxillofacial surgery. Despite being routine, it is often accompanied by considerable postoperative discomfort, including pain, facial swelling, and trismus, resulting from the inflammatory response to surgical trauma involving soft and hard tissues (1, 2). These sequelae can lead to temporary functional impairment and reduced quality of life during the recovery phase (3).

Mandibular third molar impaction commonly occurs due to inadequate arch space, abnormal tooth angulation, or eruption obstruction. Although some impacted teeth remain asymptomatic, they may lead to pericoronitis, distal caries of the second molar, periodontal damage, or cystic changes, warranting surgical removal to prevent further complications (4, 5).

Various pharmacologic and non-pharmacologic interventions have been proposed to mitigate postoperative inflammation. Non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and proteolytic enzymes are commonly used pharmacologic agents, while adjunctive measures such as cryotherapy, laser therapy, and intraoral

drains offer modest benefits (6, 7). Among these, corticosteroids remain the mainstay for controlling postoperative inflammation due to their ability to inhibit phospholipase A_2, thereby suppressing prostaglandin and leukotriene synthesis (8).

Dexamethasone, a long-acting synthetic corticosteroid, is preferred in oral surgery because of its high anti-inflammatory potency and prolonged biological half-life of up to 72 hours, providing sustained postoperative relief (9). Traditionally, dexamethasone is administered intravenously (IV) or intramuscularly (IM). However, these systemic routes may cause patient discomfort and anxiety due to venipuncture or additional injections, limiting their applicability in outpatient dental practice (10). The submucosal (SM) route has emerged as a practical alternative, offering localized and sustained anti-inflammatory action with minimal systemic involvement (11).

Recent studies from South Asia have reported encouraging outcomes with submucosal dexamethasone. A study conducted in Karachi noted that patients undergoing mandibular third molar extraction experienced considerable postoperative discomfort despite standard analgesia, underscoring the need for adjunctive corticosteroid therapy (12). Similarly, a randomized trial at the Pakistan Institute of Medical Sciences, Islamabad, found that preoperative submucosal administration of 8 mg dexamethasone significantly reduced postoperative swelling and trismus compared with methylprednisolone and placebo (13). Another investigation from Hyderabad observed faster recovery and lower pain scores with local corticosteroid delivery (14). International studies have shown comparable or superior results for the submucosal route relative to intramuscular and intravenous administration (15).

Corresponding Author:

Name: Dr. Momil Nadeem Sheikh

Affiliation: CIMS Dental College

Email: momil1202@gmail.com

Date of Receiving: July 7, 2025

Date of Revision: October 14, 2025

Date of Acceptance: October 16, 2025

DOI: https://doi.org/10.69491/i2v2oizx

Postoperative pain, swelling, and trismus continue to challenge third molar surgery outcomes in the South Asian context. Despite widespread dexamethasone use, limited local evidence directly compares its submucosal and systemic routes. Therefore, the present study aims to evaluate and compare the efficacy of submucosal and intravenous administration of dexamethasone in minimizing postoperative pain, facial swelling, and trismus following surgical removal of impacted mandibular third molars, to identify the most effective and patient-friendly route for clinical use.

Materials and methods:

This study was conducted on 30 outpatients at the Department of Oral and Maxillofacial Surgery, a private hospital in Multan, over a six-month period from January to June 2024. It was designed as a randomized controlled study. Participants were randomly allocated into two equal groups of 15 each using a simple random sampling technique through the sealed envelope method.

The inclusion criteria comprised patients aged between 18 and 35 years, classified as ASA I (medically healthy), presenting with comparable mandibular third molar impactions having similar root formation and anatomical positions. Eligible participants had no history of systemic illness, had not used any medication within seven days prior to surgery, had no known drug allergies, and showed no clinical signs of active infection at the surgical site. The exclusion criteria included a history of gastrointestinal bleeding or peptic ulcer disease, known allergy to aspirin or NSAIDs, presence of systemic disorders, long-term corticosteroid therapy, pregnancy or lactation, and any active oral infections.

Informed written consent was obtained from all participants after explaining the study objectives, surgical procedure, and postoperative care. Ethical approval for the study was granted by the Institutional Ethical Committee. Before surgery, all patients underwent routine preoperative assessment, including standard haematological investigations.

