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Dexamethasone Injection on Postoperative Complications After Impacted Lower 3rd Molar Extraction

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Abstract

Objective: The most common oral surgery is removing impacted lower third molars, which can be extremely painful and cause swelling to soft and bone tissue tension. Postoperative sequelae can bother patients and lower their quality of life. Thus, third-molar surgery patients need better pain management. The aim of this study was to determine the effectiveness of submucosal injection of 4 mg/1 ml dexamethasone in reducing postoperative pain, and facial swelling after surgical removal of impacted lower wisdom teeth. **Subjects and Methods:** This randomized clinical study included 100 patients with impacted mandibular third molars. Five minutes after the local anaesthesia injection, they were randomly assigned to a control group and a research group of fifty patients each. The study group got a 4 mg/1 ml submucosal injection of dexamethasone five minutes after local anaesthesia, whereas the control group received normal saline. Five minutes later, impacted teeth were surgically removed. estimated daily discomfort until the 7th postoperative day, and mouth opening and edema were assessed preoperatively, on the second and seventh postoperative days. These characteristics were examined between groups along with operation time. **Results:** The study group demonstrated a statistically significant ($p<0.05$) reduction in pain scores on the first and second postoperative days and a statistically significant decrease in swelling compared to the control group at a 7-day follow-up. **Conclusion:** According to the findings, a submucosal injection of dexamethasone (4 milligrams) that is administered as an intraoral injection after surgery is particularly helpful in reducing postoperative pain and swelling.

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Introduction

An "impacted tooth" is defined as a tooth that is maintained in the jaw beyond its normal time of the eruption. The impact is a pathological condition when a tooth fails to emerge properly [1].

Jaffar and Tin-Oo [2] showed that most impacted mandibular wisdom teeth are related to periodontitis, cystic lesions, pericoronitis, and undesirable effects on adjacent teeth such as root resorption. Patients may complain of pain, gingivitis, and oral infections, so removal of the impacted molars could be advocated to solve these problems. Oral and maxillofacial surgeons often remove the lower third molar.

The tooth's depth and angle relative to the jaw's investing bone and ascending ramus, as well as bone density, might make extraction difficult [3,4].

Lower third molar surgery normally causes soreness and swelling and trismus, however flap design and timing might change postoperative symptoms [5,6].

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Furthermore, the patient's physiologic inflammatory response affects these post-operative complications [7].

Knowing the variables that raise the risk of postoperative morbidity is crucial for selecting the treatment approach and preparing patients mentally [8]. To prevent postoperative complications after lower third molar surgery, several strategies were employed [9].

Secondary wound closure or recovery by secondary intention, suture-less technique, use of a drain after surgery, administration of different types of medications, including Antibiotics, corticosteroids, laser beams, or cryotherapy are different modalities used to reduce the postoperative inflammatory response [10-12].

Corticosteroids are one of the most prescribed drugs to manage postoperative inflammation [13]. Various dosages of corticosteroids and different routes of administration have been used. Corticosteroids can be injected locally or systemically during surgery [14]. Dexamethasone, the most common corticosteroid, significantly reduces inflammation [15]. Submucosal dexamethasone injection for lower wisdom tooth surgery is still being investigated [16]. While many studies show that submucosal dexamethasone improves postoperative symptoms and discomfort following impacted third molar surgery [17,18].

Materials and Methods

This randomized clinical trial was undertaken at a private dental clinic. 100 Iraqi patients with impacted mandibular third molars were selected to participate in this study for the surgical extraction of impacted mandibular third molars. They were randomly assigned into two groups (the control group and the research group) of 50 patients each.

The study group received a submucosal injection of 1 mL of dexamethasone (4 mg/mL solution) 5 minutes before surgery.

The control group received a submucosal injection of 1 mL of normal saline 5 minutes before surgery.

Inclusion criteria

The inclusion criteria of the selected patients were: -

1.No systemic disorders that might affect wound healing or surgery.

2. No recent or long-term use of anti-inflammatory drugs such NSAIDs, steroids, opioids, or antihistamines.

3. Individuals 17 years old or older who need surgery to remove impacted lower wisdom teeth

4.Well-educated patients who consented to the trial and who cooperate.

