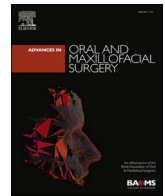




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Submucosal and intramuscular dexamethasone for the control of pain, trismus and edema after third molar surgeries: ¿Is it necessary?

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ABSTRACT

Dexamethasone in different routes of administration has been used to control discomfort after third molar surgery. The objective of this research is to determine if the application of dexamethasone by submucosal or intramuscular route is justified for the control of pain, edema and trismus after third molar surgery. A comparative study was carried out in a sample of 51 patients divided into three groups. Group 1 received preoperative intramuscular dexamethasone, group 2 received preoperative submucosal dexamethasone, and group 3 did not receive dexamethasone. The variables pain, trismus and edema were measured at different times. The analysis was carried out in the STATA V13 program, reporting simple frequencies for categorical variables and differences between groups with the Chi-square test, for numerical variables ANOVA and Kruskal Wallis test was applied. Of the 51 patients, 16 were male (31%) and 35 female (69%) and their mean age was 23 years (DE \pm 4.8) with a range from 17 to 44. No differences were found between the groups by age and sex. When comparing the different interventions to the groups (IM dexamethasone, submucosal dexamethasone and without dexamethasone), no significant differences were found between the groups in any of the parameters studied (edema, pain and trismus), neither at 2, nor at 7 days after the intervention. The administration of dexamethasone intramuscularly or submucosally does not generate important benefits for the control of edema, pain and trismus postoperatively after surgery of wisdom lower third molars. Studies with larger sample sizes are recommended.

1. Introduction

Surgical removal of third molars is the most performed surgery by oral and maxillofacial surgeons in the world [1–4]. Due to the fact that it is a surgery where soft tissue detachment is performed and that causes a certain degree of surgical trauma to both hard and soft tissues, it usually causes inflammation, pain and trismus [1,2,5].

Although this surgery is very frequent and with predictable results, it causes certain frequent postoperative discomforts, with a deterioration in the quality of life in the days after surgery [1,2]. This problem has led maxillofacial surgeons to seek treatment alternatives to reduce these effects [1].

Some of the measures used for this purpose are: chlorhexidine rinses, topical and systemic antibiotics, low-level laser therapy, corticosteroids,

analgesics and muscle relaxants [3]. Other authors have tried other alternative measures such as the facial elastic bandage with good results [6].

Some other alternatives are the administration of dexamethasone intravenously or submucosa. For outpatients managed with only local anesthesia, the submucosal route may be more comfortable for the patient and easier for the surgeon to administer [1]. Dexamethasone, one of the most widely used corticosteroids, has been used as an anti-inflammatory agent since the 1950s and has been studied with respect to attenuation of inflammation after third molar extraction [3].

The results of the meta-analysis published by Falci et al. suggest that dexamethasone may be more effective than methylprednisolone when administered preoperatively to third molar surgery for the control of edema and trismus [7].

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Intramuscular injection of dexamethasone can be an alternative route in third molar surgery, since it is more effective in reducing pain and edema compared to nonsteroidal anti-inflammatory drugs, and has similar results to dexamethasone via submucosa [8], the latter being better accepted by patients [9].

Some authors, such as Arora et al., have found that corticosteroids such as submucosal [2], or intraosseous [10–12] dexamethasone are effective in reducing postoperative edema after lower third molar surgery, but its analgesic effect is not that good [2].

Chen et al., suggest that submucosal injection of dexamethasone reduces edema and early trismus after third molar extraction, but may not minimize pain and late trismus [3], while Gursoytrak et al., conclude that this measure is effective and safe for the control of edema, trismus and postoperative pain [13].

Other authors consider that submucosal dexamethasone is a less painful and less invasive alternative compared to the systemic route, to restore quality of life after surgery [14,15].

It is thought that local infiltration of dexamethasone around the surgical site may provide a depot effect that would delay absorption (especially when administered with a local anesthetic with vasoconstrictors) and prolong the duration of action more than when applied intravenously [16]. In other words, a local injection of dexamethasone at the surgical site can achieve greater localized efficacy with a high drug concentration without loss of distribution [1].

Authors such as Chugh report that submucosal dexamethasone is effective for postoperative control of edema and pain [17–19], however they do not recommend the systematic use of corticosteroids for this purpose [20].

Other researchers have tried other medications to control these postoperative complaints. Such is the case of Cebi et al., who used diclofenac and tenoxicam. They found that diclofenac potassium and tenoxicam are equally effective in reducing swelling and lockjaw after mandibular third molar extraction, and that tenoxicam outperforms diclofenac potassium in controlling pain [21]. Diclofenac in submucosal injection is considered a good analgesic after third molar surgery [22]. The local application of ketamine has shown good results against pain and postoperative edema, however it is not effective against trismus [23], while the application of hyaluronic acid shows to be effective for pain control, but not for trismus [24]. Other researchers have used bromelain alone and in combination with dexamethasone, finding better results in the latter way [25].