Group A received 8 mg dexamethasone via submucosal injection adjacent to the surgical site, while Group B received the same dose through a systemic route, either intramuscularly or

intravenously, before surgery. All procedures were performed by the same experienced surgeon under aseptic conditions to ensure consistency. Local anesthesia was achieved through inferior alveolar and lingual nerve blocks. The surgical extraction of impacted mandibular third molars was carried out using standard techniques, including mucoperiosteal flap reflection, bone guttering, and tooth sectioning where required, with care taken to minimize soft tissue trauma. The surgical site was irrigated with 5% povidone-iodine solution, and wound closure was performed using 3-0 black braided silk sutures placed in an interrupted pattern. Standard postoperative instructions were given, and all patients received antibiotics and analgesics as part of routine care.

Follow-up evaluations were conducted on the third and seventh postoperative days. Pain was assessed using a 10 cm Visual Analogue Scale (VAS). Mouth opening was measured as the maximum interincisal distance in millimeters between the upper and lower central incisors. Facial swelling was evaluated using two extraoral linear measurements: from the tragus to the tip of the nose, and from the lateral canthus of the eye to the gonion. These measurements were recorded preoperatively and on postoperative days three and seven to determine changes in pain, swelling, and mouth opening.

Data Analysis:

Data analysis was carried out using SPSS version 21. Descriptive statistics were applied to summarize participants' demographic information and baseline data. Differences in postoperative pain, facial swelling, and trismus between the groups were assessed using the Independent Mann–Whitney U test according to data distribution. For comparisons within each group at different time intervals (post operative, third day, and seventh day), either the paired t-test or the Wilcoxon signed-rank test was used. A significance level of $p < 0.05$ was considered statistically meaningful.

Results:

The study included a total of 30 participants, with a mean age of 26.8 years (± 5.7 years), indicating a young adult population with moderate variability in age. The highest proportions were aged 19–22 years (33.3%), followed by 31–34 years (26.7%). There was an equal gender distribution, with 15 males (50%) and 15 females (50%), ensuring gender balance within the sample.In terms of the specific tooth involved in the study, tooth 48 was more frequently involved (56.7%) compared to tooth 38 (43.3%) as shown in table 1.

Table 1: Demographic Characteristics

Demographic Data		**n (%)**
Age (mean ± sd)		26.8 ±5.7
Age (years)	19-22	10 (33.3)
	23-26	3 (10)
	27-30	7 (23.3)
	31-34	8 (26.7)
	35-38	2 (6.7)
Gender	male	15 (50)
	female	15 (50)
Marital Status	Single	20 (66.7)
	married	10 (33.3)
Tooth involved	38	13 (43.3)
	48	17 (56.7)

The data compares submucosal and intravenous routes of drug administration across several postoperative parameters—visual analogue scale score, mouth opening, and facial swelling tragus and lateral canthus on Day 03 and Day 07 using median and interquartile range (IQR) values along with associated p-values to assess statistical significance. On Day 03, the median visual analogue scale score was slightly lower in the submucosal group (5, IQR 1) compared to the intravenous group (6, IQR 1), but this difference was not statistically significant ($p = 0.350$). By Day 07, both groups reported a median pain score of 4 (IQR 1), again with no significant difference ($p = 0.162$), suggesting that pain levels decreased similarly over time in both groups.

For mouth opening, both groups demonstrated a median value of 28 mm on Day 03, though the IQR was narrower in the submucosal group (3 mm) than in the intravenous group (6 mm), indicating slightly more consistency in outcomes. This difference was not statistically significant ($p = 0.273$). By Day 07, the submucosal group showed greater improvement with a median mouth opening of 32 mm (IQR 3) compared to 30 mm (IQR 4) in the intravenous group; however, the p-value remained above the threshold for significance ($p = 0.091$).

Swelling measured from the tragus showed a statistically significant difference on Day 03, with

the submucosal group having a lower median value (125 mm, IQR 6) than the intravenous group (129 mm, IQR 5), and a p-value of 0.041. This indicates that submucosal administration was more effective in reducing early postoperative swelling. However, by Day 07, both groups exhibited similar values—114 mm (IQR 12) for submucosal and 113 mm (IQR 7) for intravenous—with a non-significant p-value (0.819), showing resolution of swelling over time in both groups.

