Journal of Craniomaxillofacial Research

Vol. 9, No. 3 Summer 2022

Preoperative submucosal dexamethasone injection for minimizing postoperative pain, trismus, and oedema associated with impacted mandibular third molar surgery

Goran Lateef Fatah, Bayad Jaza Mahmood Faris *

Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Sulaimani, Sulaimani, Iraq.

ARTICLE INFO

Article Type:
Original Article

Received: 13 Feb. 2022
Revised: 2 Mar. 2022
Accepted: 19 Jun. 2022

**Corresponding author:*

Bayad Jaza Mahmood Faris

Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Sulaimani, Sulaimani, Iraq.

Tel: +96-47701955665
Email: Bayad.mahmood@Univsul.edu.iq

ABSTRACT

Aim: To evaluate the relative ability of 4mg dose of preoperative Dexamethasone, administered submucosally, to reduce the postoperative pain, swelling and trismus after third molar surgery.

Materials and Methods: The total 40 patient required surgical removal of a single mandibular third molar were included and divided into two groups, the experimental group (20 cases) received intraoperative submucosal injection of 4mg Dexamethasone buccally around the tooth at three points after the onset of anesthesia and the control group (20 cases) received no drugs. The maximum interincisal distance and facial contours were measured at baseline and at post-surgery days 2 and 7. The measurement of pain was done using visual analog scale (VAS).

Results: There was a statistically significant reduction in the severity of postoperative edema in the experimental group by the second postoperative day. While both groups saw a reduction in discomfort and trismus, there were no statistically significant differences between them.

Conclusion: The findings support submucosal injection of Dexamethasone (4mg) to decrease postoperative edema. Low-dose Dexamethasone injection at the surgical site enhances drug concentration at the injury site without loss owing to diffusion or excretion. The submucosal technique was significantly effective in reduction of postoperative swelling and trismus.

Keywords: Dexamethasone; Third molar; Pain; Trismus; Edema.

Introduction

The surgical extraction of lower third molars is one of the most common interventions in oral surgery [1]. In early 1954 Mead. has defined an impacted tooth as a tooth that is prevented from erupting into position because of malposition, lack of space, or other impediments [2]. Later Peterson, characterized impacted teeth as those teeth that fails to erupt into the dental arch within the expected time [3]. Generally, third molars have been found to erupt between the ages of 17 and 21 years, and impacted mandibular third molars are a common condition related with different difficulty degree of extraction operation and risk of complications [4,5]. The extraction of impacted lower third molars is the most common operation in oral surgery, and usually produces pain, trismus and facial swelling in the postoperative period [6]. The surgical removal of impacted third molars involves trauma to soft and bony tissue and can result in considerable pain, swelling and trismus.

These postoperative sequelae can cause distress to the patient and affect the patient's quality of life after surgery. Thus, many clinicians have emphasized the necessity for better discomfort control in patients who undergo third molar surgery, and several types of medications have been proposed [7]. Factors thought to affect the occurrence of complications after third molar removal include age, gender, medical history, smoking, use of oral contraceptives, poor oral hygiene, presence of pericoronitis, relationship of third molar to the inferior alveolar nerve, type of impaction, surgeon's experience, anesthetic technique, surgical time, surgical technique, topical antiseptics, intra-socket medications, and perioperative antibiotics [8,9].

The knowledge of various methods of reducing morbidity following third molar surgery would help both the surgeon and the patients in the management of impacted lower third molars [10]. The use of corticosteroids as anti-inflammatory agents in dental practice began in the 1950's with the administration of hydrocortisone to prevent inflammation in oral surgery. A single glucocorticoid dose inhibits the synthesis and/or release of proinflammatory and inflammatory mediators in a variety of surgical procedures, with a reduction of fluid transudation and therefore edema. This effect is well known and has been widely used to reduce swelling associated with the surgical extraction of impacted third molars. Prolonged corticosteroid use can delay healing and increase patient susceptibility to infection. The glucocorticoids most widely used in oral surgery are Dexamethasone (po), Dexamethasone sodium phosphate (intravenous and intramuscular), Dexamethasone acetate (intramuscular), Methylprednisolone (po), and Methylprednisolone acetate and Methylprednisolone sodium succinate (intravenous and intramuscular) [6]. Postoperative swelling and edema may be due in part to the conversion of phospholipids into arachidonic acid by phospholipase A2, and the resultant synthesis of prostaglandins, leukotrienes or thromboxane-related substances act as mediators of the inflammatory response. These symptoms are not observed immediately after surgery but rather begin gradually, peaking 2 days after the extraction. Corticosteroids such as Dexamethasone may inhibit the initial step in this process and have been extensively used in varying regimens and routes to lessen inflammatory sequelae after third molar surgery [7]. Therefore, the present study was conducted to evaluate the relative ability of 4mg dose of intraoperative Dexamethasone, administered submucosally, to reduce the postoperative discomfort after third molar surgery.

