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Research Article

The Effectiveness of Using a Single Postoperative Intramuscular Dexamethasone Injection on Patients with Surgical Extraction of Lower Third Molar: Split Mouth Technique

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Abstract

Background: Surgical removal of the lower third molar is one of the most common challenges in oral surgery. Their removal is associated with postoperative sequelae like pain, facial swelling, and trismus. All these sequelae are normal physiological responses of the body to tissue injury associated with surgical extraction. The pharmacological management is by analgesics, anti-inflammatory agents, and opioids perioperatively. One of the most used drugs is dexamethasone. ***Objective***: Evaluating the effectiveness of using a single immediate postoperative intramuscular dexamethasone injection on pain, swelling, trismus, and tissue healing in the first seven days. ***Methods***: A split-mouth technique was used on 16 patients with bilateral, similar impacted mandibular third molars that were extracted; one side was given an 8mg intramuscular injection of dexamethasone (study group), and the other side wasn't given an injection (control group), and comparisons of the two sides were done in the following seven days. ***Results***: 6 patients were excluded (not meeting criteria), so only 10 were left. All records showed a decrease in pain scores (significant only on the 1st and 2nd days), a decrease in swelling (not significant) measurements, and a decrease in limitation of mouth opening (significant only on the 1st day), while there were close healing scores for both groups. ***Conclusions***: The use of a single immediate postoperative intramuscular dexamethasone injection showed a decrease in pain scores, a reduction in trismus, and a lessening in swelling but had trivial or no effect on healing at the operation site.

Keywords: Dexamethasone, IM injection, Impaction, Lower third molars.

فعالية استخدام حقنة ديكساميثازون واحدة في العضلة بعد الجراحة على المرضى الذين خضعوا لخلع جراحي للضرس الثالث السفلي: تقنية تنصيف الفم

الخلاصة

الخلفية: يعد الاستئصال الجراحي للضرس الثالث السفلي أحد أكثر التحديات شيوعا في جراحة الفم. ترتبط إزالتها بعقاب ما بعد الجراحة مثل الألم وتورم الوجه وفتحة الفم. كل هذه العواقب هي استجابات فسيولوجية طبيعية للجسم لإصابة الأنسجة المرتبطة بالاستخراج الجراحي. تتم الإدارة الدوائية عن طريق المسكنات والعوامل المضادة للالتهابات والمواد الأفيونية في الفترة المحيطة بالجراحة. أحد الأدوية الأكثر استخداما هو الديكساميثازون. **الهدف**: تقييم فعالية استخدام حقنة واحدة مباشرة بعد الجراحة العضلية ديكساميثازون على الألم والتورم وتحدد فتحة الفم والتئام الأنسجة في الأيام السبعة الأولى. **الطرائق**: تم استخدام تقنية انقسام الفم على 16 مريضا يعانون من الأضراس الثالثة المتأثرة بالفك السفلي الثنائية المتشابهة التي تم استخراجها ؛ تم إعطاء جانب واحد حقنة عضلية 8 مجم من ديكساميثازون (مجموعة الدراسة) ، ولم يتم إعطاء الجانب الآخر حقنة (المجموعة الضابطة) ، وتم إجراء مقارنات بين الجانبين في الأيام السبعة التالية. **النتائج**: تم استبعاد 6 مرضى (لا يستوفون المعايير)، لذلك لم يتبق سوى 10 مرضى. أظهرت جميع السجلات انخفاضا في درجات الألم (ملحوظ فقط في اليومين 1 و 2)، وانخفاض في التورم (غير معتد به) القياسات، وانخفاض في الحد من فتح الفم (كبير فقط في اليوم الأول)، بينما كانت هناك درجات شفاء قريبة لكلا المجموعتين. **الأستنتاجات**: أظهر استخدام حقنة ديكساميثازون عضلية واحدة بعد الجراحة مباشرة انخفاضا في درجات الألم، وانخفاضا في التورم، وانخفاضا في التورم ولكن كان له تأثير بسيط أو معدوم على الشفاء في موقع العملية.