Swelling measured from the lateral canthus was identical between groups on Day 03, both reporting a median of 112 mm, though variability was greater in the intravenous group. The p-value of 0.833 indicated no significant difference. On Day 07, both groups again showed equal medians of 96 mm with no statistical significance (p = 0.753), reflecting comparable recovery trajectories. Overall, the submucosal route demonstrated a modest clinical advantage on Day 03 in reducing swelling but showed similar long-term outcomes compared to intravenous administration across all measured parameters

Table 2: Comparison of route of delivery of steroids in reduction of symptoms

Characteristics		**Day 03 Median (IQR)**	**P-value**	**Day 07 Median (IQR)**	**P-value**
Visual analogue scale score	Submucosal	5 (1)	0.350	4 (1)	0.162
	Intravenous	6 (1)		4 (1)	
Mouth Opening	Submucosal	28 (3)	0.273	32 (3)	0.091
	Intravenous	28 (6)		30 (4)	
Tragus	Submucosal	125 (6)	0.041*	114 (12)	0.819
	Intravenous	129 (5)		113 (7)	
Lateral Cantus	Submucosal	112 (6)	0.833	96 (10)	0.753
	Intravenous	112 (11)		96 (3)	

Mann whitney U test applied
*p-value significant ≤ 5%

Table 3: Postoperative recovery measured on day 03 and day 07

Characteristics	**Day 03 Median (IQR)**	**Day 07 Median (IQR)**	**P-value**
Visual analogy scale score	5.5 (1)	4 (2)	<0.001
Mouth Opening	28 (5)	31 (3)	<0.001
Tragus	127 (6)	113 (9)	<0.001
Lateral Cantus	112 (7)	96 (4)	<0.001

Wilcoxon test applied
*p-value significant ≤ 5%

The table 3 presents postoperative recovery outcomes measured on Day 03 and Day 07. Four clinical parameters were evaluated: Visual Analogue Scale (VAS) score for pain, mouth opening (in mm), and linear facial measurements from the tragus and lateral canthus (indicating swelling). All results are expressed as median (interquartile range), and P-values show the statistical significance of changes over time.

Discussion:

The surgical extraction of impacted mandibular third molars is one of the most common minor oral surgical procedures and is often accompanied by postoperative pain, swelling, and trismus consequences of acute inflammatory reactions following tissue trauma and surgical manipulation (16). Corticosteroids, especially dexamethasone**,** are widely recommended in oral and maxillofacial

surgery because of their potent anti-inflammatory and anti-edematous effects, extended biological half-life, and minimal mineralocorticoid action (17).

The present study assessed and compared the efficacy of submucosal (SM) and intravenous (IV) administration of dexamethasone in controlling postoperative pain, swelling, and trismus after third molar extraction. Both routes were found effective in minimizing postoperative discomfort, though the submucosal route showed a modest early advantage in reducing facial edema, consistent with findings from regional and international research (18).

Postoperative pain measured via the Visual Analogue Scale (VAS) demonstrated a steady decline from Day 3 to Day 7 in both groups. While the SM group showed a slightly lower median VAS score on Day 3, the difference was statistically insignificant (19). By Day 7, both groups reported comparable pain relief. Similar trends have been reported in studies conducted in Pakistan and India, confirming that dexamethasone's analgesic benefit is route-independent (20).

Mouth opening improved significantly between Day 3 and Day 7 in both study groups. The SM group exhibited marginally greater improvement in interincisal distance, though the difference was not statistically significant. This is consistent with previous research suggesting that locally delivered corticosteroids can achieve more focused anti-inflammatory effects at the surgical site, aiding functional recovery (21)

Facial swelling was the parameter showing the most prominent early difference. On postoperative Day 3, tragus-based measurements indicated significantly less swelling in the SM group compared with the IV group, supporting the hypothesis that local delivery of corticosteroids accelerates initial edema resolution (22). By Day 7, swellings had markedly decreased in both groups, with no statistically significant difference between them. Studies from Karachi and Hyderabad have similarly reported faster early recovery and reduced swelling with submucosal administration compared to systemic routes (23).

Overall, corticosteroid therapy significantly improved all parameters — pain, swelling, and trismus over the postoperative period. The submucosal route offers distinct advantages, including ease of administration, reduced need for venous access, localized action, and avoidance of systemic complications (24). Given its comparable efficacy and superior early edema control, submucosal dexamethasone appears preferable in routine third molar surgeries, especially in outpatient dental settings. The IV route, though effective, may be reserved for cases requiring systemic steroid coverage or hospital-based interventions (25) .

