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Original article

Effect of Submucosal 4 mg Dexamethasone Injection on Postoperative Complications Following Oral Surgical Procedures: A Case-Control Study

Hamuda Hamuda*, Weaam Alzwiy, Salma Abousaif, Fatma Alnaddab, Dafer Banoun, Husameddin Bakush

Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Attahadi University, Tripoli, Libya
Corresponding Email. Hamouda.hammouda@attahadi.edu.ly

KEYWORDS:
Dexamethasone; Oral Surgery; Postoperative Pain; Facial Swelling; Wound Healing;

ABSTRACT

Surgical trauma initiates a complex inflammatory cascade characterized by the release of arachidonic acid metabolites, increased vascular permeability, leukocyte migration, and edema formation, ultimately resulting in postoperative pain, facial swelling, and trismus. These complications may compromise oral function, delay recovery, reduce patient satisfaction, and increase postoperative analgesic requirements. This study was conducted to evaluate the effectiveness of a single 4 mg submucosal injection of dexamethasone in reducing postoperative pain, facial swelling, trismus, and analgesic consumption while enhancing wound healing. Patients were clinically evaluated preoperatively and on postoperative days 2, 5, and 7. Outcome measures included pain intensity using the Visual Analog Scale (VAS), Statistical analyses were performed using appropriate parametric and non-parametric tests, with statistical significance established at $p < 0.05$. Patients treated with submucosal dexamethasone demonstrated significantly improved postoperative outcomes compared with the control group. Current pain scores were significantly lower on postoperative Days 2, 5, and 7 ($p = 0.001$ for all comparisons). Postoperative facial swelling was significantly reduced in the dexamethasone group at all evaluation intervals ($p = 0.003$ on Day 2 and $p < 0.001$ on Days 5 and 7). These findings support the routine use of submucosal dexamethasone as a simple, safe, and minimally invasive approach for enhancing postoperative recovery in oral and maxillofacial surgery.

Introduction

Dexamethasone is a synthetic glucocorticoid with potent anti-inflammatory activity, negligible mineralocorticoid effects, and a prolonged biological half-life of approximately 36–54 hours. Its mechanism of action involves inhibition of phospholipase A_2 through induction of lipocortin, thereby suppressing prostaglandin and leukotriene synthesis and reducing inflammatory mediator release (1–2). Numerous randomized clinical trials and systematic reviews have demonstrated the beneficial effects of dexamethasone in minimizing postoperative morbidity after oral surgery (3–4). However, most published studies have focused exclusively on mandibular third molar surgery, while evidence regarding its effectiveness across a broader spectrum of hard-tissue oral surgical procedures remains limited (5-6).

The present study aimed to evaluate the effectiveness of a single 4 mg submucosal injection of dexamethasone in reducing postoperative pain, facial swelling, trismus, and analgesic consumption while enhancing wound healing and patient satisfaction following various oral surgical procedures compared with patients receiving no corticosteroid therapy.

Methods

Study Design

This study was designed as a prospective case-control study to evaluate the effectiveness of a single 4 mg submucosal injection of dexamethasone in reducing postoperative pain, facial swelling, trismus, and analgesic consumption while enhancing wound healing and patient satisfaction following various oral surgical procedures compared with patients receiving no corticosteroid therapy.

Study Population

The study was conducted at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Attahadi Medical Al-Ahlia University, Tripoli, Libya, between November 2025 and March 2026. A total of 100 patients requiring oral surgical procedures under local anesthesia were enrolled and divided into two equal groups. Fifty patients received a single submucosal injection of 4 mg dexamethasone immediately after completion of surgery, whereas fifty patients served as controls and received identical surgical management without corticosteroid administration.

Patients were clinically evaluated preoperatively and on postoperative days 2, 5, and 7. Outcome measures included pain intensity using the Visual Analog Scale (VAS), postoperative analgesic consumption, subjective facial swelling, maximal interincisal mouth opening for assessment of trismus, wound healing using the Landry Healing Index (LHI), and patient satisfaction with postoperative pain control. Statistical analyses were performed using appropriate parametric and non-parametric tests, with statistical significance established at $p < 0.05$. Patients were selected according to predefined

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inclusion and exclusion criteria to ensure homogeneity of the sample and reliability of the results.