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INTRODUCTION

Surgical removal of the lower third molar is one of the most commonly performed minor surgical procedures in the oral and maxillofacial field [1-3]. In most patients, the post-operative impediments from lower third molar surgery are severe pain, facial swelling, and trismus due to high blood supply in the region [4-10]. The pharmacologic management of inflammation essentially involves obstructing the formation of inflammation [11]. Dexamethasone is a synthetic corticosteroid that has greatly superior anti-

inflammatory effects [12-16]. This study aimed to evaluate the effectiveness of using a single immediate postoperative intramuscular dexamethasone injection regarding pain at the first seventh post-operative days, swelling at 1st, 3rd and 7th post-operative days, trismus at 1st, 3rd and 7th postoperative days, and tissue healing at the 7th day postoperatively at the site of the surgery (at suture removal).

METHODS

Study design and sampling

In this prospective split-mouth technique randomized clinical control trial, a total number of 16 Iraqi patients aged 16-32 years, 6 males and 10 females who met the eligibility criteria, participated in this study for the surgical removal of bilateral similar impacted mandibular third molars. The total number of mandibular third molar removals was 32 teeth. Six patients were excluded from the sample due to their poor commitment to the timelines. So, the remaining 10 patients (with bilateral impaction) make the total number of impacted mandibular third molars 20 teeth. Each patient resembles the study group in which the patient is injected intramuscularly with a single dose of 8 mg of dexamethasone immediately postoperatively after removal of the impacted mandibular third molar on one side and the control group on which the impacted mandibular third molar on the other side is removed without usage of 8 mg of dexamethasone. The surgery was performed on each patient by the same operator and the same surgical procedure for the removal of bilaterally impacted mandibular third molars.

Inclusion criteria

Patients aged 15-40 years with bilateral similar impacted lower third molar who need and are willing to do surgical extraction.

Exclusion criteria

Patients who are not fulfill the inclusion criteria, allergic to dexamethasone, who has medical problems, those taking other medications, and pregnant or lactating women.

Preoperative assessment

History with thorough clinical examination, including both extraoral and intraoral examination, together with all records through a specially designed case sheet. Preoperative radiographic record (orthopantomography (OPG) and/or cone beam computed tomography (CBCT)) to check the shape of the crown, location and root configuration, relation to the adjacent tooth and mandibular canal, and the status of the adjacent tooth and the surrounding bone, as seen in Figures 1 and 2.

Figure 1: An OPG demonstrating a bilateral horizontally impacted mandibular third molar.

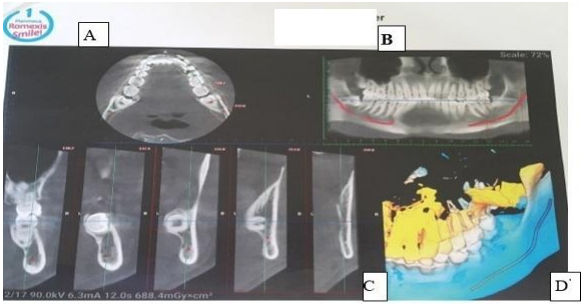

Figure 2: A CBCT showing relation of mandibular third molar to inferior alveolar canal: **A**) axial section showing the tooth position; **B**) a panoramic view with tracing of IDC; **C**) coronal sections showing IDC distance from third molar; and **D**) a three-dimensional image illustrating the path of IAC.

Surgical procedure

The surgeries were performed by the same surgeon on both sides for each patient under local anesthesia (lidocaine hydrochloride 2% with adrenaline 1:10000) by inferior alveolar nerve block, lingual nerve block, and long buccal nerve block. Flap design was selected according to each case, either envelope flap or triangular in more difficult cases, but the same design was used for both sides for each patient, as seen in Figure 3. The flap was reflected, and surgical extraction was done with bone removal and tooth sectioning, then sutured using 3/0 black silk suture using the simple interrupted suturing technique as shown in Figure 4.

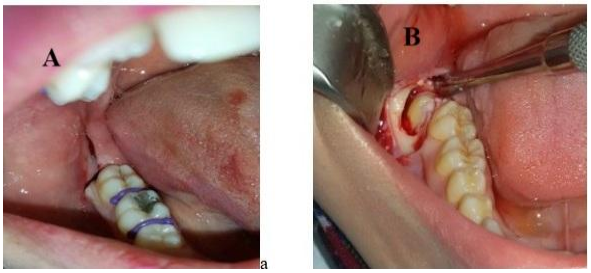

Figure 3: A) Incision of triangular flap; and **B**) Reflection of the flap.

Figure 4: Final steps in surgical procedure including socket inspection and then suture with black silk 3/0.