It is considered that the use of piezoelectric instruments instead of traditional rotary instruments for this type of surgery influences the reduction of postoperative discomfort [26].

1.1. Aims and objectives

The objective of this research is to determine if the application of dexamethasone by submucosal or intramuscular route is justified for the control of pain, edema and trismus after third molar surgery.

1.2. Hypothesis

Although dexamethasone by different routes of administration has a certain degree of effectiveness for the control of discomfort after third molar surgery, its administration is not necessary.

2. Material and methods

2.1. Ethical aspects

This study followed the principles of the Declaration of Helsinki on medical protocols and ethics, and was approved by the ethics and research committee of the Faculty of Dentistry of the Autonomous University of Guerrero in a session of January 20, 2019.

The data was handled confidentially and each of the patients was

asked to sign an informed consent letter. In the present study, no new techniques or experimental drugs were tested.

2.2. Patients

Participants were recruited from the oral surgery clinic of the Autonomous University of Guerrero with a diagnosis of retained mandibular third molars in mesioangular position that underwent lower third molar surgery in the period February–December 2019, free of systemic diseases that alter the inflammatory processes or that were under medical treatment based on steroids or other medications that could affect inflammatory response. Patients with local diseases such as pericoronitis or local infections, or with painful symptoms in the region of the third molar to be extracted were not included.

The sample was made up of 51 patients randomly divided into three groups: Group I made up of 16 patients, Group II made up of 19 patients and Group III made up of 16 patients.

2.3. Interventions

All patients underwent lower third molar surgery, including the Magnus surgical approach and osteotomy. Amoxicillin 500 mg orally every 8 h for 7 days as a prophylactic antimicrobial agent, and Ibuprofen 600 mg were prescribed orally every 8 h as analgesia therapy to all patients in the study. Indications of postoperative care including the application of ice on the skin of the intervened area were given.

Group I, made up of 16 patients, received 8 mg of intramuscular dexamethasone in the gluteus in the immediate postoperative period, Group II, made up of 19 patients, received 8 mg of dexamethasone in submucosal injection in the area of the surgical wound in the immediate postoperative period, and Group III, made up of 16 patients, did not receive dexamethasone.

Dexamethasone was used in an 8 mg ampoule in 2 ml of solution, applying it with insulin syringes for the submucosal injection, and with a conventional 3 ml hypodermic syringe with a black 22G x 32 mm needle for the intramuscular injection.

2.4. Variables

The three variables studied and measured were edema, pain and trismus were recorded in a predesigned format. For the measurement of edema, 4 distances were taken into account and they were measured with an adhesive tape to later add and average them: tragus at the angle of the jaw, outer corner of the eye at the angle of the jaw, nasal wing at the angle of the jaw and labial commissure to the angle of the jaw. The first measurements were made in the preoperative period before the application of local anesthesia to be considered as baseline reference, and later the measurements were taken during the evolution on the second and seventh day during the postoperative period.

To determine the degree of trismus, the interincisal distance was taken with a millimeter ruler immediately before anesthetic infiltration as a baseline measurement, and subsequently the measurement was taken again on the second and seventh day during the postoperative stage.

To measure pain, the visual analog scale (VAS) was applied at two postoperative moments (second and seventh day after surgery).

2.5. Analysis of data

The analysis was carried out in the STATA V13 program, reporting simple frequencies for categorical variables and differences between groups with the Chi-square test. For the numerical variables with normality the difference between the groups were performed with the ANOVA test, and for those variables that did not had normality the Kruskal Wallis test was applied.

3. Results

Of the 51 patients, 16 were male (31%) and 35 female (69%) and their mean age was 23 years (DE ± 4.8) with a range from 17 to 44. No differences were found between the groups by age and sex (Table 1).

Table 2, Fig. 1, 2 and 3 shows that when comparing the different interventions to the groups (IM dexamethasone, submucosal dexamethasone and without dexamethasone), no significant differences were found between the groups in any of the parameters studied (edema, pain and trismus), neither at 2, nor at 7 days after the intervention.

When each of the parameters that evaluated edema were compared separately, no significant differences were found between the groups at any of the measurement moments (day 2 and day 7). Table 3.

The behavior of the variables trismus, pain and edema were similar in the three study groups, observing a decrease in mouth opening (trismus) as the days passed and a clear recovery on the seventh day, but without significant differences between the groups (Fig. 1). Regarding pain, there was a downward trend between the second and seventh day for the three groups, although without significant differences between them (Fig. 2).

Edema had a similar evolution in the three groups with an increase in inflammation on the second day and clear improvement on the seventh, but without significant differences between the study groups (Fig. 3).

4. Discussion

Although the surgical removal of third molars is a very performed and safe procedure, it is highly frequent that after these surgeries different postoperative discomforts are generated, within these, edema, pain and trismus, which usually generates in patients a certain degree of disability and a temporary deterioration in the quality of life in the social and work sense. This research aims to determine if the use of dexamethasone is justified for the control of edema, pain and trismus, assuming that this is not necessary.

