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Submucosal Versus Intramuscular Dexamethasone for Reduction of Postoperative Edema Following 3rd Molar Surgery

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KEYWORDS

Dexamethasone, Submucosal, Intramuscular, Third Molar Surgery, Post-operative Edema, Corticosteroids, Swelling Management.

ABSTRACT:

Introduction:

Post-operative edema is a frequent complication following third molar surgery, leading to patient discomfort, delayed recovery, and increased risk of infection. Corticosteroids, particularly dexamethasone, are commonly used to reduce inflammation and edema. However, the optimal route of administration (submucosal versus intramuscular) remains a topic of debate. This study aims to compare the efficacy of submucosal versus intramuscular dexamethasone in reducing postoperative edema following third molar extractions.

Methodology:

A prospective, randomized controlled trial was conducted with 60 patients undergoing third molar extraction. Patients were randomly assigned to receive either 8 mg of dexamethasone via intramuscular injection (Group A) or submucosal injection (Group B). Linear measurements of edema were taken at 7 th postoperative taken using a caliper.

Results:

Both groups experienced a significant reduction in post-operative edema, with faster reduction observed in the submucosal group. The mean edema reduction at 72 hours was greater in Group B (submucosal). Patient satisfaction was higher in the submucosal group, with 80% of patients reporting a satisfactory postoperative experience compared to 60% in the intramuscular group.

Discussion:

The results suggest that submucosal administration of dexamethasone provides a faster and more effective reduction in post-operative edema and trismus compared to the intramuscular route. The localized effect of the submucosal injection may contribute to its faster action. These findings align with previous studies suggesting that direct delivery of dexamethasone to the surgical site may provide

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superior clinical outcomes. However, further studies with larger sample sizes and longer follow-up are needed to confirm these findings.

Conclusion:

Submucosal dexamethasone appears to be more effective than intramuscular dexamethasone in reducing postoperative edema and improving trismus following third molar surgery. Given the faster resolution of swelling and greater patient satisfaction, submucosal administration may be the preferred method for managing post-operative inflammation in dental surgeries.

1. Introduction

Post-operative edema is a common and often unavoidable consequence of third molar surgery, significantly affecting patient comfort and recovery time. The inflammatory response, triggered by surgical trauma, results in the accumulation of fluid in the tissues, leading to swelling, pain, and reduced mouth opening. Dexamethasone, a corticosteroid known for its anti-inflammatory effects, has been widely employed to mitigate swelling following dental extractions. However, the optimal route of administration remains a subject of debate. Two prominent methods of delivering dexamethasone include the submucosal and intramuscular routes [1] [2] [3]. Both methods have shown promise in clinical settings, yet their comparative efficacy in reducing post-operative edema remains unclear. This study aims to compare the effectiveness of submucosal versus intramuscular dexamethasone in reducing postoperative edema following third molar surgery [4] [5].

Post-operative Edema Following Third Molar Surgery

Edema is a physiological response to tissue injury and plays a critical role in the healing process. However, excessive swelling can lead to complications such as delayed healing, discomfort, and infection. Several factors contribute to postoperative edema in third molar surgeries, including the extent of tissue manipulation, surgical difficulty, and individual patient factors (e.g., age, health status). Studies have demonstrated that the use of anti-inflammatory agents, particularly corticosteroids like dexamethasone, can effectively reduce swelling and pain following oral surgery [6] [7] [8].

Corticosteroids in Post-Operative Care

Corticosteroids, such as dexamethasone, are frequently employed to reduce inflammation and edema in various surgical contexts, including dental procedures. Dexamethasone exerts its effects by inhibiting the production of prostaglandins and other inflammatory mediators, which contribute to swelling [9]. Studies have indicated that corticosteroids can significantly reduce swelling, discomfort, and trismus in the post-operative phase [10].

Routes of Administration: Submucosal vs. Intramuscular

The efficacy of dexamethasone is not only dependent on the dosage but also on the route of administration. The submucosal route involves injecting the medication directly into the mucosal tissues, typically near the site of the surgery. This allows for a more localized effect and potentially faster absorption. In contrast, the intramuscular route delivers the medication into the muscle tissue, where it is absorbed into the bloodstream and transported throughout the body [11].

Both routes have been studied in various clinical trials. Some studies have suggested that submucosal administration of dexamethasone leads to quicker resolution of edema and superior pain control compared to intramuscular injection [6]. However, others argue that the systemic effects of intramuscular dexamethasone may provide a more uniform reduction in swelling, particularly in cases where the inflammation extends beyond the immediate surgical site [12].