Post-surgical instructions and medications

After surgery, all patients were given the same instructions and standard painkillers and antibiotics to keep them healthy. These included amoxicillin cap 500 mg or azithromycin tab 500 mg for people who are allergic to penicillin, paracetamol tablet 1000 mg for five days, and chlorhexidine digluconate mouthwash. Patients in the study group were given a single dose of 8 mg intramuscular dexamethasone after surgery.

Outcome measurements

The variables that the study depended on to compare between both sides of each person were postoperative pain, degree of swelling, decrease in mouth opening, and evaluation of healing of the surgical site. The follow-up took place on the 1st, 3rd, and 7th postoperative days, except for the pain, which was recorded daily by the patients. The operator ensured that all patients received information about how to assess the degree of pain, as 0 represents no pain and 10 the worst pain. VAS (Visual analogue scale) [8]: The patients were educated to record the extent of pain each day at the same time for 7 days post-operatively. The swelling assessment was done by measuring the distance between the specific points by using flexible tape extending from gonion to commissure, gonion to lateral canthus, and tragus to commissure [1]. The dimensions measured were recorded preoperatively (as a base record) and on the 1st, 3rd, and 7th postoperative days. The degree of maximum mouth opening was recorded using a ruler, and the distance is recorded in millimeters from the incisal edge of the upper left central incisor to the lower left central incisor as the patient opens his/her mouth as much as possible preoperatively (as a base record to measure the decreases in mouth opening) and on the 1st, 3rd, and 7th postoperative days. Healing was assessed on the 7th postoperative day by using the Landry, Turnbull, and Howley index [17], which ranges from 1 (very poor healing) to 5 (excellent healing).

Ethical considerations

Ethical approval was obtained from the Research Ethics Committee at the College of Dentistry, University of Baghdad. Additionally, the study was registered at www.clinicatrials.gov with registration number: NCT06809855

Statistical analysis

All the data of our sample were subjected to computerized statistical analysis using the SPSS version 15 (2006) computer program. The statistical analysis included both descriptive and inferential statistics (paired sample t-test to assess the preoperative and postoperative pain, swelling, trismus, and healing). All information was recorded using a specific patient case sheet.

RESULTS

According to VAS, the mean pain scores from the 1st to the 7th day post-operatively were recorded; all records showed a decrease in pain scores in the study group (3.6, 3.1, 2.3, 1.4, 1, 0.8, and 0.6) compared with the control group (5.4, 5.7, 4.1, 3, 2, 1.4, and 1.1). Although all records displayed a decrease in pain scores in the study group, the pain decrease is highly significant on the first day and significant on the second day, while it is not significant on the 3rd to 7th postoperative days, as seen in Table 1.

Table 1: Comparison of the pain score between control and study groups for 7 days follow up

Time	Pain score		*p*-value
	Control group	Study group	
Day 1	5.4±2.72	3.7±1.77	0.001
Day 2	5.7±2.79	3.1±2.47	0.012
Day 3	4.1±2.88	2.3±2.26	0.051
Day 4	3.0±2.71	1.4±2.12	0.065
Day 5	2.0±2.62	1.0±1.63	0.128
Day 6	1.4±2.17	0.8±1.40	0.168
Day 7	1.1±1.66	0.6±1.07	0.177

Values are expressed as mean±SD.

Pain in both groups was highest on the first two days and then dropped gradually. Patients in the control group experienced more swelling than the study group; the mean increase of the swelling in the control group was 22.1, 24, 1.0, and 3.6 mm, while in the study group the mean increase of the swelling was 14.1, 17, and 4.9 mm for the 1st, 3rd, 7th postoperative days, respectively. Although there was less increase in swelling in the study group, it did not reach a statistically significant level, as seen in Table 2.

Table 2: Comparison of the swelling score between control and study groups for 7 days follow up

Day	Swelling score (mm)		*p*-value
	Control group	Study group	
Day 1	22.1±13.98	14.1±18.61	0.234
Day 3	24±16.63	17±23.19	0.419
Day 7	13.6±15.12	4.9±6.84	0.141

Values are expressed as mean±SD.

Records of the mean decrease in mouth opening on the 1st, 3rd, 7th postoperative days were 13, 9.66, and 4.11 mm for the control group and 5.9, 5.3, and 2.55 mm for the study group, respectively. Although there was a decrease in the trismus in the study group, it was statistically significant only on the first day, as seen in Table 3.

