Efficacy of Dexamethasone-Infused Gelfoam on Postoperative Sequelae in Patients Undergoing Lower Third Molar Surgery: A Prospective Clinical Study

Nikita Jagtap[1], Dr. Vinod Krishna*[2], Prof. Dr. Murugesan Krishna[3], Santhosh Kumar M P[4]

[1]Post Graduate, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai - 600077, Tamil Nadu

[2]Associate Professor, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai - 600077, Tamil Nadu

[3]Head of Department, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai - 600077, Tamil Nadu

[4]Professor, Dept of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai - 600077, Tamil Nadu

Corresponding Author: Dr. Vinod Krishna, Associate Professor, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai - 600077, Tamil Nadu

Abstract:

Background: Impacted lower third molar extractions are commonly associated with postoperative complications such as pain and swelling. Although corticosteroids are known to reduce inflammation, the benefits of their localized administration remain under investigation. **Objective:** To evaluate the efficacy of 8 mg dexamethasone, delivered via a 1×1 cm gel foam placed in the extraction socket, in reducing postoperative pain and swelling compared with conventional closure without any additional intervention. **Methods:** This prospective randomized clinical trial was conducted from 2023 to 2024 at the Department of Maxillofacial Surgery, Saveetha Dental College and Hospital, Chennai. A total of 50 patients, aged 20–45 years requiring lower third molar extraction, were randomly allocated (1:1) to either the dexamethasone group (n = 25) or the control group (nil intervention, n = 25). In the dexamethasone group, after tooth extraction, a piece of gel foam infused with 8 mg dexamethasone was placed in the socket before primary closure; the control group received routine closure. Postoperative pain was measured using a 10-point Visual Analog Scale (VAS), and swelling was quantified via facial measurements taken preoperatively and on postoperative day 2 and 7. Data normality was assessed using the Shapiro-Wilk test; between-group differences were analyzed using the Mann-Whitney U test (for VAS scores) and unpaired t-tests (for swelling). A p-value < 0.05 was considered statistically significant. **Results:** There was no significant difference in VAS pain scores between the groups ($p = 0.984$). However, a statistically significant reduction in swelling was observed in the dexamethasone group compared to the control group ($p < 0.001$). Variability in swelling outcomes was also reduced in the dexamethasone group, as indicated by the Brown-Forsythe test. **Conclusion:** Local administration of dexamethasone via gel foam significantly reduces postoperative swelling following lower third molar surgery but does not appear to provide substantial pain relief. These findings support the role of targeted corticosteroid delivery for minimizing edema, although additional analgesic measures may be needed to manage postoperative pain comprehensively.

Keywords: Dexamethasone-Infused Gelfoam, Postoperative Sequelae, Lower Third Molar Surgery

Introduction

As the field of oral and maxillofacial surgery expands and evolves over the years, dentoalveolar surgery remains a fundamental aspect of dental practice. Mandibular molars are the most commonly impacted teeth, followed by maxillary third molars and maxillary canines.(Gaur et al. 2022) Less frequently, other teeth, such as mandibular canines, maxillary and mandibular premolars, and second molars, may also be impacted.(Almeida et al. 2019) Although impacted lower third molar removal surgery is the most frequently performed procedure, extensive literature already exists on the surgical removal of impacted third molars and interventions taken, yet the concept remains somewhat unclear.(Selvido et al. 2021) Modern Oral and maxillofacial surgery aims at reducing the postoperative effects through a wide range of modalities.

The modalities that have been currently in use are analgesics and antibiotics.(Herrera-Briones et al. 2013) Initially, analgesics have been given postoperatively to reduce postoperative pain, whereas recently surgeons have started to give pre-emptive analgesics as a safety measure to prevent immediate discomfort after the lower third molar removal surgery.(Lima et al. 2018) While many techniques have been used for the reduction of postoperative complications, basic techniques like the use of proper copious saline to irrigate while tooth splitting and bone guttering can reduce most of the complications like alveolar osteitis, and also reduce postoperative swelling, trismus, and pain.(Barbalho et al. 2017)

Other modalities in the reduction of postoperative complications include corticosteroids, sutures, and additional therapies like platelet-rich plasma and fibrin, ozone therapy, cryotherapy, the use of lasers, and piezoelectric surgery(Freda and Keenan 2016) The administration of corticosteroids in different dosage forms has proven effective in controlling pain, inflammation, and trismus. Since the action of the drug is required in a local site, systemic administration may not be required.(Singh et al. 2023) As an alternative, we have used 8mg of dexamethasone infused 1x1cm gel foam in an extraction socket followed by primary closure to evaluate its potential effect in reducing postoperative complications for lower third molar removal surgery.

The aim of the study was to evaluate the efficacy of dexamethasone-infused gel-foam followed by primary closure over direct closure without any intervention in the reduction of postoperative sequelae for lower third molar removal surgery.

Materials and Methods

Trial Design

This study was designed as a prospective, randomized, double-blind clinical trial conducted at Saveetha Dental College and Hospital, Chennai, from 2023 to 2024 as per CONSORT 2020 guidelines.

Ethical Approval:

Institutional Ethical Committee clearance was obtained before we began the study (IHEC/SDC/ORTHO-2306/23/122) .

Participants

Patients aged 20–45 years requiring lower third molar extraction were recruited.

Inclusion Criteria:

- Patients requiring impacted lower third molar removal.
- Both male and female patients within the specified age range.

Exclusion Criteria:

- Patients with uncontrolled systemic illnesses (e.g., diabetes, hypertension).
- Teeth with extensive decay and acute pain.
- Known allergies to corticosteroids or contraindications for steroid use.