Inclusion Criteria
- Patients aged ≥18 years
- Indicated for dental surgical procedures
- ASA I or II patients
- Willing to return for postoperative follow-up on days 2, 5, and 7

Exclusion Criteria
- History of hypersensitivity to corticosteroids
- Chronic steroid or immunosuppressive therapy within the past 3 months
- Uncontrolled systemic disease
- Pregnancy or lactation
- Acute infection at the surgical site requiring systemic antibiotics
- Intraoperative complications significantly altering surgical trauma

Ethical Considerations
This study was conducted following approval from the Ethical Committee of the Faculty of Dentistry, Attahadi University (Reference 11-2025 AU). All procedures were carried out in accordance with ethical standards and guidelines for clinical research involving human subjects.

Patient Consent
All patients were informed about the nature and purpose of the study prior to participation. Written informed consent was obtained from each participant. Data collected included demographic variables such as age and sex, in addition to clinical information related to the surgical procedures. Baseline data collected included age, sex, smoking status, medical history, allergies, and chronic steroid/immunosuppressive use.

Group Allocation
Patients were randomly divided into two equal groups (n = 50 each). Randomization was performed using a computer-generated random allocation sequence to ensure unbiased distribution between the study and control groups. Allocation concealment was maintained using sealed opaque envelopes, which were opened at the time of intervention.
Due to the nature of the procedure, operator blinding was not feasible. However, postoperative evaluation was performed by an independent examiner who was blinded to the group allocation in order to minimize assessment bias.
- Group I (Dexamethasone Group): Received a single submucosal injection of 4 mg dexamethasone.
- Group II (Control Group): Received no corticosteroid.

Dexamethasone Administration Technique:
In the dexamethasone group, a single dose of 4 mg dexamethasone was administered locally via submucosal injection immediately following completion of the surgical procedure after suturing (5-6).

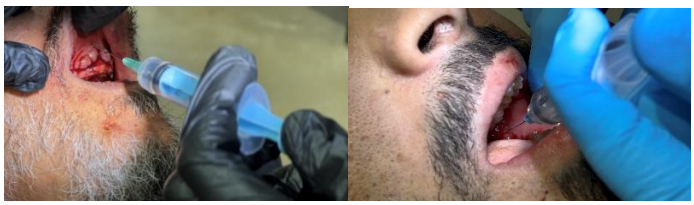

Fig 1: Submucosal Administration of 4mg dexamethasone following surgical procedures

Surgical Procedure
All procedures were performed under local anesthesia using standard aseptic surgical protocols.
The following intraoperative variables were recorded:
- Type of surgery performed
- Duration of surgery (minutes)
- Surgeon grade (Intern / Resident / Consultant)
- Intraoperative complications (if any)

Postoperative medications (antibiotics and analgesics) were prescribed according to institutional protocol and recorded.

Outcome Measures
Patients were evaluated preoperatively and postoperatively on Day 2, Day 5, and Day 7.

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1. Pain Assessment
Pain intensity was measured using a Visual Analog Scale (VAS) from 0 to 10, where:
• 0 = no pain
• 10 = worst imaginable pain
The following were recorded:
• Baseline pain score
• Current pain at each follow-up
• Worst pain since last visit
• Total number of analgesic tablets consumed
• Patient satisfaction with pain control was also documented.
2. Swelling Assessment
Swelling was evaluated using both objective linear facial measurements and subjective assessment.
Objective Measurement
Facial swelling was measured using standardized linear distances with a flexible measuring tape:
• Tragus to pogonion
• Lateral canthus to gonion
Measurements were recorded preoperatively and on postoperative Days 2, 5, and 7.
Subjective Swelling
Patients self-assessed swelling as:
• None
• Mild
• Moderate
• Severe
3. Trismus Assessment
Trismus was evaluated by measuring maximal interincisal mouth opening (mm) using a disposable ruler, both preoperatively and at follow-up visits.
Reduction in mouth opening compared to baseline was used to assess postoperative trismus.
4. Wound Healing Assessment
Wound healing was evaluated clinically using:
• Landry's Wound Healing Index (Scale 1–5)
• Presence of infection signs: Erythema, Suppuration, Trismus, Requirement of antibiotics
Need for additional intervention (resuturing, drainage, etc.) was also recorded.