Exclusion criteria

1.Patients with acute pericoronitis.

2.Impacted teeth associated with pathologies.

3.Pregnant women

4.Medically compromised patients with uncontrolled systemic disease that affect normal tissue healing ex: uncontrolled diabetes mellitus, autoimmune diseases.

5.Patients allergic to corticosteroids.

6. Patients who neglect postoperative instructions and follow-up.

Preoperative data collection and assessment of the Pederson difficulty index

Two variables were investigated preoperatively, at 48 hours, and at the 7-day visit, and comparison was done between the study and control groups and within each group separately: extent of swelling, and postoperative pain. Pain was scored daily by the patients.

The Pederson difficulty index was used to evaluate the degree of difficulty of extraction.

Surgical procedure

A 2.2-ml were used glass cartridge containing lidocaine hydrochloride 2% with adrenaline 1:80000 (Septodent, France) provided local anaesthesia for all operations (2 capsules).

Five minutes after the lingual, inferior alveolar nerve block, and long buccal nerve infiltration anaesthesia, each patient received a submucosal injection with an insulin syringe containing 1 mL of dexamethasone or N.S., depending on their group, study, or control, which was randomly assigned (0.5 mL in the lower buccal vestibule near the intended area for surgical removal of an impacted mandibular tooth). Five minutes after dexamethasone or N.S administration, an incision was made and a buccal three-sided mucoperiosteal flap was reflected to get field access. For exposure, a tungsten carbide fissure bur in a straight surgical handpiece was used to remove bone from the distal and buccal parts of the teeth under continuous normal saline irrigation.

A turbine with a fissure burr and sectioned teeth were delivered, removed from the socket, and irrigated with N.S. After surgery, the flap was repositioned and fitted to the bone. 3/0 black silk sutures were used to approximate the distal papilla of the 2nd molar, sew the tissue that covered the impacted tooth, and stitch the buccal releasing incision. Interrupted sutures were used. Sterile gauze covered the wound (Figure 1).

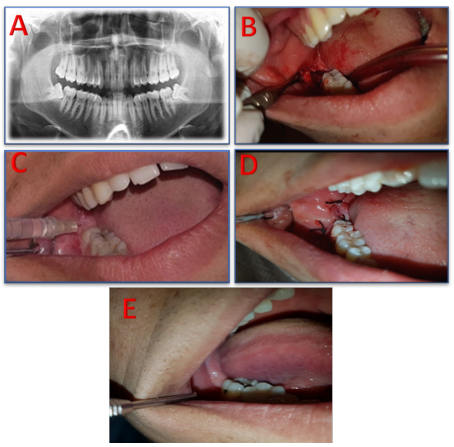

Figure 1. (A) Panoramic radiograph. (B) Tooth removal. (C) Submucosal injection of dexamethasone. (D) Suturing. (E) Suture removal.

Post-surgical instructions and medications

Systemic amoxicillin 875 mg and clavulanate 125 mg tablets were given to all patients. If the patient is penicillin-allergic, give Azithromycin Tablets 500 mg daily for 5 days. Paracetamol was 500 mg twice a day for three days. Following extraction, the patient was instructed to bite on a gauze pad for 30 minutes, apply an ice bag extraorally for the first 8 hours, refrain from rinsing for the first 24 hours, then rinse gently with warm saltwater every two to three hours, and eat a soft diet for the next two days.

Swelling measurement

To assess facial swelling, the tragus, soft tissue pogonion, outer canthus of the eye, and mandible angle were measured. These stages precede and follow third molar surgery.

Pain evaluation

All of the people in the study were given a printed version of the numeric rating scale and told to pick the number that best described how much pain they were in every day after surgery until the seventh day after surgery. The patients had no trouble using the number scale to keep track of how much pain they were in. (Figure 2).

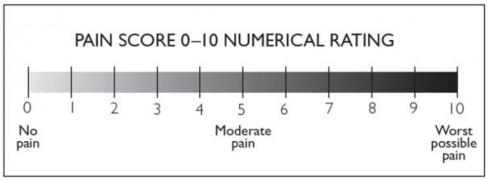

Figure 2. Numeric rating scale.

