Effectiveness of Submucosal Dexamethasone to Control Postoperative Pain & Swelling in Apicectomy of Maxillary Anterior Teeth

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Abstract:

Purpose: The purpose of this study was to evaluate the effect of submucosal dexamethasone injection to control postoperative pain and swelling in apicectomy of maxillary anterior teeth.

Methods: A randomized, controlled trial comprising 60 adult patients (68.3% male, 31.7% female) with no local or systemic problems was conducted. Patients were randomly divided into two groups: Group A was given 4mg dexamethasone injection perioperatively. Group B (control group) was treated conventionally without any steroid injection.
Postoperative pain and swelling was evaluated using a visual analog scale (VAS). Objective measurements of facial pain and swelling were performed daily up to six days postoperatively.

Results: Dexamethasone group showed significant reduction in pain and swelling postoperatively compared with the control.

Conclusion: Submucosal dexamethasone 4mg injection is an effective therapeutic strategy for swift and comfortable improvement after surgical procedure and has a significant effect on reducing postoperative pain and swelling. The treatment offers a simple, safe, painless, noninvasive and cost effective therapeutic option for moderate and severe cases.

Key Words: Pain control, dexamethasone injection, swelling, apicectomy

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Introduction

Among dental treatments, oral surgical procedures cause the most pain. [1] During these procedures; damage caused to soft and hard tissues leads to an inflammatory reaction. This reaction can occur during and after surgical procedure following damage to the tissue. Tissue changes occur through endogenous biological mediators that are released from the blood cells and damaged tissue during inflammation. These include histamine, serotonin, kinin, and prostaglandin.[2]

When a patient is to decide whether or not to have oral surgery, the dentist should be able to provide information on the expected discomfort during and after the operation. It has been demonstrated that pain following periapical surgery tends to peak on the operational day [3-5] whereas swelling is the most pronounced 1 to 2 days post operatively. [6] Postoperative discomfort was found in some studies to be associated with tooth group, patient's expectation of pain, patient's gender, and age, while some other studies did not find a relationship between postoperative discomfort and gender or age. [6-7]

Most studies have found that non prescriptive analgesics are sufficient to control postoperative pain after apicectomy, however some studies have recommended the use of steroids to minimize pain and swelling. [3-5] Oral dexamethasone reduces pain and swelling following oral surgical procedures. For several decades, dental surgeons have administered corticosteroids before or just after third molars surgery to reduce inflammation and associated symptoms. [8] Corticosteroids act by inhibiting, through a variety of proposed mechanisms, the body's inflammatory response to injury, with a reduction of fluid transudation and, therefore, edema. [9] The use of corticosteroids has gained wide acceptance in the oral and maxillofacial surgery community, and numerous reports are now available supporting the use of systemic corticosteroids in the setting of third molar surgery. [10-16] Recent meta-analytical studies have concluded that perioperative administration of corticosteroids has a mild to moderate value in reducing postoperative inflammatory signs and symptoms. Several studies have demonstrated a better effect in the control of the swelling trismus when using steroid anti-inflammatory drugs versus non steroidal anti-inflammatory drugs. [17-21]

However, clinical use of steroids should be moderate and rational, and for limited time and dose; according to endocrinology analyses, after the 5th day of steroid use, therapy has already begun to produce immunosuppresion, from which some patients may take up to 9 months to return to normal levels. [22]

Schmelzeisen and Frolich [23] found that dexamethasone administered orally, preoperatively, and postoperatively reduced pain by 50%, and postoperative analgesic needs by 37% in patients who had osteotomy of impacted molars. In a double-blind study, Pedersen [14] examined the effect of preventive dexamethasone on pain and swelling after removal of an impacted mandibular molar. Postoperative pain was reduced by 30%. In a randomized double-blind study, Baxendale et al [24] examined the effect of a single prophylactic dose of oral dexamethasone, 8 mg, on postoperative complications after extraction of third molars and found a significant reduction in pain.

Most studies of postoperative pain in oral surgery are based on the extraction of impacted teeth [25-26] and the placement of dental implants. [27] Very few studies have involved periapical surgery. However, the conclusions drawn from the extraction and implant studies should be applicable to periapical surgery.

In these studies, it was shown that submucosal injection of decadron 4mg (Dxamethasone, Dexa-Allvoran; TAD Pharma GmbH, Legmo, Germany) showed significant improvement in swelling, pain, and improving the recovery phase of the patient after surgical endodontic procedure. It offers a simple, painless, less-invasive, and cost-effective approach to reduce the postoperative sequelae. However, additional studies are needed to confirm the effectiveness of locally administered corticosteroids in surgical procedures under local anesthesia. Larger patient samples are also needed to evaluate the potential adverse effects of locally applied corticosteroids on wound healing after surgery.