Table 3: Comparison of the decrease in mouth opening in control and study groups for 7 days follow up

Days	Decrease of mouth opening		*p*-value
	Control group	Study group	
Day 1	13±9.24	5.9±5.65	0.014
Day 3	9.66±7.04	5.3±3.13	0.122
Day 7	4.11±4.28	2.55±2.50	0.250

Values are expressed as mean±SD.

Patients in both groups had close recordings of the healing index, but the control group had slightly higher scores; however, they were not statistically significant, as demonstrated in Table 4.

Table 4: Comparison of the healing scale at day-7 between control and study groups

Days	Healing scale		*p*-value
	Control group	Study group	
Day 7	3.0±0.67	2.8±0.42	0.509

Values are expressed as mean±SD.

DISCUSSION

Surgical removal of impacted mandibular third molars is one of the most frequent dentoalveolar surgical procedures in the field of oral surgery [1,16]. Postoperative sequelae such as pain, swelling, and trismus are routinely present since the procedure involves trauma and tissue manipulation and subsequently inflammation [5]. Many previous studies [7,18,19] reported the reduction of postoperative pain, swelling, and trismus using dexamethasone in various doses and routes of administration. Our study used a single-dose intramuscular 8mg injection immediately postoperatively. The reason for choosing dexamethasone is due to its proven safety [20], while the reason for choosing the dose is that 8 mg is more effective than smaller doses, whereas the route of administration in this study was immediate intramuscular because other studies had some drawbacks in other routes like intramuscular injection preoperatively, in which the patient has to wait at least one hour before the operation [21-22]. In this study, we use a single dose to try to improve postoperative sequelae and avoid unwanted drug side effects resulting from more doses [23]. This clinical prospective split-mouth technique study included 10 patients with bilaterally impacted lower third molars with the same surgical difficulty on both sides. The inhibition of the release of mediators (lymphokines, prostaglandins, serotonin, and bradykinin) from the injured tissue is what causes the effect of pain reduction [14]. Although corticosteroids are mostly effective during the first 24 hours after injection, their effect can also be reflected up to three days [6]. The facial swelling can also be a source of pain because it tenses the tissue and causes tension pain, which dexamethasone relieves [8]. Pain scores measured by the VAS in this study showed a decrease in pain among the study group during the first seven days compared to the control group. It is a significant decrease on the first post-operative day and a significant decrease on the second day, while it is not statistically significant on the other days. The action of the dexamethasone in reducing pain post-operatively was significant in previous studies using different routes [8,24-26]. Some studies show no significant decrease on the first day but a significant decrease on the second and third days, with no significance from the fourth to the seventh day [24]. While other studies declared that oral administration of 8 mg of dexamethasone proved effective in reducing pain after lower third molar surgery [27]. Swelling is caused by the inflammatory response of the injured tissue, like hyperemia, vasodilation, and increased capillary permeability [28]. TNF-α, IL-1, and IL-6 are three cytokines that increase the permeability of blood vessels. This raises the osmotic pressure of the interstitial fluid, which leads to exudate edema [29]. Dexamethasone can lower this edema. In this study there was decreased swelling on the 1st, 3rd, 7th postoperative days, but it was not significant, which was also seen in other studies [1,30,31]. However, others report significant reduction in the first three days [18,24-26,32]. Our study shows a decrease in trismus on the 1st, 3rd, 7th postoperative days; however, this decrease is only significant on the 1st day. Some studies show significant improvement only on the second day [27]; others show significant reduction [8,30], while other studies suggest that a single dose is not significant [8,25,31]. The two groups were evaluated on the seventh day, and generally both groups had close recordings of the healing index, with slightly higher scores for the control group, but the difference is trivial and non-significant. Contrary opinions show a negative effect on wound healing in rats [33].

Conclusion

A single dose of 8 mg intramuscular injection of dexamethasone immediately postoperatively significantly decreased the pain scores at all seven postoperative days and reduced the swelling on the 1st, 3rd, and 7th postoperative days, but not to a statistically significant level. It also reduced the trismus through 1st, 3rd and 7th postoperative days, which was significant only on the first day, without trivial or no effect on healing at the operation site.

Conflict of interests

The authors declared no conflict of interest.

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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