Patients and Methods

A prospective randomized clinical study was conducted among 40 randomly selected patients from different regions of Kurdistan/Iraq, treated at the Department of Oral and Maxillofacial Surgery, Sulaymaniyah Teaching Hospital, from November 2021 to November 2022. The present study has been carried out in accordance with the declaration of Helsinki. Patients were registered only after receiving sufficient information and providing written consent to participate in the study. Enrolled patients in the study were over 20 years of age undergoing surgical removal of lower third molar teeth. Whereas children, patients with systemic diseases, patients with a history of chemotherapy or radiation therapy, pregnant or lactating women, smokers, patients taking medications that affect wound healing, and anticoagulant drugs, hypersensitivity were excluded.

The patients who necessitated surgical extraction of lower third molar tooth were randomly divided into 2 groups: the first group consisted of 20 patients (interventional group) and received intraoperative submucosal 4mg Dexamethasone drug injections buccally around the tooth at three points after anesthetizing the case at the level of mucobuccal fold. The other 20 cases (control group) were operated conventionally without using Dexamethasone injection Figure 1.

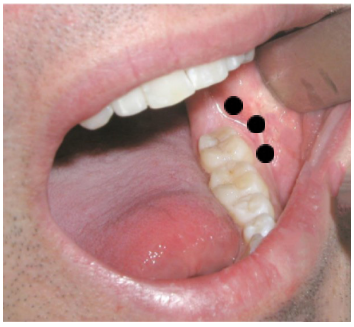

Figure 1. Areas of submucosal Dexamethasone injection.

The selected patients were clinically examined preoperatively and postoperatively (2nd and 7th day) for pain, maximum mouth opening and swelling. The pain was examined using visual analog scale (VAS) ranging from "no pain" (0) and "very severe" pain (9) and mouth opening was assessed using Vernier calipers, measuring the maximum distance between the upper and lower central incisors to estimate mouth opening, and swelling was measured using the distance between the tragus, pogonion, and the corner of the mouth according to the Tape method Figure 2 [11], three measurements between five reference points were taken. The

first distance was between the outer canthus of the eye and angle of the mandible. The second measurement was the distance between the tragus and outer corner of the mouth, finally the third measurement was the distance between the tragus and the soft pogonion. Then the photos were taken analyzed by two blinded reviewers and individual values were added to obtain a median score for every symptom and visit.

One hour prior to the procedure, a prophylactic dosage of oral antibiotics (1gm, amoxicillin) was administered. Antibiotics for postoperative use was not prescribed. Following surgery, patients received oral analgesics (acetaminophen, 500mg twice day for 3 days). After the routine anesthetic technique to block the inferior alveolar and long buccal nerve (1.8ml of lidocaine anesthetic solution with 1:100:000 vasoconstrictor), the 4mg Dexamethasone drug were administered buccally submucosally and the patient were allowed to rest 15 minutes to give the time to the drug to be absorbed by the periodontal tissue before starting the operation.

Data entered by excel sheet then after cleaning of the data transferred to Statistical Package for Social Sciences (IBM SPSS) program version 22 for analysis. Frequency and percentages used for qualitative data while for quantitative variables mean with standard deviation used for normally distributed quantitative data by Shapiro-Wilk test. T-test used to compare means in normally distributed variables. Correlation between quantitative variables determined by Pearson correlation and Man-Whitney test. P- Value equal or less than (0.05) regarded statistically significant.