The aim of this randomized controlled trial was to evaluate the effect of dexamethasone injection (submucosal) on patient's quality of life in the immediate postoperative period requiring surgical endodontic treatment in maxillary anterior teeth. The study sought to determine whether among patients receiving a

4-mg submucosal injection of dexamethasone compared to those having no dexamethasone would have better postoperative outcomes in terms of pain & swelling. A study hypothesis was formed stating that "submucosal dexamethasone injection provides reduction in pain and swelling of apicectomy of maxillary anterior teeth when compared with no such intervention."

Material and methods:

Patients with periapical radiolucency on a root-filled tooth were examined. Each patient fulfilling the inclusion criteria was selected from the OPD of the Punjab Dental Hospital, Punjab, Pakistan from January 2006 to February 2007. The inclusion criteria for the study were the following: an incisor or canine with a sufficient orthograde root filling regarding length and density and with a periapical lesion persisting for at least 2 years.

Patients, who were pregnant, had a history of drug or alcohol abuse and who were suffering from renal, hepatic and hemorrhagic diseases were excluded. Other criteria for selection included no current medication specifically steroidal anti-inflammatory drugs for the last two weeks and no history of steroid medication complication.

Marginal bone level around the tooth in question should be reduced no more than 50%. All registrations were performed on a periapical radiograph taken with the paralleling technique and at a successive clinical examination.

They were given written and verbal information about the study, and a consent form was signed before participation. Neither the patients nor the operator were blinded to the use of corticosteroids. There was no financial inducement to participate, and patients were given the opportunity to withdraw from the study at any time. The study was approved by the regional Committee of Ethics.

A standardized surgical procedure was performed in all patients by the author. A standard infiltration anesthesia was given using 1.8-mL cartridges of 2% lidocaine hydrochloride with epinephrine 1:100,000. Surgical access was routinely achieved labially through a submarginal (Oscheinbein lubke) incision. Bone removal, if necessary around the tooth was then performed with a round bur on a straight hand-piece under continuous irrigation with a normal saline solution.

After root end resection and retrograde restoration, the area was inspected, copiously irrigated, and the flap was sutured back by 3 to 4 interrupted stitches using a 4-0 silk suture. A small gauze pack was then applied to the surgical site, and the usual post surgical instructions were given to the patient.

Sixty patients (19 women and 41 men), average age 28.75 years (range 14-50) were randomly divided into 2 groups, with 30 patients in each. Group A received 4 mg decadron (Dexa-Allvoran; TAD Pharma GmbH, Legmo, Germany) as a submucosal injection immediately after surgery. It was injected into the labial vestibule near the surgical site. In the second group (control), the patients received no corticosteroid treatment.

Apart from dexamethasone treatment, all patients in the study routinely received amoxicillin (oral 500 mg every 8 hours) for 5 days after surgery. In addition, a chlorhexidine mouth rinse was prescribed twice daily to be started the day after surgery for 5 days.

Facial swelling and pain were objectively measured once daily for six postoperative days by an independent examiner. Swelling on the operated side was measured as follows: [6] none (no inflammation), mild (intraoral swelling confined to the surgical field), moderate (extra oral swelling in the surgical zone), or intense (extraoral swelling spreading beyond the surgical zone).

Postoperative pain was evaluated using a visual analog scale, 100 mm in length, ranging from 0 for "no pain" to 100 for "the worst possible pain." [7]

Pain and swelling were recorded by the surgeon once daily during the first two days after surgery, and by the patient once daily for the remaining 4 days of observation.

The data was incrementally entered during the course of study into an electronic sheet (Excel; Microsoft, Windows 2006, Redmond, WA) and then processed using the Statistical Package for Social Sciences, version 15 (SPSS, Chicago, IL) and analyzed.

Descriptive statistics were calculated. The variables analyzed include demographic (age, sex), VAS for pain and swelling. The age was presented as Mean ± SD. The frequency and intensity were calculated as percentages for each age group. Variance homogeneity was

verified in each case, with calculation of the corresponding percentage variance in those cases where the results were found to be significant, and the application of non parametric tests as required. Statistical significance was considered for *P* less than or equal to .05.

Results:

The mean patient age (41 men and 19 women) was 28.7 ± 9.5 years (range 14 to 50). No data were missing, and all patients included in the present study attended all study visits. At follow-up, no cases of alveolar osteitis or wound infection were reported. No side effects of the drugs used in the trial were mentioned or noted.