Results

Patients treated with submucosal dexamethasone demonstrated significantly improved postoperative outcomes compared with the control group. Current pain scores were significantly lower on postoperative Days 2, 5, and 7 ($p = 0.001$ for all comparisons). Peak pain intensity was similarly reduced throughout the follow-up period. Patients receiving dexamethasone also consumed fewer analgesic tablets during recovery. Postoperative facial swelling was significantly reduced in the dexamethasone group at all evaluation intervals ($p = 0.003$ on Day 2 and $p < 0.001$ on Days 5 and 7). Furthermore, postoperative trismus occurred significantly less frequently in patients treated with dexamethasone (28%) than in controls (52%) ($p = 0.025$). Although wound healing scores consistently favored the dexamethasone group, no statistically significant differences were observed between groups during the postoperative follow-up period. Patient satisfaction with postoperative pain control was substantially higher among participants receiving dexamethasone.

Table 1: Mean Measurement of Post-Operative Outcomes in Study and Control Group

Outcome	Time point	Dexamethasone group (Mean ± SD)	Control group (Mean ± SD)	p-value
Pain (current)	Day 2	1.70 ± 1.20	4.00 ± 1.50	0.001
	Day 5	0.76 ± 0.90	3.00 ± 1.40	0.001
	Day 7	0.44 ± 0.70	1.42 ± 1.10	0.001
Pain (peak)	Day 2	3.54 ± 1.60	5.44 ± 1.70	0.002
	Day 5	2.36 ± 1.50	3.88 ± 1.60	0.018
	Day 7	0.72 ± 0.90	2.68 ± 1.40	0.001
Swelling	Day 2	1.00 ± 0.80	1.64 ± 0.90	0.003
	Day 5	0.46 ± 0.60	1.08 ± 0.80	0.001
	Day 7	0.28 ± 0.50	1.00 ± 0.70	0.001
Trismus (occurrence)	Day 2	28%	52%	0.025

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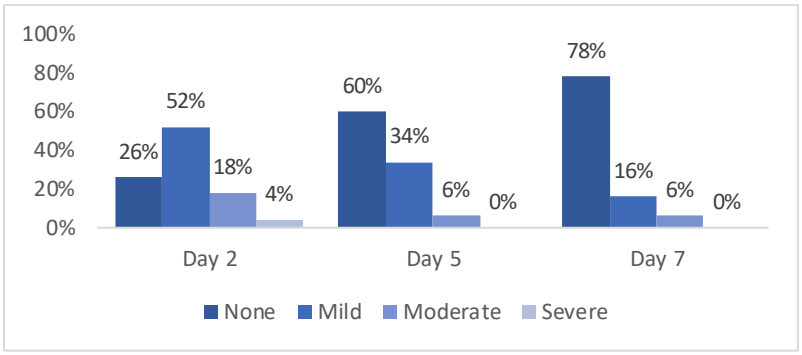


Fig 2: Severity of Facial Swelling in the Study Group (%)

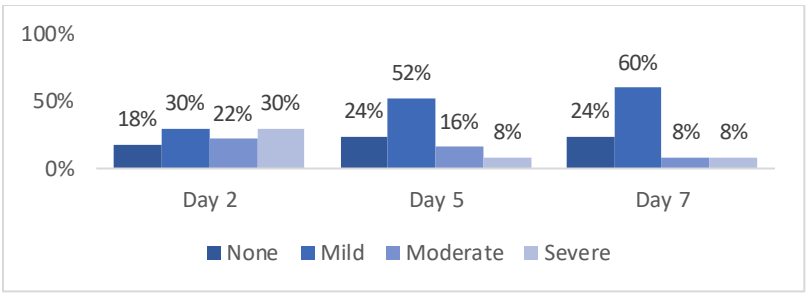


Fig 3: Severity of Facial Swelling in the Control Group (%)