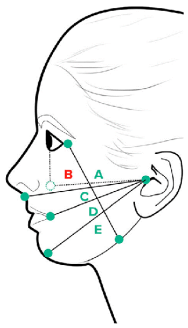

Figure 2. Schematic representation of points for measuring swelling [11].

Results

The participants in this study were 40 patients, in which 20 of them received steroid intraoperatively (interventional group) and the other 20 patients were not receiving the steroid (control group). The mean age of our participants was (23.37±2.58) as shown in Table 1. In comparing the mean of swelling in different area in the second day after operation between intervention and controlled groups, we found highly significant association concerning swellings between mentioned groups as the swelling was significantly lessen in interventional group in comparing to controlled group and these differences were statistically highly significant (P-value<0.001) as shown in Table 2 and Figure 3 (A,B). While there were no significant association between mean rank of pain and trismus in between intervention and control group (p-value>0.05), as shown in Table 3. In correlating the findings before and after operations by two days, we found strong correlation between swelling and mouth opening while very weak correlation between pain in the interventional group. While in the current study control group showed strong correlation between swelling, medium correlation between mouth opening and very weak correlation between pain as shown in tables (4, 5 and 6).

Table 1. Sociodemographic distribution of the participants.

Categorical Variables		*Frequency*	*Percent*
Interventional vs control	*Interventional*	*20*	*50.0*
	Control	*20*	*50.0*
Sex	*Female*	*22*	*55.0*
	Male	*18*	*45.0*
Total		*40*	*100.0*
Age		*Mean*	*St. Deviation*
		23.37	*2.58*

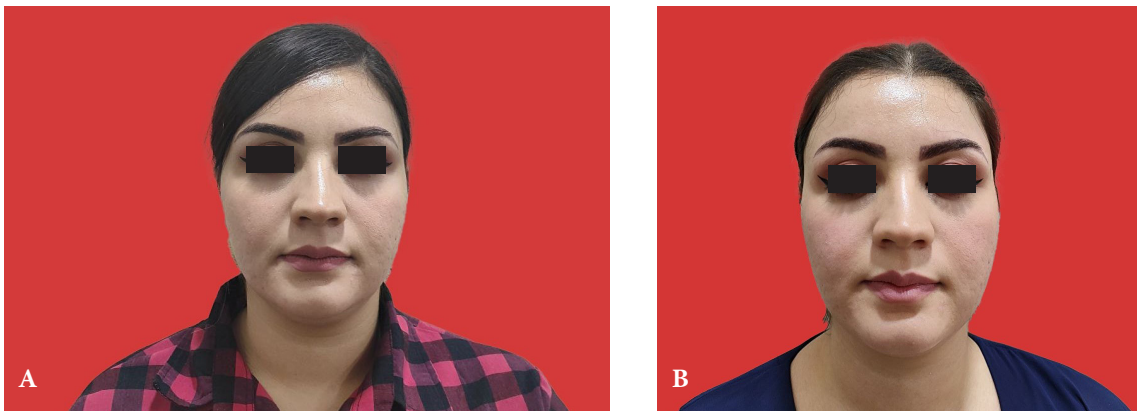

Figure 3. A. Preoperative picture of the patient before undergoing surgical removal of impacted left lower third molar tooth. B. Second postoperative day showed significant reduction in the swelling in the interventional group.

Table 2. Association between means of Swelling in different studied groups.

Interventional vs control		*Swelling 1 (OC-AM) (mm)*	*Swelling 1(T-P) (mm)*	*Swelling 1 (T-CM) (mm)*
Interventional	*Mean*	*101.850*	*143.500*	*112.150*
	Std. Deviation	*1.1367*	*1.1471*	*1.4609*
Control	*Mean*	*105.100*	*146.900*	*115.400*
	Std. Deviation	*1.0712*	*1.5526*	*1.3139*
Total	*Mean*	*103.475*	*145.200*	*113.775*
	Std. Deviation	*1.9740*	*2.1862*	*2.1422*
P- Value		*<0.001 **	*<0.001 **	*<0.001 **

* P-value determined by independent T-test.