Interventions

Following standard aseptic protocols and administration of local anaesthesia (1:80,000 adrenaline dilution via inferior alveolar, lingual, and long buccal nerve blocks), all patients underwent a modified Ward's incision, full thickness mucoperiosteal flap elevation, and bone guttering as per the Moore and Gillbe collar technique. After extraction and saline irrigation:

- **Dexamethasone Group:** A 1×1 cm piece of gel foam soaked with 8 mg dexamethasone was placed in the extraction socket, followed by primary closure with 3-0 silk sutures.
- **Control Group:** The extraction socket was closed with sutures without any additional intervention.

Outcomes

Primary Outcomes:

- **Pain:** Assessed using a 10-point Visual Analog Scale (VAS) immediately postoperatively, and on postoperative days 2 and 7.
- **Swelling:** Measured using standardized facial landmarks (corner of the mouth to the tragus; corner of the eye to the soft tissue gonion) preoperatively and on postoperative days 2 and 7.

Sample Size

Based on G*Power analysis at a 95% confidence interval, 25 patients per group were required. To account for potential dropouts, the final sample size was set at 50 patients (25 per group).

Randomization and Blinding

Participants were randomized using a simple random allocation technique with non-transparent envelopes to conceal allocation. Double-blinding was maintained: the patients and the principal investigator performing the assessments were unaware of the treatment assignments, while the operating surgeon was informed of the intervention.

Statistical Analysis

Data were analyzed using SPSS version 23.0. Normality of data was verified via the Shapiro-Wilk test. The Mann-Whitney U test was used for non-parametric pain (VAS) scores, and unpaired t-

tests were applied for swelling measurements. The Brown-Forsythe test was also employed to assess variance differences. Statistical significance was defined as $p < 0.05$.

Results

Participant Flow and Baseline Data

Fifty patients were randomized equally into the dexamethasone and control groups. All patients completed the study with no dropouts. Baseline demographic and clinical characteristics were similar between groups.

Outcomes and Estimation

- **Pain:** The Mann-Whitney U test revealed no significant difference in VAS pain scores between the dexamethasone group (mean = 3.000 ± 0.913) and the control group (mean = 3.040 ± 0.978; p = 0.984).

Parameter	Group	W	p-value
VAS Day 2	Dexamethasone	0.853	0.002*
	Nil intervention	0.930	0.088
VAS Day 4	Dexamethasone	0.874	0.005*
	Nil intervention	0.857	0.002*
VAS Day 7	Dexamethasone	0.858	0.003*
	Nil intervention	0.822	<0.001*
Swelling Pre-op	Dexamethasone	0.905	0.024*
	Nil intervention	0.927	0.074
Swelling Post-op Day 2	Dexamethasone	0.948	0.229
	Nil intervention	0.919	0.049*
Swelling Post-op Day 7	Dexamethasone	0.966	0.546
	Nil intervention	0.972	0.692

- **Swelling:** The Student's t-test indicated a statistically significant reduction in swelling in the dexamethasone group (mean = 0.268 ± 0.305) compared with the control group (mean = 0.920 ± 0.501; p < 0.001). Additionally, the Brown-Forsythe test confirmed a significant difference in variance, demonstrating more consistent swelling reduction in the dexamethasone group.

Group	Mean	SD	t	p

Dexamethasone	0.268	0.305	0.061	<0.001a
Nil intervention	0.920	0.501		

Ancillary Analyses and Harms

No adverse events or complications related to the use of dexamethasone were observed during the study.

Discussion

This study evaluated the local application of dexamethasone via gel foam for reducing postoperative sequelae after lower third molar extractions. The findings indicate that while the intervention did not significantly affect postoperative pain—likely due to the transient nature of dexamethasone's peak analgesic effect within the first 24 hours—it was effective in substantially reducing postoperative swelling. The anti-inflammatory properties of dexamethasone, particularly its capacity to reduce vascular permeability and inhibit leukocyte migration, likely underlie the observed edema reduction. Moreover, the reduced variability in swelling outcomes suggests that the localized administration of dexamethasone offers a more consistent therapeutic effect.(Sharma, George, and Krishnan 2024)

Additionally, studies have shown that a local injection of dexamethasone achieves a higher drug concentration at the site of inflammation with minimal systemic distribution. This localized delivery could enhance the therapeutic impact on swelling while reducing potential side effects associated with systemic corticosteroid use.(Beirne 2013)

Corticosteroids, such as dexamethasone, are known to inhibit inflammatory mediators that contribute to vascular exudation and edema. Their ability to suppress prostaglandin synthesis also provides analgesic effects due to their anti-inflammatory properties.(Jason et al. 2023) Although corticosteroids are most effective within the first 24 hours after surgery, their impact can persist up to three days. Various studies have explored administering dexamethasone via intramuscular and submucosal routes. However, improper use of dexamethasone can risk adrenal insufficiency.(Ruthvik et al. 2023)

A limitation of the study is the relatively small sample size, which may affect the generalizability of the findings. Additionally, inter-individual differences in inflammatory responses and potential subtle variations in surgical technique, despite standardization efforts, could have influenced the outcomes. Future research with larger sample sizes and further refinement of the administration protocol is warranted.

Conclusion

Local administration of dexamethasone via gelfoam effectively reduces postoperative swelling following lower third molar extractions, though its effect on pain control is limited. This targeted

approach may enhance patient recovery by minimizing edema, yet should be complemented with other analgesic strategies for comprehensive postoperative management. Further studies are recommended to optimize dosing and to validate these findings in larger patient populations.

Conflicts of interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analysis, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

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