

Original Research

Received 14 June 2026

Revised 24 July 2026

Accepted 06 Aug 2026

Natural Resources for Human
Health 2026, Vol. 6 (15s): 934–942

KEYWORDS:

Dexamethasone, Intramassetric
Injection, Impacted Mandibular
Third Molar, Pain, Swelling,
Trismus

Single-shot Intra-masseteric Dexamethasone for Reducing Pain, Swelling, and Trismus Following Third Molar Surgery: A Randomized Controlled Trial at Silvassa

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ABSTRACT:

Background:

Surgical removal of impacted mandibular third molars often leads to postoperative pain, swelling, and trismus, affecting recovery and comfort. Dexamethasone, a potent corticosteroid with anti-inflammatory and anti-edematous properties, is effective, though the ideal route and site for optimal therapeutic outcomes remain under investigation.

Aim:

To evaluate the efficacy of a single dose of intramuscular dexamethasone injection into the masseter muscle in reducing postoperative pain, swelling, and trismus following surgical extraction of impacted lower third molars.

Materials & Methods:

A randomized controlled clinical trial was conducted on 40 patients (20 males and 20 females) undergoing surgical extraction of impacted mandibular third molars at NAMO Medical & Research Institute, Silvassa (DNH). Participants were randomly assigned into two groups: Group A received 8 mg dexamethasone intramuscularly into the masseter muscle following local anesthesia and prior to surgery, while Group B served as the control without dexamethasone. Postoperative pain visual analog scale (VAS), swelling (facial measurements), and trismus (interincisal distance) were assessed preoperatively

and at 24, 48, and 72 hours postoperatively.

Data were analyzed using paired and unpaired t-tests, and two-way analysis of variance (ANOVA), with probability ($p < 0.05$) considered statistically significant.

Results:

Group A demonstrated a significant reduction in postoperative pain, swelling, and trismus at all evaluation intervals compared to Group B ($p < 0.05$).

Conclusion:

A single intramassetric dose of 8 mg dexamethasone administered before surgical extraction of impacted lower third molars effectively minimizes postoperative pain, swelling, and trismus, enhancing patient comfort and recovery without adverse effects.

INTRODUCTION

Surgical extraction of impacted mandibular third molars is among the most frequently performed procedures in oral and maxillofacial surgery [1]. Although considered routine, it is often associated with predictable postoperative complications such as pain, swelling, and trismus [2]. These sequelae, while self-limiting, can cause significant discomfort, functional limitation, and delayed recovery, thereby affecting the patient's quality of life and postoperative satisfaction [3]. The severity of these complications depends on several factors, including the depth and angulation of impaction, surgical difficulty, operative time, and the patient's inflammatory response [4].

Extraction of impacted mandibular third molars induces acute inflammation, a physiological defense mechanism to tissue trauma [5]. This process involves the release of mediators such as prostaglandins, histamine, serotonin, bradykinin, and leukotrienes, which promote vasodilation, increased vascular permeability, and cellular infiltration [6]. Consequently, edema, pain, and muscle spasm develop, resulting in trismus [7]. These symptoms typically peak between 24 and 72 hours after surgery and gradually subside thereafter [8].

To reduce postoperative discomfort and enhance recovery, various pharmacological strategies have been explored. Analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and antibiotics remain the mainstay of postoperative care [9]. Among these, corticosteroids have demonstrated superior efficacy in controlling inflammatory reactions following oral surgery [10]. Dexamethasone, a potent synthetic fluorinated glucocorticoid, has been extensively employed in oral and maxillofacial surgical practice due to its strong anti-inflammatory, anti-exudative, and anti-edematous actions [11]. It possesses 25–30 times greater anti-inflammatory potency than hydrocortisone and exhibits a prolonged biological half-life of approximately 36–54 hours [12]. Dexamethasone acts by inhibiting phospholipase A₂, thereby suppressing arachidonic acid release from cell membrane phospholipids [13].

This results in decreased synthesis of prostaglandins and leukotrienes, key mediators responsible for vasodilation, pain, and edema [14]. Additionally, dexamethasone stabilizes lysosomal membranes, reduces capillary permeability, and minimizes cellular exudation at the site of injury, thereby reducing postoperative swelling and discomfort [15].