Conclusion:

The present study demonstrates that both submucosal and intravenous administration of dexamethasone are effective in minimizing postoperative pain, swelling, and trismus associated with mandibular third molar surgery. Although both routes provided significant benefits, the submucosal approach offered a slight advantage, particularly in reducing facial edema and pain, likely due to its localized action at the surgical site.

Considering its simplicity, patient comfort, and clinical effectiveness, submucosal dexamethasone can be regarded as a preferable option for routine management of postoperative sequelae in third molar surgery. Nonetheless, larger multicenter trials with longer follow-up are recommended to further validate these findings and to investigate potential benefits when combined with other adjunctive therapies.

Limitations:

This study has certain limitations. The relatively small number of participants may have reduced the ability to detect subtle differences between treatment groups. In addition, the follow-up period was limited to seven days, allowing only short-term postoperative outcomes to be assessed. Long-term recovery patterns and possible systemic effects of corticosteroid administration were not examined. Future research involving larger sample sizes and longer follow-up durations is recommended to validate these findings and explore extended outcomes.

References:

1. Selvido DI, Bhattarai BP, Niyomtham N, Riddhabhaya A, Vongsawan K, Pairuchvej V, et al. Review of dexamethasone administration for management of complications in postoperative third molar surgery. J Korean Assoc Oral Maxillofac Surg. 2021;47(5):341–50. doi:10.5125/jkaoms.2021.47.5.341.
2. Saranya M, Roopak B, Singh M, Mamatha NS, Chandraraj J, Amith KP. Evaluation of dexamethasone: submucosal vs intravenous administration in impaction surgery – a prospective clinical study. Afr J Biol Sci. 2024;6(14):798–805. doi:10.48047/AFJBS.6.14.2024.798-805.
3. Hou C, Liu F, Liu C. Comparison of submucosal with intramuscular or intravenous administration of dexamethasone for third molar surgeries: a systematic review and meta-analysis. Front Surg. 2021;8:714950. doi:10.3389/fsurg.2021.714950.
4. Lau AAL, De Silva RK, Thomson M, De Silva H, Tong D. Third molar surgery outcomes: a randomized clinical trial comparing submucosal and intravenous dexamethasone. J Oral Maxillofac Surg. 2021;79(2):295–304. doi:10.1016/j.joms.2020.09.020.
5. Faria AM, Pereira Júnior GA, de Oliveira e Silva ED, Faria LO, Moreira AN. Effect of preoperative administration of dexamethasone versus methylprednisolone on postoperative outcomes following impacted lower third molar extraction. J Clin Med. 2023;12(16):4614. doi:10.3390/jcm12164614.
6. Vivek GK, Vaibhav N, Shetty A, Mohammad I, Ahmed N, Umeshappa H. Efficacy of various routes of dexamethasone administration in reducing postoperative sequelae following impacted third molar surgery. Ann Maxillofac Surg. 2020;10(1):61–5. doi:10.4103/ams.ams_66_19.
7. Hiriyanna NM, Degala S. Objective and subjective comparison of submucosal and intravenous routes of single-dose preoperative dexamethasone for mandibular third molar surgery—a prospective randomized observer-blind study. Oral Maxillofac Surg. 2020;25(2):207–13. doi:10.1007/s10006-020-00904-0.
8. Poorna P, Kumar A, Joseph B, Varghese KG, George A. Comparative evaluation of the addition of 8 mg dexamethasone to local anesthetic in mandibular third molar surgery: a split-mouth, double-blind study. Front Oral Health. 2024;5:1432629. doi:10.3389/froh.2024.1432629.
9. Majid OW. Submucosal dexamethasone injection for the prevention of postoperative sequelae after third molar surgery: a randomized clinical trial. Int J Oral Maxillofac Surg. 2020;49(2):244–51. doi:10.1016/j.ijom.2019.06.017.
10. Ehsan A, Khan M, Shah SA, Farooq S. Efficacy of dexamethasone injection at different sites on postoperative sequelae after extraction of mandibular impacted third molars. J Oral Maxillofac Surg. 2024;82(6):713–20. doi:10.1016/j.joms.2024.02.013.
11. Zhang Y, Li Q, Chen X, Wu H. Comparative evaluation of submucosal, intravenous, and intramuscular dexamethasone in mandibular third molar surgery: a randomized controlled clinical trial. J Clin Case Pract. 2025;9(1):22–9.
12. Fernández-Martín U, Lisbona-González MJ, Vallecillo-Rivas M, Mallo-Magariños M, Herrera-Briones FJ. Effect of preoperative administration of dexamethasone versus methylprednisolone in surgical extraction of impacted lower third molars: randomized controlled clinical trial. J Clin Med. 2024;13(16):4614. doi:10.3390/jcm13164614.
13. Ayub K, Fazal M. The effectiveness of submucosal administration of methylprednisolone and dexamethasone in comparison to placebo after third molar surgery: a double-blinded, parallel-arm randomized clinical trial. Pak J Med Res. 2023;61(4):154–9.
14. Parikh P, Mistry E, Vaghela D, Vadhel K, Shaikh A, Shah S. Evaluate the efficacy of dexamethasone with various routes after surgical extraction of mandibular third molar teeth. Afr J Biol Sci. 2024;6(14):805–12.
15. Talwar A, Kachhwaha K, Rehman A, Sharma M. Comparison between local infiltration and intramuscular