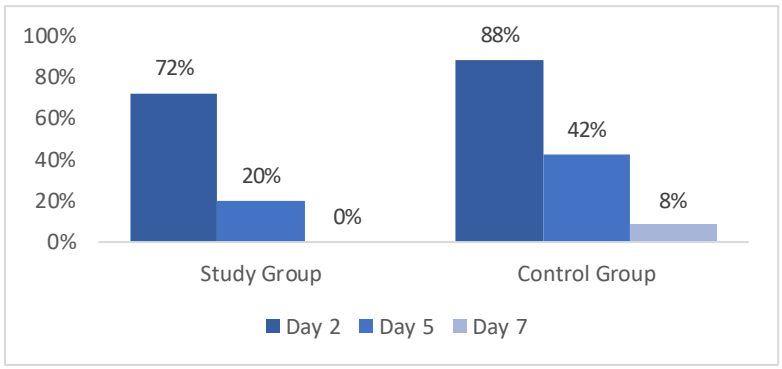
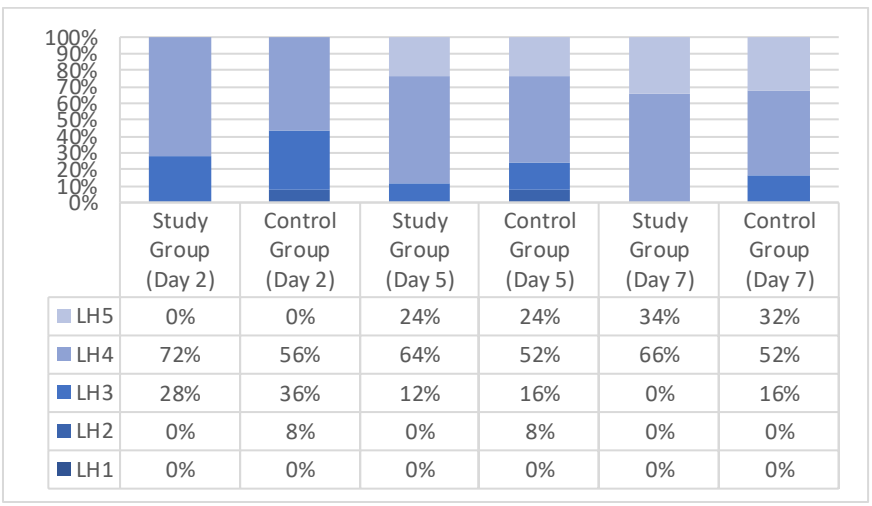


Fig 4: Analgesic intake on follow-up days (%)



	Study Group (Day 2)	Control Group (Day 2)	Study Group (Day 5)	Control Group (Day 5)	Study Group (Day 7)	Control Group (Day 7)
LH5	0%	0%	24%	24%	34%	32%
LH4	72%	56%	64%	52%	66%	52%
LH3	28%	36%	12%	16%	0%	16%
LH2	0%	8%	0%	8%	0%	0%
LH1	0%	0%	0%	0%	0%	0%

Table 2: Distribution of LHI Grades at Follow-Up Days in the Study Group

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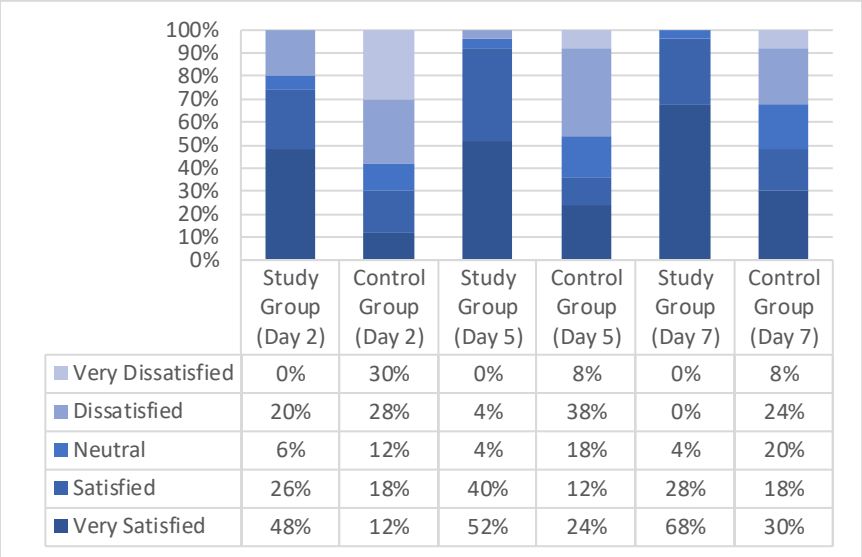

	Study Group (Day 2)	Control Group (Day 2)	Study Group (Day 5)	Control Group (Day 5)	Study Group (Day 7)	Control Group (Day 7)
Very Dissatisfied	0%	30%	0%	8%	0%	8%
Dissatisfied	20%	28%	4%	38%	0%	24%
Neutral	6%	12%	4%	18%	4%	20%
Satisfied	26%	18%	40%	12%	28%	18%
Very Satisfied	48%	12%	52%	24%	68%	30%

Table 3: Pain Control Satisfaction Between Study and Control Groups.