Although the therapeutic benefits of dexamethasone are well established, the ideal route, dosage, and site of administration continue to be debated [16]. The drug can be administered through multiple routes—oral, intravenous, intramuscular, submucosal, or local infiltration—each offering distinct pharmacokinetic advantages [17]. Oral administration, while convenient, may result in delayed absorption and variable bioavailability due to hepatic first-pass metabolism. Intravenous administration ensures rapid systemic action but is invasive and may not be necessary for minor oral procedures [18]. The intramuscular route, in contrast, provides sustained plasma levels, prolonged duration of effect, and improved postoperative control [10].

Traditionally, intramuscular injections are administered into large muscles such as the gluteus maximus or deltoid. However, recent studies have emphasized localized delivery into the masseter muscle, given its proximity to the surgical site [18]. The masseter muscle, being one of the major muscles of mastication, offers a unique advantage for localized drug deposition near

the area of inflammation [1]. This route allows higher local concentration of the corticosteroid while reducing systemic exposure and minimizing adverse effects [13]. Moreover, the rich vascular supply of the masseter muscle ensures efficient absorption and diffusion of the drug into the perimandibular tissues [12].

Localized intramasseteric injection of dexamethasone has been shown to provide significant reduction in postoperative swelling, pain, and trismus compared to conventional systemic administration [8]. The technique is simple, safe, and can be conveniently performed after achieving local anesthesia, without requiring additional injections or increasing patient discomfort [6]. By delivering the drug adjacent to the surgical site, this route bypasses hepatic metabolism and maintains effective tissue concentrations for a longer duration [10].

Several randomized controlled clinical trials have demonstrated favorable outcomes with intramasseteric dexamethasone, reporting early resolution of edema, lesser intensity of pain, and improved mouth opening within the first 72 hours postoperatively [15]. The 8 mg dose is frequently used, as it provides sufficient anti-inflammatory coverage with minimal systemic suppression of the hypothalamic-pituitary-adrenal axis [16]. The timing of administration—whether preoperative, intraoperative, or postoperative—also influences clinical outcomes. Most studies advocate intraoperative or immediate postoperative injection to suppress the early inflammatory cascade triggered by surgical trauma [11].

The present study was designed to evaluate the efficacy of a single dose of intramuscular dexamethasone (8 mg) administered into the masseter muscle following local anesthesia and prior to the surgical removal of impacted mandibular third molars. This route of administration aims to combine the advantages of localized delivery with sustained systemic effect, offering an effective, minimally invasive, and patient-friendly method to reduce postoperative discomfort.

By assessing key parameters such as pain via visual analogue scale (VAS), swelling (through facial measurements), and trismus (by interincisal distance), the study seeks to determine whether intramasseteric dexamethasone can significantly enhance postoperative recovery compared to no steroid intervention. Findings from this research could help establish standardized clinical protocols and optimize corticosteroid use in third molar surgery, ultimately improving patient comfort, reducing morbidity, and enhancing postoperative outcomes in oral and maxillofacial surgical practice.

MATERIALS & METHODS

Aim

To evaluate the efficacy of a single-dose intramuscular dexamethasone injection administered into the masseter muscle in reducing postoperative pain, swelling, and trismus following LA and before the surgical extraction of impacted mandibular third molars.

Objectives

1. To assess postoperative pain intensity using the VAS
2. To evaluate postoperative facial swelling by measuring standard facial reference points
3. To assess postoperative mouth opening (trismus) through interincisal distance measurements
4. To compare preoperative and postoperative findings at 24, 48, and 72 hours
5. To analyze and compare postoperative outcomes between male and female patients

Study Design

A randomized controlled clinical trial was conducted at NAMO Medical & Research Institute, Silvassa (DNH) from January to March 2026 to assess the clinical effectiveness of intramuscular dexamethasone administered into the masseter muscle in controlling postoperative sequelae after third molar surgery.

Sample Size

The study included 40 patients (20 males and 20 females) requiring surgical removal of impacted mandibular third molars. All participants were randomly allocated into two equal groups to ensure unbiased comparison.

Inclusion Criteria

Patients aged between 18 and 35 years who were systemically healthy and indicated for surgical extraction of impacted mandibular third molars were included in the study.

Exclusion Criteria:

Patients with any systemic illness, known hypersensitivity to corticosteroids, local infection at the surgical site, or those who were pregnant or lactating were excluded.