Table 3. Association between mean rank of pain and trismus in different studied groups.

Intervention. vs Control		*N*	*Mean Rank*	*P- Value*
Pain 1	*Interventional*	*20*	*19.88*	*0.694 **
	Control	*20*	*21.13*	
Pain 2	*Interventional*	*20*	*20.45*	*0.971 **
	Control	*20*	*20.55*	
*M. open. 1 (mm)***	*Interventional*	*20*	*18.48*	*0.273 **
	Control	*20*	*22.53*	
*M. open. 2 (mm)***	*Interventional*	*20*	*17.63*	*0.12 **
	Control	*20*	*23.38*	

* P-value determined by Mann-Whitney test, ** M. Open=Mouth opening (trismus).

Table 4. Correlation between pain before and two days after operation in regards to groups.

Interventional vs control		*Mean*	*Std. Deviation*	*Correlation*	*P- Value*
Interventional	*Pain 1*	*3.45*	*0.69*	*.017*	*.943*
	Pain 1	*1.10*	*0.45*		
Control	*Pain 1*	*3.55*	*0.76*	*.013*	*.957*
	Pain 1	*1.10*	*0.55*		

* P-value determined by Pearson correlation.

Table 5. Correlation between trismus before and two days after operation in regards to groups.

Interventional vs Control		Mean	Std. Deviation	Correlation	P-Value
Interventional	M. open. 0 (mm)	44.13	3.57	.708	<0.001
	M. open. 1 (mm)	32.89	2.82		
Control	M. open. 0 (mm)	43.25	2.96	.517	.019
	M. open. 1 (mm)	33.09	5.05		

* P-value determined by pearson correlation.

Table 6. Correlation between swellings before and two days after operation in regards to groups.

Interventional vs Control		Mean	Std. Deviation	Correlation	P-Value
Interventional	Swelling 0 (OC-AM) (mm)	106.05	5.36	.911	<0.001
	swelling 1 (OC-AM) (mm)	108.85	5.57		
	Swelling 0(T-P) (mm)	147.85	5.69	.880	<0.001
	Swelling 1(T-P) (mm)	151.15	6.03		
	Swelling 0 (T-CM)(mm)	112.55	3.69	.927	<0.001
	Swelling 1 (T-CM)(mm)	115.10	3.46		
Control	Swelling 0 (OC-AM) (mm)	104.95	4.99	.994	<0.001
	swelling 1 (OC-AM) (mm)	109.95	5.09		
	Swelling 0(T-P) (mm)	145.60	5.21	.869	<0.001
	Swelling 1(T-P) (mm)	151.45	5.78		
	Swelling 0 (T-CM)(mm)	109.40	3.33	.991	<0.001
	Swelling 1 (T-CM)(mm)	114.30	3.36		

* P-value determined by pearson correlation.

Discussion

Even when using a moderate surgical method, the extraction of third molars is frequently accompanied by substantial postoperative agony [12]. Consequently, numerous practitioners have attempted to prevent postoperative complications by using anti-inflammatory medicines [13]. The frequent use of corticosteroids in the extraction of third molars is attributable to their anti-inflammatory effects [14,15]. Corticosteroids such as Dexamethasone and methylprednisolone have been frequently employed in dentoalveolar surgery due to their nearly pure glucocorticoid effects, nearly nonexistent mineralocorticoid effects, and the least deleterious effects on leukocyte chemotaxis [16]. There are several accounts of using parenteral corticosteroids in oral surgery, although data on intraoral and submucosal delivery are sparse. Only one trial has reported on submucosal delivery, and the authors found modest responses to single low doses of corticosteroids [17]. The research found no benefit from administering 4mg of intravenous Dexamethasone shortly before surgery, and such a dose is considered subtherapeutic by the medical community [18]. In contrast, Messer and Keller observed a predictable reduction in postoperative pain when 4mg of intramuscular Dexamethasone was administered immediately following surgery [19]. The effect of dentoalveolar application of two different doses of Dexamethasone powder (4 and 10mg) and submucosal injection of Dexamethasone 4 mg, in 43 subjects undergoing bilateral surgical extraction of lower third molars, was investigated in a well-conducted study with patients serving as their own controls [20].