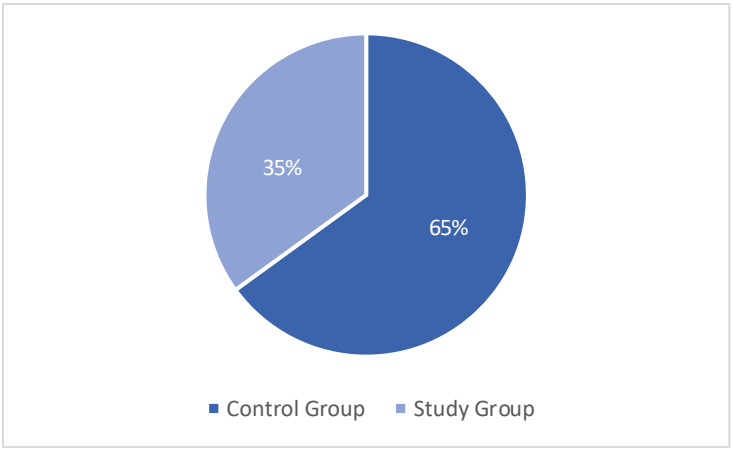

Fig 5: People Who Suffered from Trismus in Each Group (%)

Discussion

The results of the present study demonstrated that submucosal administration of dexamethasone significantly improved postoperative outcomes following dental surgeries. Compared with the control group, patients who received dexamethasone experienced lower postoperative pain intensity, reduced facial swelling, and a lower incidence of trismus. In addition, patient satisfaction was higher in the dexamethasone group, indicating an overall improvement in postoperative comfort and recovery. The beneficial effects of submucosal dexamethasone were observed throughout the postoperative period. Patients reported earlier pain relief and a sustained reduction in facial swelling, suggesting that the anti-inflammatory effects of dexamethasone persist beyond the immediate postoperative phase. These findings highlight the ability of dexamethasone to effectively control the inflammatory response associated with surgical trauma and contribute to a more favorable healing process.

The improvements observed can be explained by the potent anti-inflammatory properties of dexamethasone. (7) Corticosteroids inhibit the synthesis of inflammatory mediators, including prostaglandins and leukotrienes, thereby reducing the inflammatory cascade triggered by tissue injury. (8) Furthermore, dexamethasone decreases vascular permeability, which limits fluid extravasation into surrounding tissues and consequently reduces postoperative edema and facial swelling. (9) The reduction in trismus observed in the dexamethasone group may also be attributed to the suppression of inflammation within the masticatory muscles and adjacent tissues. (9-10) By minimizing inflammatory edema and muscle involvement, dexamethasone facilitates improved mouth opening and functional recovery. (11) Clinically, these effects are important because they enhance patient comfort, improve oral function, and reduce postoperative complications. Therefore, submucosal dexamethasone appears to be an effective adjunctive measure for promoting postoperative recovery and improving overall patient outcomes following third molar surgery.

The findings of the present study are supported by previous literature. Mushtaq et al (2011) (10) and Antunes et al (11) both reported significant reductions in postoperative pain, swelling, and trismus following dexamethasone administration, which is consistent with the outcomes observed in this study. These studies support the effectiveness of dexamethasone

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as an anti-inflammatory agent that improves postoperative recovery.
In contrast, other studies have shown less consistent results. Marques et al. (2022) (12) and He et al (2025) (13) found that while dexamethasone reduces swelling and trismus, its impact on postoperative pain may not always be statistically significant. This differs from the present study, where a clear reduction in pain was observed, and may be explained by variations in study design, dosage, and clinical factors.

Conclusion

Submucosal administration of a single 4 mg dose of dexamethasone represents an effective and clinically practical adjunctive therapy for minimizing postoperative inflammatory complications following hard-tissue oral surgical procedures. The intervention significantly reduced postoperative pain, facial swelling, trismus, and analgesic consumption while improving patient satisfaction without adversely affecting wound healing. These findings support the routine use of submucosal dexamethasone as a simple, safe, and minimally invasive approach for enhancing postoperative recovery in oral surgery.

Conflict of interest. Nil

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