In both groups, pain and swelling were most severe on postoperative day 1 & 2 and decreased gradually through the subsequent evaluation points to approximately reach the preoperative measures by the sixth day. Pain (using the visual analog scale) was worse on day 1 and had decreased completely by day 6.

In group A, 1 out of 30 patients (3.3%) had severe pain on 1st day. In control group B, 11 patients (36.6%) were having severe pain. There is a statistically significant difference between VAS score for pain on 1st day (P _ .004), 4th day (P _ .004) and 6th day (p=.02) postoperatively. (Table 2)

Table 1: Postoperative pain in the patients of group A & B

Postoperative pain	Level of pain	Groups		P-value
		Patients with Preoperative Dexamethasone	Patients without Preoperative Dexamethasone	
Day 1	No pain	0	0	.004
	Mild pain	5	2	
	Moderate pain	24	17	
	Severe pain	1	11	
Day 2	No pain	0	0	.064
	Mild pain	14	11	
	Moderate pain	16	14	
	Severe pain	0	5	
Day 3	No pain	2	0	.11
	Mild pain	22	18	
	Moderate pain	6	12	
	Severe pain	0	0	
Day 4	No pain	15	4	.004
	Mild pain	14	26	
	Moderate pain	1	0	
	Severe pain	0	0	
Day 5	No pain	25	19	.14
	Mild pain	5	11	
	Moderate pain	0	0	
	Severe pain	0	0	
Day 6	No pain	30	24	.02
	Mild pain	0	6	
	Moderate pain	0	0	
	Severe pain	0	0	

* Mild pain:
** Moderate Pain:
*** Severe Pain:

Swelling peaked on 2nd day postoperatively in control group in which 20 patients (66.6%) were having moderate swelling and 8 patients (26.6%) having swelling extending beyond surgical site. 11 (36.6%) Patients in group A showed moderate swelling. There is a statistically significant difference observed for postoperative swelling on 1 day (P _ .003), 2nd day (p= .01), and 3rd day (P _ .00) (Table 2).

Table 2: Postoperative swelling in the patients of group A & B

Postoperative swelling	Level of swelling	Groups		P-value
		Patients with Preoperative Dexamethasone	Patients without Preoperative Dexamethasone	
Day 1	No inflammation	0	0	.00
	Mild swelling	24	11	
	Moderate swelling	6	18	
	Severe swelling	0	1	
Day 2	No inflammation	0	0	.00
	Mild swelling	19	2	
	Moderate swelling	11	20	
	Severe swelling	0	8	
Day 3	No inflammation	6	0	.00
	Mild swelling	24	18	
	Moderate swelling	0	12	
	Severe swelling	0	0	
Day 4	No inflammation	19	14	.29
	Mild swelling	11	16	
	Moderate swelling	0	0	
	Severe swelling	0	0	
Day 5	No inflammation	28	25	.42
	Mild swelling	2	5	
	Moderate swelling	0	0	
	Severe swelling	0	0	
Day 6	No inflammation	30	28	.49
	Mild swelling	0	2	
	Moderate swelling	0	0	
	Severe swelling	0	0	

*Mild swelling: swelling confined to surgical site
** Moderate swelling: Extraoral swelling in surgical zone
*** Severe swelling: extraoral swelling beyond surgical zone

Discussion

The main results of our study were that submucosal injections of 4 mg dexamethasone perioperatively resulted in significant improvement in swelling and pain measures in the immediate postoperative period compared with control. The response rate to the study was high, indicating the high feasibility of using patient-centered outcome measures in oral surgery.

Post-surgical pain and facial swelling affects the daily life of the patient. Many authors have advocated the use of corticosteroids to limit postoperative pain & edema due to their suppressive action on transudation [8, 28] but few have made definitive recommendations supported by randomized clinical trials [29] Kvist and Reit [30] reported that on the evening after endodontic surgical procedure using a traditional technique, nearly all patients experienced pain, with 67% requiring analgesics. None of the patients remained at home because of the pain. However, 23% reported absence from work because of swelling and tissue discoloration. No measures were taken to reduce postoperative symptoms in the aforementioned studies.

