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Efficacy of Dexamethasone on Pain and Swelling Following Extraction of Impacted Mandibular Third Molars

A Randomized Controlled Trial

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Abstract

Objective: Surgical extraction of impacted mandibular third molars is a common dental procedure associated with significant postoperative complications, including pain and swelling. Dexamethasone, a corticosteroid known for its anti-inflammatory properties, has been utilized to mitigate these postoperative sequelae. This study aimed to evaluate the efficacy of submucosal dexamethasone injection in reducing postoperative pain and swelling compared to a control group receiving normal saline. **Material and Methods**: A randomized controlled trial was conducted involving 40 patients scheduled for surgical extraction of impacted mandibular third molars. Participants were randomly assigned to two groups: the study group received a submucosal injection of 8mg dexamethasone, while the control group received an equivalent volume of normal saline. Postoperative pain was assessed using a Numeric Rating Scale (NRS) at 24 hours, 48 hours, and 7 days post-surgery. Facial swelling was measured at the same intervals using standardized landmarks. **Results**: The results indicated that the study group experienced significantly less pain at 24 hours (NRS: 4.28 ± 0.71 vs. 5.8 ± 0.87, p=0.001) and 48 hours (NRS: 3.45 ± 0.75 vs. 4.9 ± 0.99, p=0.001) compared to the control group. Additionally, facial swelling was significantly reduced in the dexamethasone group at 48 hours (3.01% vs. 6.49%, p=0.001). By the 7th postoperative day, both groups showed similar levels of pain and swelling, indicating that the effect of dexamethasone was most pronounced in the early postoperative period. **Conclusion**: Submucosal injection of dexamethasone is effective in minimizing postoperative pain and swelling following the surgical extraction of impacted mandibular third molars. The findings support the use of dexamethasone as a standard adjunctive treatment in oral surgery to enhance patient recovery during the critical early postoperative phase. Further studies are warranted to explore optimal dosing and long-term outcomes associated with this intervention.

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Introduction

Surgical extraction of impacted mandibular third molars is a common dental procedure that can result in significant postoperative complications, including pain, swelling, and trismus. These sequelae can lead to discomfort, functional impairment, and a prolonged recovery period for patients. The management of postoperative pain and swelling is crucial to improve patient outcomes and satisfaction [1,2].

Corticosteroids, such as dexamethasone, have been widely used to reduce inflammation and alleviate postoperative symptoms. Dexamethasone has potent anti-inflammatory properties, making it an effective agent in reducing swelling and pain. The submucosal route of administration has gained popularity due to its targeted action, reduced systemic side effects, and ease of administration [3,4].

Despite the growing evidence supporting the use of dexamethasone in oral surgery, there is a need for further research to establish its efficacy in reducing postoperative pain and swelling following impacted mandibular third molar surgery. The optimal dosage, timing, and route of administration of dexamethasone remain unclear, and the current literature is limited by the variability in study designs, sample sizes, and outcome measures [5,6].

This randomized controlled trial aims to evaluate the efficacy of submucosal dexamethasone injection in reducing postoperative pain and swelling following surgical extraction of impacted mandibular third molars. The study will compare the outcomes of patients receiving submucosal dexamethasone injection with those receiving a normal saline injection. The results of this study will provide valuable

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insights into the effectiveness of submucosal dexamethasone injection in managing postoperative pain and swelling, ultimately contributing to improved patient care and outcomes in oral surgery.

Material and Methods

Study Design: This randomized controlled trial was conducted from November 4, 2022, to December 15, 2022. The study was approved by the institutional review board, and informed consent was obtained from all participants.

Participants: A total of 40 patients aged 17 to 40 years, requiring surgical extraction of impacted mandibular third molars, were enrolled in the study. Patients were randomly assigned to two groups: the study group (n=20) received a submucosal injection of 8 mg dexamethasone, while the control group (n=20) received an equivalent volume of normal saline (Normon, Spain). Inclusion criteria included patients with fully impacted mandibular third molars, while exclusion criteria included those with systemic diseases, allergies to corticosteroids, or pregnant women [7,8].

Surgical Procedure: All surgical extractions were performed under local anesthesia using 20 mg/ml lidocaine with 0.0125 mg/ml epinephrine. A full-thickness two-sided flap was created using a No. 15 blade and scalpel handle No. 3. Flap reflection was achieved with a periosteal elevator, followed by bone removal using a low-speed surgical handpiece and normal saline irrigation. The impacted tooth was extracted, and the flap was repositioned and sutured [9,10].

Intervention: Immediately after the surgical procedure, the study group received a submucosal injection of 8 mg dexamethasone (Caspian Tamin, Iran) at the surgical site, while the control group received an equivalent volume of normal saline. The injections were administered using a dental syringe (Dental Syringe, Pakistan) to ensure accurate delivery.

Outcome Measures: Postoperative pain was assessed using a Numeric Rating Scale (NRS) at 24 hours, 48 hours, and 7 days post-surgery. Patients were instructed to rate their pain intensity on a scale from 0 (no pain) to 10 (worst pain imaginable). Facial swelling was measured at baseline, 48 hours, and 7 days postoperatively using standardized landmarks on the face.