Regarding the analysis of edema, each treatment subgroup demonstrated a reduction in postoperative edema relative to the control group, which was highly significant on both the second postoperative day and one week later. In addition, this study found no statistically significant differences across treatment regimens. The submucosal infusion of 4mg Dexamethasone resulted in a highly substantial reduction in edema on the second postoperative day, as was seen in the present investigation. Following surgical procedures, corticosteroids are largely utilized to decrease tissue mediators of inflammation, thereby lowering fluid loss and minimizing edema [21,22]. Although a reduction in post-

operative pain is typically accompanied by a decrease in edema, steroids do not have a clinically significant analgesic impact on their own. In a study conducted, it was determined that Dexamethasone taken orally at a dose of 4mg 12 hours and intravenously at a dose of 4mg 1 hour before third molar surgery does not inhibit PGE2 release sufficiently to provide pain after the anesthetic offset [23]. It has also been stated that administering glucocorticoids for analgesia following minor surgery, such as removing impacted third molars, is not recommended. Similar to earlier studies [14,24].

Our data could not demonstrate that steroid therapy significantly reduced pain. In addition, the preoperative treatment with a corticosteroid had a limited and insignificant effect on trismus compared to the control group at both evaluation dates. Furthermore, it has been found that the topical injection of 4mg Dexamethasone did not affect trismus or pain perception compared to the control group [20]. Almost usually, an inflammatory reaction is triggered by any tissue injury. Five phases of inflammation have been identified, and it has been observed that glucocorticoids can inhibit each of these processes. By preventing arachidonic acid from cell membrane phospholipids, they suppress the formation of prostaglandins [22,25]. Our study demonstrates that perioperative submucosal injection of 4mg Dexamethasone lowers postoperative edema on the second postoperative day following the third molar surgery.

Conclusions

This research supports using lower doses of submucosal corticosteroids including Dexamethasone sodium phosphate (4mg) to alleviate postoperative swelling and trismus. Consequently, the effective drug concentration at the site of an injury is maximized following a low-dose injection of Dexamethasone at the surgical site, without loss due to diffusion to other compartments or the onset of excretion. In addition, the submucosal approach benefits the surgeon and the patient when a third molar is surgically extracted under a local anesthetic.

Acknowledgment

The author would like to acknowledge the Oral and maxillofacial department, University of Sulaimani for supporting the study.

Conflict of Interest

There is no conflict of interest to declare.

References

[1] Shepherd JP, Brickley M. Surgical removal of third molars. British Medical Journal Publishing Group; 1994; 309: 620–1.

[2] Hupp JR. Principles of Management of Impacted Teeth. Contemp Oral Maxillofac Surg. 2014; 3:143–67.

[3] Hupp JR, Tucker MR, Ellis E. Contemporary oral and maxillofacial surgery. 5th edition. Br Dent J 205, 109 (2008).

[4] Elsey MJ, Rock WP. Influence of orthodontic treatment on development of third molars. Br J Oral Maxillofac Surg. 2000; 38(4):350–3.

[5] Pahkala R, Pahkala A, Laine T. Eruption pattern of permanent teeth in a rural community in northeastern Finland. Acta Odontol Scand. 1991; 49(6):341–9.

[6] Grossi GB, Maiorana C, Garramone RA, Borgonovo A, Creminelli L, Santoro F. Assessing Postoperative Discomfort After Third Molar Surgery: A Prospective Study. J Oral Maxillofac Surg. 2007; 65(5):901–17.

[7] Grossi GB, Maiorana C, Garramone RA, Borgonovo A, Beretta M, Farronato D, et al. Effect of Submucosal Injection of Dexamethasone on Postoperative Discomfort After Third Molar Surgery: A Prospective Study. J Oral Maxillofac Surg. 2007; 65(11):2218–26.

[8] Blondeau F, Daniel NG. Extraction of impacted mandibular third molars: Postoperative complications and their risk factors. J Can Dent Assoc (Tor). 2007; 73(4):325.

[9] Bouloux GF, Steed MB, Perciaccante VJ. Complications of third molar surgery. Oral Maxillofac Surg Clin. 2007; 19(1):117–28.