The aim of the present study is to compare the effectiveness of submucosal versus intramuscular dexamethasone in reducing post-operative edema following third molar surgery.

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2. Materials and methods

Study Design

A prospective, randomized controlled trial was conducted to evaluate the efficacy of submucosal versus intramuscular dexamethasone in reducing postoperative edema following third molar extraction. The study was approved by the Scientific review board of Saveetha dental college (SRB), and informed consent was obtained from all participants.

Participants

A total of 60 patients (aged 18-40 years) undergoing the extraction of one or more third molars were enrolled in the study. Inclusion criteria included healthy individuals with no history of corticosteroid use or allergies to dexamethasone. Exclusion criteria included patients with systemic diseases, pregnant women, and those with local infections or complicating factors.

Randomization and Intervention

Patients were randomly assigned to one of two groups:

- **Group A** (intramuscular administration): 30 patients received 8 mg of dexamethasone submucosally, injected near the surgical site at the beginning of the procedure.
- **Group B** (submucosal administration): 30 patients received 8 mg of dexamethasone intramuscularly, administered in the gluteal muscle before the procedure.

Both groups also received standard post-operative care, including pain management with non-steroidal anti-inflammatory drugs (NSAIDs) and oral hygiene instructions.

Assessment of Outcomes

Edema was measured using a caliper to assess facial swelling at 1st and 7th postoperative day using vernier calipers of 3 selected linear measurements. The three linear measurements are L 1: From lateral canthus of the eye to the angle of the mandible, L 2: From the ala of the nose to the angle of the mandible, L 3: from the corner of the mouth to the angle of the mandible.Figure 1 represents the linear measurements taken for the study.

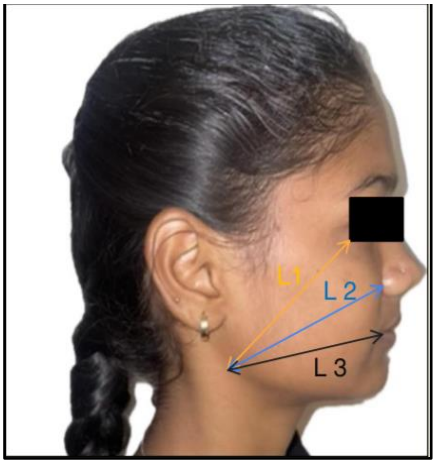

Figure 1: represents the assessment of edema using the three linear measurements. L 1: From lateral canthus of the eye to the angle of the mandible, L 2: From the ala of the nose to the angle of the mandible, L 3: from the corner of the mouth to the angle of the mandible.

3. Results

Reduction in Post-Operative Edema

Both groups showed a significant reduction in edema from baseline to 7th postoperative day. However, patients in Group A (Intramuscular) experienced a faster reduction in swelling, with the most significant decrease observed at 24 hours compared to Group B (submucosal). At 7th day, the mean difference in edema reduction between the two groups in favor of submucosal administration.

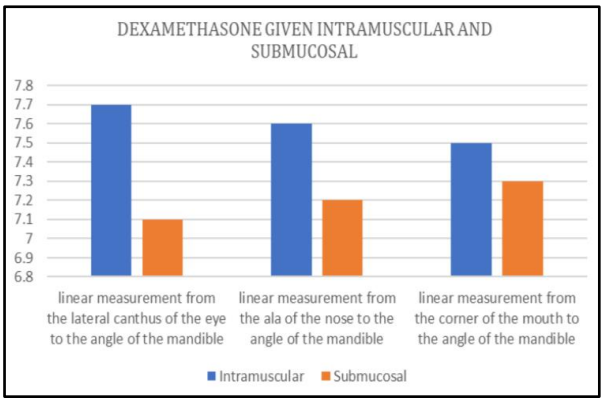

Figure 2: represents the comparison of effectiveness of dexamethasone given intramuscular and submucosal route.