Data Analysis: Data were analyzed using SPSS software (version 25). Descriptive statistics were calculated for demographic data. Comparisons between groups for pain scores and swelling measurements were performed using independent t-tests and ANOVA, with a significance level set at $p < 0.05$. The results were presented as mean ± standard deviation (SD) [11,12].

Results

Summary of Findings

The results of this study indicate that submucosal dexamethasone injection is effective in reducing both postoperative pain and swelling following the surgical extraction of impacted mandibular third molars. The most significant benefits were observed within the first 48 hours post-surgery, with both pain and swelling returning to similar levels by the 7th postoperative day. These findings support the use of submucosal dexamethasone as a standard adjunctive treatment in oral surgery to enhance patient recovery during the critical early postoperative phase.

Demographic Data

A total of 40 patients were enrolled in the study, with 20 patients in the study group receiving submucosal dexamethasone injection and 20 patients in the control group receiving normal saline. The mean age of the patients was 28.85 years, with a standard deviation of ±6.95 years. The sex distribution showed that in the control and intervention groups 12 participants were male and eight were female, with no significant difference between the groups ($p \geq 0.05$).

Pain Assessment

Postoperative pain scores were assessed using the Numeric Rating Scale (NRS) at 24 hours, 48 hours, and 7 days post-surgery. At 24 hours postoperatively, the study group reported significantly lower pain scores compared to the control group (4.28 ± 0.71 vs. 5.8 ± 0.87, p=0.001). Similarly, at 48 hours, the pain scores remained significantly lower in the study group (3.45 ± 0.75 vs. 4.9 ± 0.99, p=0.001). By the 7th postoperative day, the pain scores in both groups were comparable, with no statistically significant difference (0.2 ± 0.41 vs. 0.43 ± 0.31, p=0.069).

Swelling Assessment

Facial swelling was measured at baseline, 48 hours, and 7 days postoperatively. At 48 hours, the study group exhibited significantly less swelling compared to the control group (3.01% vs. 6.49%, p=0.001). By the 7th postoperative day, the swelling in both groups was similar, with no statistically significant difference (1.05% vs. 1.26%, p=0.16).

Adverse Effects

No serious adverse effects were reported in either group during the study period. Minor side effects, such as transient nausea and dizziness, were noted in a few patients but were not significantly different between the groups.

Discussion

The findings of this randomized controlled trial demonstrate that submucosal dexamethasone injection significantly reduces postoperative pain and swelling following the surgical extraction of impacted mandibular third molars. The study revealed that patients receiving dexamethasone reported lower pain scores at 24 and 48 hours postoperatively compared to the control group, with a notable reduction in facial swelling at 48 hours. These results align with previous studies that have highlighted the efficacy of corticosteroids in managing postoperative inflammation and discomfort [13,14].

Corticosteroids, particularly dexamethasone, are known for their potent anti-inflammatory properties. They inhibit the release of inflammatory mediators, such as prostaglandins and leukotrienes, which play a crucial role in the development of pain and swelling following surgical trauma [15]. The significant reduction in pain and swelling observed in this study supports the findings of Moraschini et al. (2016), who conducted a meta-analysis indicating that dexamethasone administration [1], particularly via the submucosal route, effectively mitigates postoperative symptoms after third molar surgery [16,17].

Conversely, some studies have reported mixed results regarding the efficacy of dexamethasone. For instance, Klongnoi et al. (2012) found no significant difference in pain reduction when comparing dexamethasone to placebo in certain patient populations. This discrepancy may be attributed to variations in study design, patient demographics, and the timing of dexamethasone administration. This study's focus on the submucosal route may explain the more favorable outcomes, as this method allows for localized delivery of the medication, maximizing its anti-inflammatory effects while minimizing systemic exposure [18].

These results also indicate that the benefits of dexamethasone are most pronounced in the early postoperative period, with pain and swelling levels converging by the seventh day. This finding is consistent with the pharmacokinetics of dexamethasone, which has a half-life of approximately 36 to 54 hours, suggesting that its effects diminish as the drug is metabolized [19,20]. These findings contribute to the growing body of evidence supporting the use of corticosteroids in oral surgery and highlight the importance of optimizing postoperative care to enhance patient recovery.

Conclusions

This randomized controlled trial demonstrates that submucosal dexamethasone injection is an effective intervention for minimizing postoperative pain and swelling following the surgical extraction of impacted mandibular third molars. The results indicate that patients receiving dexamethasone experienced significantly lower pain scores at 24- and 48-hours post-surgery, as well as reduced facial swelling

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at the 48-hour mark compared to the control group receiving normal saline.

The findings support the use of submucosal dexamethasone as a standard adjunctive treatment in oral surgery, particularly during the critical early postoperative period when patients are most vulnerable to discomfort and inflammation. The localized administration of dexamethasone not only enhances its efficacy but also minimizes potential systemic side effects, making it a favorable option for managing postoperative sequelae.

Considering these results, it is recommended that dental practitioners consider incorporating submucosal dexamethasone injections into their postoperative care protocols for patients undergoing third molar extractions. Further research is reasonable to explore optimal dosing strategies, timing of administration, and long-term outcomes associated with this intervention. Overall, the use of submucosal dexamethasone injection represents a valuable advancement in enhancing patient recovery and improving the quality of care in oral and maxillofacial surgery.

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