[10] Chukwuneke F, Onyejiaka N. Management of postoperative morbidity after third molar surgery: a review of the literature. Niger J Med. 2007; 16(2):107–12.

[11] Mobilio N, Vecchiatini R, Vasquez M, Calura G, Catapano S. Effect of flap design and duration of surgery on acute postoperative symptoms and signs after extraction of lower third molars: A randomized prospective study. J Dent Res Dent Clin Dent Prospects. 2017; 11(3):156–60.

[12] Phillips C, White Jr RP, Shugars DA, Zhou X. Risk factors associated with prolonged recovery and delayed healing after third molar surgery. J Oral Maxillofac Surg. 2003; 61(12):1436–48.

[13] Petersen JK, Hansson F, Strid S. The effect of an ibuprofen-codeine combination for the treatment of patients with pain after removal of lower third molars. J oral Maxillofac Surg. 1993; 51(6):637–40.

[14] Hyrkäs T, Ylipaavalniemi P, Oikarinen VJ, Paakkari I. A comparison of diclofenac with and without single-dose intravenous steroid to prevent postoperative pain after third molar removal. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg. 1993; 51(6):634–6.

[15] Schultze-Mosgau S, Schmelzeisen R, Frölich JC, Schmele H. Use of ibuprofen and methylprednisolone for the prevention of pain and swelling after removal of impacted third molars. J oral Maxillofac Surg. 1995; 53(1):2–7.

[16] Dionne RA, Gordon SM, Rowan J, Kent A, Brahim JS. Dexamethasone suppresses peripheral prostanoid levels without analgesia in a clinical model of acute inflammation. J oral Maxillofac Surg. 2003; 61(9):997–1003.

[17] Milles M, Desjardins PJ. Reduction of postoperative facial swelling by low-dose methylprednisolone: an experimental study. J oral Maxillofac Surg. 1993; 51(9):987–91.

[18] Neupert III EA, Lee JW, Philput CB, Gordon JR. Evaluation of Dexamethasone for reduction of postsurgical sequelae of third molar removal. J oral Maxillofac Surg. 1992; 50(11):1177–82.

[19] Messer E.J, Keller J.J, The use of intraoral dexamethasone after extraction of mandibular third molars. Oral Surgery, Oral Medicine, Oral Pathology. 1975; 40, (5): 594-598.

[20] Graziani F, D'aiuto F, Arduino PG, Tonelli M, Gabriele M. Perioperative Dexamethasone reduces post-surgical sequelae of wisdom tooth removal. A split-mouth randomized double-masked clinical trial. Int J Oral Maxillofac Surg. 2006; 35(3):241–6.

[21] Esen E, TaŞar F, Akhan O. Determination of the anti-inflammatory effects of methylprednisolone on the sequelae of third molar surgery. J oral Maxillofac Surg. 1999; 57(10):1201–6.

[22] Gersema L, Baker K. Use of corticosteroids in oral surgery. J oral Maxillofac Surg. 1992; 50(3):270–7.

[23] Troullos ES, Hargreaves KM, Butler DP, Dionne RA. Comparison of nonsteroidal anti-inflammatory drugs, ibuprofen and flurbiprofen, with methylprednisolone and placebo for acute pain, swelling, and trismus. J oral Maxillofac Surg. 1990; 48(9):945–52.

[24] Sekhar CH, Narayanan V, Baig MF. Role of antimicrobials in third molar surgery: prospective, double blind, randomized, placebo-controlled clinical study. Br J Oral Maxillofac Surg. 2001; 39(2):134–7.

[25] Montgomery MT, Hogg JP, Roberts DL, Redding SW. The use of glucocorticosteroids to lessen the inflammatory sequelae following third molar surgery. J oral Maxillofac Surg. 1990; 48(2):179–87.

Please cite this paper as:
Lateef Fatah G, Jaza Mahmood Faris B. Preoperative submucosal dexamethasone injection for minimizing postoperative pain, trismus, and oedema associated with impacted mandibular third molar surgery. J Craniomaxillofac Res 2022; 9(3): 128-134