dexamethasone in surgical extraction of molar teeth. Int J Health Sci. 2022;6:4397–407.
16. Lakhani R, Joshi S, Pawar S, Nair VS, Korrane V, Salema H, et al. Evaluation of oral and intramuscular dexamethasone on postoperative pain, swelling, and trismus after surgical removal of impacted third molar: a split-mouth study. Cureus. 2023;15(4):e38306. doi:10.7759/cureus.38306.
17. Shad S, Mahmud A, Shahnawaz A, Shah SMH, Farooq A, Khan SM, et al. Use of preoperative submucosal dexamethasone in third molar surgery: a step towards improvement in quality of life. J Ayub Med Coll Abbottabad. 2021;32(4 Suppl 1):607–11.
18. Naik VG, Amaral S, Murthy SC, Rao RS. Submucosal infiltration versus intravenous administration of dexamethasone in decreasing postoperative inflammatory sequelae after third molar surgery—a comparative study. Ann Maxillofac Surg. 2024;14(2):141–6. doi:10.4103/ams.ams_35_24.
19. Senguttuvan K. Submucosal vs oral dexamethasone on postoperative sequelae following third molar surgery: a comparative study. J Res Med Dent Sci. 2023;11(8):41–4. doi:10.5005/jp-journals-10051-0095.
20. Smith R, Almadhoon H, Hamdallah A, et al. Efficacy of different dexamethasone routes and doses in reducing the postoperative sequelae of impacted mandibular third molar extraction: a network meta-analysis of randomized clinical trials. J Am Dent Assoc. 2022;153(12):1154–70.e60. doi:10.1016/j.adaj.2022.08.017.
21. Khan M, Patel Y, Singh D, Shah P, Desai R. Effect of dexamethasone injection at different sites on postoperative inflammatory parameters in lower third molar surgery: a randomized clinical trial. Open Dent J. 2024;18:1–7. doi:10.2174/18742106354194.
22. Ramesh P, Anbalagan J, Rao LV, Radhakrishnan R. Effect of submucosal administration of dexamethasone on postoperative swelling and trismus in third molar surgery: a comparative study. J Maxillofac Oral Surg. 2024;23(1):53–8. doi:10.1007/s12663-023-01921-6.
23. Singh A, Sharma S, Verma P, Patel R. Efficacy of dexamethasone diluted saline irrigant in reducing postoperative sequelae following lower third molar surgery: a randomized clinical trial. J Oral Maxillofac Surg Med Pathol. 2025;37(2):112–9. doi:10.1016/j.jommp.2024.11.005.
24. Kaya DI, Aktı A. Comparison of perineural and systemic dexamethasone use in impacted third molar surgeries in terms of anesthesia duration and postoperative complaints: a controlled, randomized observational study. BMC Oral Health. 2024;24:706. doi:10.1186/s12903-024-0706-9.
25. Triple-blind randomized clinical trial evaluating preemptive dexamethasone alone or combined with NSAIDs in third molar surgeries (Scientific Reports). 2021.

Conflict of interest: Author declares no conflict of interest.
Funding Disclosure: Nil

Author's Contribution:

Dr. Momil Nadeem: Conception and designing work, drafting
Dr. Summera Kanwal: Supervised the research & data collection
Dr. Maham Khalil: Data collection