Statistical Analysis

The data was analyzed using (SPSS) version 25. Quantitative data used "mean" and "SD" qualitative data frequency and percentage. "Chi-square" was used to determine whether two qualitative variables were associated, and "ANOVA" was used to compare means.

Results

The patient's age ranged from 17 to 40 years with a mean±SD was (27.52±7.039) years. The highest proportion of patients in this study was in the age group (>30) years (62.5%). As demonstrated in Table (1).

In comparison between study and control group by gender, this study revealed that there was no significant difference (P=0.216) in gender between study groups as shown in Table (2).

Preoperatively

Results demonstrated that there was a significant difference (P<0.05) in preoperative facial measurements between both groups as revealed in Table 3.

The Comparison of the percentage of swelling between groups postoperatively

Table 4 displays the percentage of edema rising in both groups on the second and seventh postoperative days. In this investigation, the control group had a larger percentage of swelling at the first follow-up (5.49 vs. 4.06%, P<0.05), while the study group had a lower percentage at the 7-day follow-up (1.09 vs. 0.63 %, P<0.05).

Evaluation of postoperative pain by numerical rating scale

Table 5 shows the comparison between the pain levels of both groups for seven days and found that the control group had substantially greater pain scores in the first two postoperative days than the study group (6.94 vs 5.41, P<0.05; and 5.47 vs 3.51, P<0.05, respectively). As indicated in the table, there are non-significant differences (P>0.05) between groups regarding pain from the third to the seventh postoperative day.

Discussion

In this study (62.5%) of the patients were in the age group (>30) years 62% were males, and 38% were females.

According to Arakji et al. [19], early extraction of impacted teeth is recommended to avoid complications such as recurring pericoronitis, face discomfort for no apparent reason, cysts, odontogenic tumors, and periodontitis.

In addition to Krishnan et al., [20] most patients who had a lower third molar surgically removed were between the ages of 15 and 30, which is consistent with our results. Ayaz's study discovered that the third decade (58.5%) was the most common age group [21], this is a similar result to the results of our study.

Males outnumber females in the current study (62% versus 38%). This is in contrast with the studies by Ma'aita and Alwrikat [22], Quek et al. [23], Kim et al. [24], Hashemipour et al. [25], Saravanakumar et al. [26], Zafar et al. [27], and which reported a gender predilection for females.

A study conducted by Srivastava et al. [28] supports the findings of our study, with 55% being male and 45% being female patients. Also, a study done by Ehsan et al. [29], Grossi et al. [30] supports the results of our study with a male predilection.

This study has more men than women, which may be because of how people live in Iraq. Many female patients refused to take part in this study because they couldn't make it to the follow-up visits.

On the second postoperative day, both groups had the most facial edema, which gradually diminished. According to Patil et al. [31] surgical injury to the third impacted molar implanting tissues causes facial swelling. Slow onset, peaking after $24-48$ hours and lasting up to seven days. This reduction in facial swelling after submucosal dexamethasone injection may be due to the anti-inflammatory role of corticosteroids which inhibit the enzymatic activity of Phospholipase A_2 [32].

PLA2 hydrolyzes membrane glycerophospholipids to produce arachidonic acid, a precursor of eicosanoids such prostaglandins, leukotrienes, and others that cause swelling, fever, and hyperalgesia [33]. Furthermore, Corticosteroids stabilize lysosomal membranes, reduce capillary permeability, and decrease inflammation-related neutrophil and macrophage accumulation [34]. Maximum reduction of swelling at 48 hours after surgery could be explained by the fact that the half-life of dexamethasone is $36-54$ h [35].

The present study agrees with Grossi et al. [30], who revealed a significant difference between the dexamethasone and control groups on the second postoperative day and on day 7, postoperative swelling differed significantly across groups. In addition, Graziani et al. [36] and Khalida et al. [37] demonstrated on the second postoperative day a substantial decrease in swelling compared to the control group.

Tissue injury caused by surgical trauma led to inflammatory response like hyperemia, vasodilatation, and increased capillary permeability [38].

Numerical rating scale was the method used for evaluation of pain in our study which revealed that despite the reduction in pain scores in favor of dexamethasone group throughout 7 postoperative days, but the difference was a significant for the first two postoperative days only.