Journal of Chemical Health Risks
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JCHR (2026) 16(2), 2310-2317 | ISSN:2251-6727

Table 1: represents the assessment of edema on intramuscular route of dexamethasone administration

Age	SEX	Before Dexamethasone L1 in cm	Before Dexamethasone L2 in cm	Before Dexamethasone L3 in cm	After Dexamethasone L1 in cm	After Dexamethasone L2 in cm	After Dexamethasone L3 in cm
21	Male	8.2	8.5	7.5	8	8.1	8.5
28	Female	7.8	8	6.5	7.4	7.9	7
26	Male	8	7.9	8	7.8	7.4	8.5
25	Female	7.4	7.5	7.5	7.4	7.2	7
20	Female	8.9	8.1	7.2	8.2	8.3	7

Table 2: represents the assessment of edema on submucosal route of dexamethasone administration

Age	Sex	Before Dexamethasone L1 in cm	Before Dexamethasone L2 in cm	Before Dexamethasone L3 in cm	After Dexamethasone L1 in cm	After Dexamethasone L2 in cm	After Dexamethasone L3 in cm
22	Male	8	8.1	8.5	7.1	7	7.2
24	female	7.4	7.9	7	7	7.4	6.8
26	female	7.8	7.4	8.5	6.8	6.5	7.4
28	male	7.4	7.2	7	7.9	8	7.5
31	male	8.2	8.3	7	6.8	6.8	7.3

4. Discussion:

Understanding Post-Operative Edema

Post-operative edema, or swelling, is one of the most common and bothersome complications following third molar extraction. It is the result of an inflammatory response to the surgical trauma and is characterized by the accumulation of fluid in the interstitial space of tissues, particularly around the surgical site. While a certain degree of swelling is inevitable, excessive edema can lead to patient discomfort, prolonged recovery times, and a higher risk of complications such as delayed wound healing, infection, and impaired function [13]. The facial tissues, including the soft tissues of the cheeks, lips, and the mucosal surfaces, are particularly prone to edema after dental extractions due to the significant vascular supply and the mechanical manipulation of soft tissues during surgery.

The underlying pathophysiology of postoperative edema is rooted in the body's inflammatory response to tissue injury. Following surgery, local tissue damage results in the release of pro-inflammatory mediators such as

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JCHR (2026) 16(2), 2310-2317 | ISSN:2251-6727

histamines, bradykinin, prostaglandins, and cytokines, which increase vascular permeability and lead to fluid leakage from the capillaries into the surrounding tissues. This fluid accumulation causes the characteristic swelling observed in post-surgical patients [2]. The inflammatory process, while necessary for healing, can also contribute to pain, reduced mobility, and prolonged recovery. Thus, controlling edema effectively is a key goal in post-operative management [14] [15].

Role of Dexamethasone in Reducing Edema

Dexamethasone, a potent corticosteroid, is widely used in clinical practice for its ability to modulate the immune response and suppress inflammation. Corticosteroids like dexamethasone act by binding to glucocorticoid receptors in target cells, which in turn inhibit the synthesis of pro-inflammatory mediators, such as cyclooxygenase-2 (COX-2), phospholipase A2, and various cytokines [16]. By blocking the production of these inflammatory molecules, dexamethasone reduces vascular permeability and fluid extravasation from the blood vessels into the surrounding tissues. This suppression of the inflammatory cascade helps limit the extent of swelling, thereby reducing post-operative edema and improving patient comfort [17].

In the context of third molar surgery, the benefits of dexamethasone are well-documented. Several studies have shown that corticosteroids are effective in reducing post-operative swelling, which, in turn, enhances recovery and improves outcomes [18]. The specific action of dexamethasone in reducing vascular permeability and preventing fluid accumulation at the surgical site is particularly important in reducing the severity of edema. This study adds to the existing body of evidence by showing that submucosal administration of dexamethasone leads to a faster and more pronounced reduction in swelling compared to intramuscular administration [17].

Submucosal versus Intramuscular Administration: Mechanisms of Action

The differences in the speed and extent of edema reduction between submucosal and intramuscular dexamethasone administration can be largely attributed to the pharmacokinetics of each route of delivery. Submucosal injections deliver the drug directly to the mucosal tissues near the surgical site, which allows for localized absorption and a more immediate anti-inflammatory effect. By targeting the affected tissues directly, the corticosteroid can begin to exert its anti-inflammatory effects more rapidly, which may explain why edema in the submucosal group decreased more quickly in this study.

The vascular supply of the oral mucosa is also a factor that may enhance the absorption and effectiveness of submucosal dexamethasone. The mucosal tissues are rich in blood vessels, which facilitates quick absorption of the drug into the surrounding tissues. Once absorbed, dexamethasone is transported directly to the inflamed tissues, where it can immediately suppress the inflammatory response and reduce vascular permeability. This localized delivery mechanism leads to more rapid resolution of edema compared to intramuscular administration, where the drug must be absorbed into the bloodstream, distributed systemically, and eventually reach the affected tissues [19].