Oral surgeons have been using corticosteroids to minimize these sequelae and have obtained satisfactory results. [31-33] Corticosteroids are successful in controlling acute inflammation by interfering with the multiple signaling pathways involved in the inflammatory response. [34] The primary mechanisms are thought to involve suppression of leukocyte and macrophage accumulation at the site of inflammation, and prevention of prostaglandin formation through the disruption of the arachidonic acid cascade [35] Dexamethasone has been extensively used in oral surgery due to its high potency and long half life [36, 41] Several different routes and times of administration (e.g., intravenous and intramuscular; preoperative and perioperative) have been recently advocated because of limited benefits when the therapy was applied postoperatively. Clinicians would therefore benefit from knowing whether it is clinically relevant during surgery to use an effective perioperative steroid therapy. Patients would also not incur the risk of pharmacological over-treatment or side effects. Despite the frequent clinical use of dexamethasone, the post-surgical efficacy of either intra-alveolar or sub-mucosal perioperative administration remains poorly investigated.

In the present study, VAS score was used to assess pain, which in previous studies has been found to be a valid recording scale. [42, 29] A VAS for pain intensity is generally easily understood by patients. This method has been reported to be simple to administer, reliable, and valid. [43]

The role of corticosteroids in preventing postsurgical pain is controversial. Corticosteroids alone do not seem to have a clinically significant analgesic effect but it has been reported that steroids can be related to a reduction in the number of analgesic tablets used after surgical extractions. Dexamethasone in particular appears to decrease pain after surgery. [28, 29] for more than 30 years, glucocorticosteroids have been used in an attempt to minimize or prevent postoperative sequelae after surgical removal of impacted third molars. Several studies have been published in the literature on this subject. [21] Most studies have reported that steroids significantly reduce the pain, swelling and trismus while a few has not shown any benefit from the administration of steroids. [44] However, it is clear that the type and the dose of steroids, as well as the duration and route of administration, can have a significant impact on the efficacy of the agent.

In the present study, VAS scores for pain peaked on 1st and 2nd day of surgery. There is a good correspondence between the present findings for pain intensity and previous studies that have used VAS scores, even though these studies were conducted in 5 countries over a period of 20 years. Furthermore, it suggests that pain may not be the main factor for postoperative discomfort. [1, 3, 4]

The decision as to which route of administration to be chosen depends on the clinician's expertise and preference. Orally administered glucocorticoids are rapidly and almost completely absorbed therefore repeated dose is required to maintain adequate blood concentration throughout the immediate postoperative period. [11] Intravenous route offers instantaneous blood levels but requires expertise and additional armamentarium. [3, 7, 12] Studies of intramuscular and intraregional doses suggest

that this route of administration can be effective in a single dose given either preoperatively or postoperatively. [6, 13]

These results imply that with intraregional administration, the repository is significant throughout the first six postoperative days and that additional doses may not be necessary. In the present study, dexamethasone was selected since it is potent, cause minimal sodium retention and has interminable biological potency.

The investigations in our study indicate that intraregional dexamethasone tested was more effective in reducing the pain and swelling as compared to the patients without steroid injection. Pain was at the maximum on the first day which is in contrast to the study conducted by penarrocha, [6] Christiansen [41] as well as by Al khateeb et al. [45] Swelling was at a maximum on the second postoperative day and lasted for 4-5 days in group A & B corresponding to the study conducted by christiansen but in contrast to the results presented by penarrocha. The VAS score for pain peaked on 1st day postoperatively in group B in which 11 patients (36.6%) having severe pain compared to group A in which 1 patient (3.3%) had severe pain. There was a statistically significant difference between VAS score for pain on 1st day (P _ .004), 4th day (P _ .004) and 6th day (P _ .02) postoperatively.

Based on earlier clinical studies that postoperative pain can be reduced by combining long-acting anesthetics with non-steroidal anti-inflammatory agents, [46] it can be concluded that further clinical trials are needed to compare the effect of steroids, nonsteroidal anti-inflammatory drugs and long-acting local anesthetics in reducing postoperative sequelae. Additional studies are also necessary to further define the benefits of preoperative intraregional administration of dexamethasone. Finally, more sensitive measuring techniques to quantify the decrease of post-surgical swelling need to be developed. The literature contains studies that have used methylprednisolone, betamethasone, and dexamethasone at various dosages and routes of administration.

The risk factors of edema, pain and swelling after surgery have been reported by many investigators and included age, gender, smoking, oral hygiene, duration and difficulty of the operation, and surgical experience. [47-51]

The findings of this study may have a significant clinical impact as submucosal dexamethasone injection is an effective therapeutic strategy for improving the quality of life of the patient Overall, the present study have shown the advantage of submucosal dexamethasone as an effective alternative to systemically applied dexamethasone. The technique is quite simple, less invasive, painless (given in an anesthetized region), and convenient for the surgeon and patient and offers a low-cost solution for the typical patient discomfort associated with the surgical endodontic procedures. Injection after surgery offers the advantage of concentrating the drug near the surgical area with less systemic absorption.

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