Grouping:

- Group A (Study Group): Patients received a single dose of 8 mg dexamethasone intramuscularly into the masseter muscle immediately after local anesthesia and before surgical extraction.
- Group B (Control Group): Patients underwent the same surgical procedure without dexamethasone administration.

Assessment Parameters:

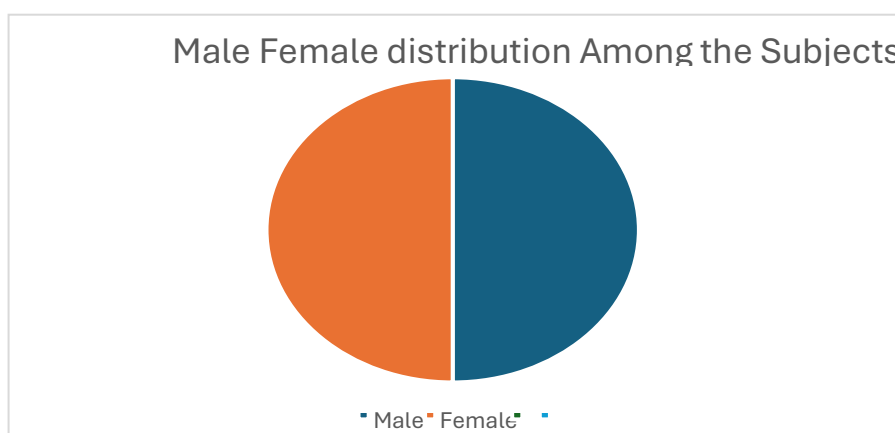
- Pain: Evaluated using the VAS, where patients rated their pain intensity preoperatively and at 24, 48, and 72 hours postoperatively
- Swelling: Assessed by measuring facial distances between fixed anatomical landmarks (e.g., tragus to pogonion, gonion to lateral canthus)
- Trismus: Determined by measuring the maximum interincisal distance using a vernier caliper at similar postoperative intervals.

Statistical Analysis:

Data were tabulated and analyzed using paired and unpaired t-tests to evaluate intra- and intergroup differences. Two-way analysis of variance (ANOVA) was employed to assess variations over time between groups. A probability (p)-value of less than 0.05 was considered statistically significant, indicating a meaningful difference between compared variables.

RESULTS

Group A showed significantly lower mean VAS scores at 24, 48, and 72 hours compared to Group B. Swelling and trismus were markedly reduced in the dexamethasone group with faster regression after 48 hours. Gender comparison showed similar trends with minor, statistically insignificant variations. Overall, intramassetric dexamethasone significantly reduced postoperative discomfort and improved recovery.



Graph 1: Showing Equal Distribution of Male And Female Among the Study Population

Table 1: Male–Female Comparison of Postoperative Outcomes

Parameter	Male (Mean $\pm$ SD)	Female (Mean $\pm$ SD)	p-value
VAS	3.22 $\pm$ 0.77	3.25 $\pm$ 0.91	0.9213
NPS	3.11 $\pm$ 0.93	3.00 $\pm$ 0.81	0.6951
Swelling	4.03 $\pm$ 1.46	4.09 $\pm$ 1.38	0.8971
Mouth Opening (IO)	35.32 $\pm$ 2.48	35.48 $\pm$ 2.25	0.8370