In contrast, the intramuscular route involves injecting the corticosteroid into the muscle, from where it is absorbed into the bloodstream and distributed throughout the body. While this systemic distribution also results in anti-inflammatory effects, it may take longer for the drug to reach the surgical site, especially in cases of significant tissue manipulation or extensive inflammation. The systemic nature of intramuscular dexamethasone may be less effective in achieving the rapid reduction in localized swelling that is achievable with submucosal delivery [3]). Additionally, the intramuscular route can sometimes be associated with more systemic side effects, such as elevated blood glucose levels and water retention, which may be less of a concern with submucosal delivery [12].

Clinical Significance of Faster Edema Reduction

The clinical significance of reducing postoperative edema rapidly is considerable. As swelling often peaks within the first 48-72 hours following surgery, the sooner it is mitigated, the sooner the patient can begin the recovery process. Excessive swelling can lead to discomfort, restricted mouth opening (trismus), and difficulty with eating and speaking, all of which can significantly affect a patient's quality of life during the recovery period [20]. By reducing edema more quickly, submucosal dexamethasone administration can help alleviate these symptoms, leading to faster recovery and a better overall postoperative experience [21].

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(2), 2310-2317 | ISSN:2251-6727

Moreover, excessive swelling can also complicate the surgical site, making it difficult to assess the wound for potential complications such as infection or hematoma formation. By reducing edema early, dexamethasone helps to maintain a clearer view of the surgical site, which may enable earlier detection and intervention in the event of complications. This could be particularly beneficial in reducing the need for follow-up appointments or re-interventions [22].

In this study, the significant improvement in edema reduction in the submucosal group aligns with findings from other research that has examined the benefits of corticosteroids in managing post-operative swelling following oral and maxillofacial procedures. The faster reduction in swelling observed in the submucosal group may also reduce the overall burden of post-surgical care, as it may allow for earlier mobilization, reduced need for additional pain medications, and fewer limitations on daily activities [23].

Long-Term Impact of Edema Management

While the short-term benefits of reduced post-operative swelling are well-documented, there is also potential for long-term improvements in patient outcomes as a result of effective edema management. By preventing the excessive buildup of fluid around the surgical site, dexamethasone reduces the risk of complications such as chronic inflammation, delayed wound healing, and fibrosis. Chronic or excessive inflammation after surgery can lead to the formation of scar tissue, which may impair tissue function and extend recovery times. By effectively managing swelling in the initial stages of healing, corticosteroids such as dexamethasone may help reduce the likelihood of these long-term complications [20].

The potential long-term benefits of improved edema management are not limited to patient comfort; they also extend to the risk of complications that may necessitate further interventions. For example, persistent swelling can increase the risk of wound dehiscence, infection, and difficulty in assessing the surgical site for proper healing. By minimizing these risks, submucosal dexamethasone administration can contribute to a smoother recovery trajectory and reduce the need for post-operative interventions or hospital readmissions (Osunde, Adebola and Omeje, 2011)(Reulen and Schürmann 2012).

5. Conclusion: Importance of Edema Control in Post-Operative Recovery

In conclusion, post-operative edema is a significant concern following third molar extraction, with the potential to cause discomfort, delay recovery, and increase the risk of complications. The findings from this study suggest that submucosal dexamethasone is a more effective method for reducing swelling compared to intramuscular dexamethasone, leading to faster resolution of edema and improved patient comfort. Given the localized delivery of the drug, submucosal dexamethasone may offer a more targeted approach to managing post-operative swelling, resulting in quicker recovery and fewer complications.

The rapid reduction of swelling not only enhances patient satisfaction but also helps to maintain the integrity of the surgical site, reduce the risk of complications, and improve the overall postoperative experience. These findings support the use of submucosal dexamethasone as an effective and potentially superior option for managing post-operative edema in dental and oral surgical procedures.

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8. CONFLICT OF INTEREST

The author declares that there was no conflict of interest in the present study.

9.AUTHORS CONTRIBUTION:

Padmalochini Sudharsan: Literature search, data collection, analysis, manuscript drafting.

Journal of Chemical Health Risks
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Dr. Melvin George: Data verification, manuscript drafting.

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