Several inflammatory mediators are involved in the pain process, especially prostaglandins and bradykinin [39]. The locally administered steroids act directly on eicosanoids, most prominently the prostaglandins. Prostaglandin synthesis inhibition by DXM facilitates some analgesic effects because these mediators sensitize spinal neurons to pain [40]. Moreover, locally administered glucocorticoids reduce nociceptive "C-fiber" signal transmission in damaged neurons [41].

A second way that DXM relieves pain is by stopping the body from making bradykinin at the site of an injury. Most people know that bradykinin, kallidin, and the products of the arachidonic acid cascade all play a role in pain and increased vascular permeability [42]. According to O'Hare et al. [43] the submucosal DXM injection has the most pain-relieving effect in the early postoperative phase. By the late postoperative phase, the pain has gone down, and the effects of dexamethasone have worn off, which may explain also why there is a big difference in the first two days after surgery.

In contrast, Nair et al. [44] found non-significant difference in terms of discomfort between the intraoperative submucosal injection of 4 mg dexamethasone and the control group. Deo et al. [45] found that the preoperative injection of 8 mg dexamethasone delayed the start of discomfort, however, the effect was non statistically significant when compared to placebo.

Grossi et al. [30] who examined the impact of submucosal injection of two different dosages of dexamethasone (4 mg vs. 8 mg) on pain reduction and determined that there were non-significant between the two dosage regimens of dexamethasone in comparison to a placebo. According to Majid, [46] and Saravanan et al. [47] have shown that dexamethasone considerably reduced pain on all postoperative days.

Warraich et al. [48] found that patients receiving a submucosal injection of 4 mg of dexamethasone saw a substantial decrease in pain and an improvement in quality of life compared to the control group.

Pain is difficult to evaluate and depends on individual variations like pain tolerance or anxiety [49]. Pain is complex, and it is not reliable to depend on the patient's ability to measure it [50]. This may affect the outcome of pain between different studies.

Conclusion

Dexamethasone administered submucosally is efficacious, safe, and comfortable since it is injected into an anaesthetized area. In addition, pre-operative 4 mg/1 ml submucosal dexamethasone injections reduce postoperative facial edoema and pain.

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Table 1. Age distribution according to groups.

Age (year)	Groups		Total No. (%)	Chi-Square (p. value)
	Control group No. (%)	Study group No. (%)		
≤30	38 (55.9%)	30 (44.1%)	68 (100.0%)	0.086
>30	12 (37.5%)	20 (62.5%)	32 (100.0%)	
Total	50 (50.0%)	50 (50.0%)	100 (100.0%)	

Table 2. Gender distribution among groups.

Gender	Groups		Total	Chi-Square (p. value)
	Control group No. (%)	Study group No. (%)		
Female	22 (57.9%)	16 (42.1%)	38 (100.0%)	0.216
Male	28 (45.2%)	34 (54.8%)	62 (100.0%)	
Total	50 (50.0%)	50 (50.0%)	100 (100.0%)	

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Table 3. The comparison between control and study groups in preoperative facial dimensions.

	Control group	Study group	F. value	p. value
	Mean±SD	Mean±SD		
Preoperative swelling	9.276±0.86	10.382±1.61	14.735	0.001

Table 4. Comparison in amount of increased swelling between study and control groups in first and second follow up

Increased swelling (%)	Control group Mean±SD	Study group Mean±SD	F value	p – value
First follow up	5.49±0.96	4.06±0.65	6.144	0.015
Second follow up	1.092±0.18	0.63±0.27	20.780	0.001

Table 5. Comparison between groups by pain scores throughout 7 days postoperatively.

Postoperative Pain	Groups		F. value	p-value
	Control group Mean±SD	Study group Mean±SD		
Day 1	6.94±0.561	5.41±0.247	26.725*	0.001
Day 2	5.47±0.323	3.71±0.42	6.248*	0.001
Day 3	3.57±0.379	3.51±0.329	1.949	0.370
Day 4	2.51±0.413	2.46±0.319	1.494	0.125
Day 5	1.61±0.189	1.58±0.199	1.242	0.085
Day 6	1.35±0.164	1.34±0.136	0.856	0.691
Day 7	0.68±0.154	0.69±0.165	0.398	0.741