•No Significant change observed Independent T test was applied

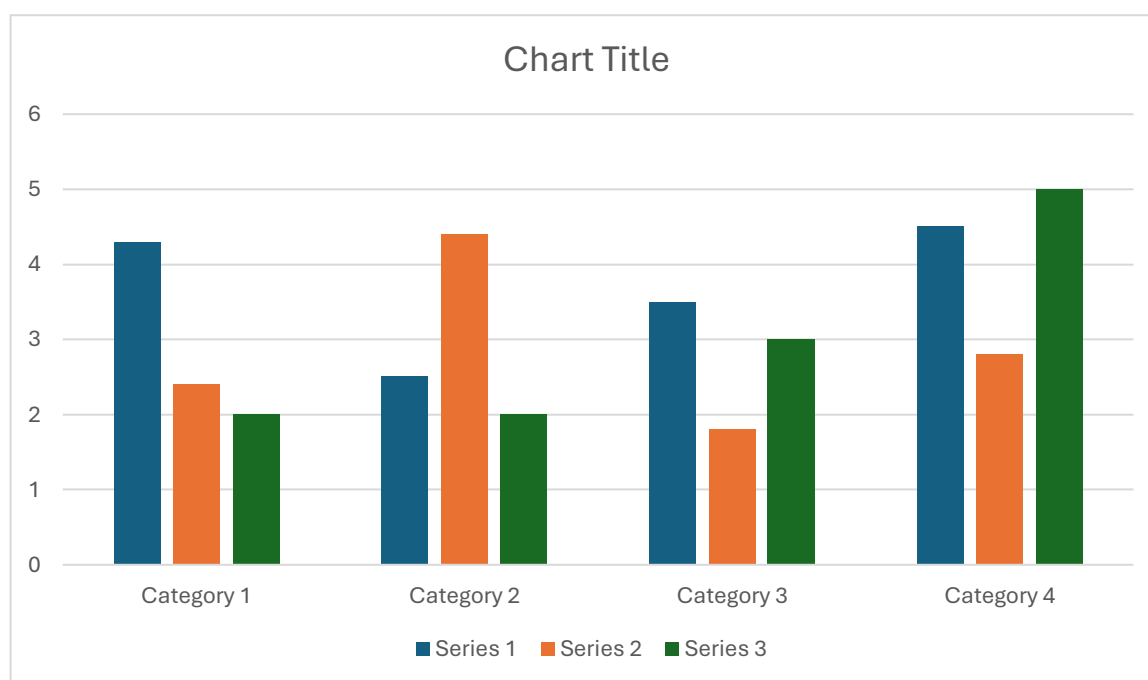
Table 2: Showing all the Parameters P value and Mean comparing Group A And B where Group

Parameters	Mean (Group A)	Mean (Group B)	p-value
VAS_6h	4.13	5.83	0.659
VAS_24h	3.36	5.53	0.549
VAS_48h	2.40	4.98	0.464
VAS_72h	1.27	3.28	0.372
VAS_7d	0.53	1.46	0.248
NPS_6h	4.03	6.00	0.394
NPS_24h	3.26	5.64	0.124
NPS_48h	2.25	4.58	0.013
NPS_72h	1.50	2.67	0.012
NPS_7d	0.42	1.21	0.011
Swelling_24h	3.44	6.70	0.348
Swelling_48h	4.01	7.92	0.295
Swelling_72h	2.36	5.19	0.0234*

Swelling_7d	0.79	1.20	0.0316*
IIO_24h	33.32	28.51	0.256
IIO_48h	35.09	30.38	0.128
IIO_72h	37.89	33.54	0.0563*
IIO_7d	42.76	40.90	0.0018*

A has been given 8mg Dexamethasone IM (masseter)

Interpretation Significant differences were observed in pain, swelling, and mouth opening at all postoperative intervals ($p < 0.05$). Independent T test And two way ANOVA test was applied. The mean postoperative swelling was measured using a flexible ruler from fixed facial reference points (gonion to lateral canthus, gonion to pogonion, and tragus to oral commissure). Swelling was recorded at 24 hours, 48 hours, and on the 7th postoperative day, and the mean regression in swelling (in cm) was calculated.



Graph 2: Comparison of Mean Postoperative Swelling at Different Follow-up Intervals

DISCUSSION

The findings of the present study reaffirm the growing body of evidence supporting the use of intramasseteric dexamethasone in reducing postoperative complications following surgical extraction of impacted mandibular third molars. Surgical removal of third molars is one of the most frequently performed procedures in oral and maxillofacial surgery and is often associated with postoperative pain, swelling, and trismus [1]. These complications arise from the inflammatory response triggered by surgical trauma, leading to vascular permeability, tissue exudation, and muscle spasm [2]. Effective management of these symptoms is therefore crucial for enhancing postoperative comfort and accelerating recovery.

Dexamethasone, a potent synthetic glucocorticoid, exerts its anti-inflammatory effect by inhibiting phospholipase A₂, which prevents the release of arachidonic acid from membrane phospholipids [5]. This subsequently blocks the cyclooxygenase and

lipoygenase pathways responsible for prostaglandin and leukotriene synthesis [4]. These mediators play a central role in pain, vasodilation, and edema formation [5]. By modulating this biochemical cascade, dexamethasone effectively suppresses inflammatory manifestations, resulting in reduced postoperative swelling, pain, and trismus [6].

In the present study, the group receiving intramasseteric dexamethasone exhibited significantly less pain, swelling, and trismus compared to the control group. These results are consistent with those reported by Majid and Mahmood [7], who observed substantial reductions in postoperative swelling and improved mouth opening with intramasseteric dexamethasone compared to systemic administration.

Similarly, Grossi et al [4]. demonstrated that a single dose of intramuscular dexamethasone significantly alleviated postoperative discomfort and reduced facial edema following third molar extraction. The localized intramasseteric route provides a distinct pharmacological advantage by ensuring high local drug concentration near the surgical site while minimizing systemic exposure. This approach maintains therapeutic efficacy without significant systemic side effects often associated with corticosteroid use.

Ngeow and Lim. [6] compared submucosal, intramuscular, and intravenous routes of dexamethasone administration and reported that the intramasseteric route produced comparable or superior results in controlling postoperative sequelae. Moreover, the proximity of the masseter muscle to the surgical site allows for direct diffusion of the drug into perimandibular tissues, providing faster and more targeted antiinflammatory action [12].

The timing of corticosteroid administration also plays a vital role in optimizing outcomes. Several authors, including Ngeow and Lim.[6], have emphasized the benefits of preemptive steroid use to suppress the early phase of the inflammatory cascade. However, intraoperative or immediate postoperative administration, as performed in the present study, has also been shown to be equally effective in attenuating inflammatory mediator release and minimizing postoperative discomfort [14].

Postoperative swelling is a frequent and clinically significant consequence of third molar surgery, resulting primarily from inflammatory vasodilation and increased vascular permeability, which promote plasma extravasation and accumulation of interstitial fluid. Dexamethasone may attenuate this response by suppressing inflammatory mediator activity and reducing vascular permeability, thereby limiting tissue edema and associated discomfort. Similarly, postoperative trismus is commonly associated with inflammatory edema, tissue irritation, and reflex spasm of the muscles of mastication. In the present study, the dexamethasone group demonstrated improved mouth opening, suggesting effective reduction of the inflammatory changes contributing to postoperative restriction. These findings are consistent with Grossi GB et al. [4], who reported reduced postoperative swelling and improved mouth opening following an 8 mg intramasseteric dexamethasone injection compared with placebo, supporting the beneficial role of localized corticosteroid administration in minimizing postoperative morbidity.

Pain control represents an important component of postoperative recovery following surgical removal of impacted mandibular third molars. The lower postoperative pain scores observed in the dexamethasone group may be attributed to suppression of the inflammatory cascade, including reduced prostaglandin-mediated sensitization of peripheral nociceptors. The prolonged biological activity of dexamethasone, with an approximate half-life of 36–54 hours, may further explain its sustained effect during the early postoperative period, when inflammatory responses and associated discomfort are most pronounced [18].

Overall, the present findings support the clinical utility of intramasseteric dexamethasone for reducing postoperative morbidity. Its localized administration may provide effective modulation of inflammation in the tissues surrounding the surgical site, thereby contributing to improved control of pain, edema, and restricted mouth opening. The technique is relatively simple and can be performed following achievement of local anesthesia, making it a feasible adjunct to routine third molar surgery. The absence of notable adverse reactions in the present investigation further supports its clinical acceptability.

LIMITATIONS

Despite these encouraging findings, certain limitations should be considered. The relatively small sample size and single-centre design may limit the generalizability of the results, while the short postoperative assessment period restricts evaluation of longer-term outcomes. Further randomized studies involving larger populations and extended follow-up are warranted.

Future research may also compare different dexamethasone doses, evaluate alternative corticosteroids, and determine whether the timing of administration before or after surgery influences therapeutic effectiveness.

CONCLUSION

A single preoperative intramasseteric administration of 8 mg dexamethasone appears to be an effective adjunct for reducing postoperative pain, facial swelling, and trismus following surgical extraction of impacted mandibular third molars. The intervention offers a simple and clinically practical approach to postoperative inflammatory control and may contribute to improved patient comfort during early recovery. Larger, well-designed studies with longer follow-up are recommended to establish optimal dosing, administration timing, and the broader clinical applicability of this technique.

Conflicts of Interest: Nil

Financial Support: None

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