Regarding the trismus parameter, which was evaluated by measuring the mouth opening, we found that in the three groups there was a similar behavior. After taking the baseline measurement, in all cases the mouth opening decreased on the second day, and recovered to a certain average on the seventh day. In group I the mouth opening decreased 21% on the second day and had a recovery of 95% compared to the baseline measurement on the seventh day, in group II the mouth opening decreased 31% on the second day and had a recovery of 90% while that and in group III the mouth opening decreased 36% on the second day and had a 90% recovery. This shows that group I, in which intramuscular dexamethasone was administered, showed a lower percentage of mouth opening limitation than the other two groups, and a more optimal recovery on the seventh day compared to groups II and III. The group that was most affected by the limitation of oral opening on the second day was group III.

In this regard, Ai Lyn did not find significant differences between the administration of subcutaneous dexamethasone versus other routes of administration (intravenous) for the control of postoperative trismus [1], while Chen reported, unlike our results, that submucosal dexamethasone is effective for early trismus control [3].

Table 1
Distribution by age and sex of the study population.

Characteristic	Group I (Intramuscular)	Group II (Submucosal)	Grupo III (Without dexamethasone)	P value
Sex ^a MFTotal	7 (44)9 (56)16 (100)	6 (32)13 (68) 19 (100)	3 (20)12 (80)15 (100)	0.3
Age ^b	22 (21–26)	22 (20–24)	21 (20–24)	0.8

^a Numbers and percentages are shown, *p* value calculated with Chi square test.

^b Median, 25th and 75th percentile are shown, *p* value calculated with K. Wallis test.

Table 2

Measurement of the three parameters between groups at different times.

Characteristics	Group I (Intramuscular)	Group II (Submucosal)	Grupo III (Without dexamethasone)	P value
Trismus A ^a	4.3 (0.6)	3.9 (0.6)	4.2 (0.7)	0.39
Trismus B ^a	3.4 (0.9)	2.7 (1.2)	2.7 (0.8)	0.12
Trismus C ^a	4.1 (0.6)	3.5 (1.0)	3.8 (0.7)	0.20
Pain 1 ^a	2.8 (1.6)	3 (2.0)	3.3 (2.6)	0.82
Pain 2 ^b	1 (1–2)	1 (1–4)	2 (1–4)	0.76
Edema A ^b	9.8 (9.5–10.5)	9.5 (9.5–10.2)	9.6 (9.03–10.0)	0.37
Edema B ^b	10.6 (10.2–10.8)	10.3 (10.2–10.8)	10.3 (9.9–10.8)	0.58
Edema C ^b	9.9 (9.5–10.5)	10 (9.5–10.2)	9.8 (9.1–10.2)	0.36

^a Means and standard deviation are shown, *p* value calculated with Anova test.

^b Medians, 25th and 75th percentiles are shown, *p* value calculated with K. Wallis test.

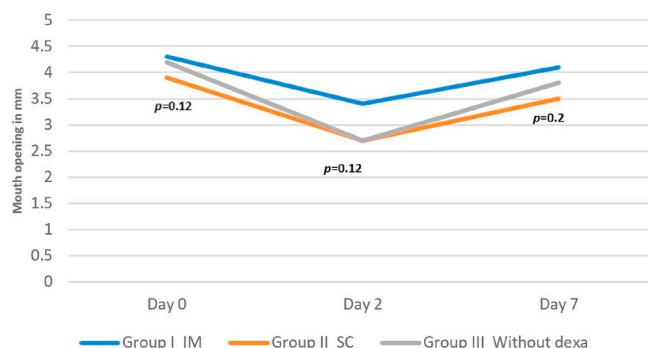


Fig. 1. Evolution of mouth opening *p* value calculated with ANOVA test.

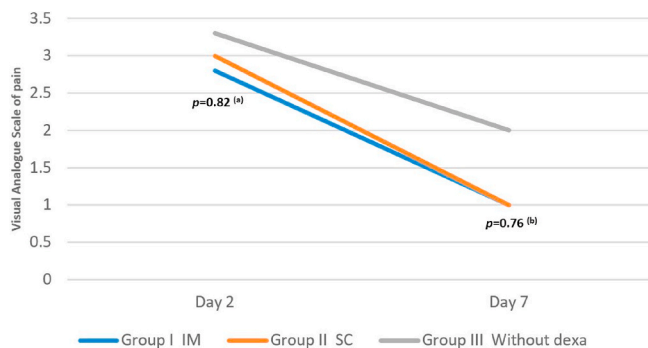


Fig. 2. Evolution of pain

^a *p* value calculated with ANOVA test.

^b *p* value calculated with K. Wallis test.

Regarding the pain variable, evaluated by applying the VAS, it was more intense on the second day (3.3) in group III followed by group II (3) and group I (2.8). In the three groups the intensity was greater on the second day than on the seventh day. In group I there was a 64% decrease between referred pain on the second and seventh day, in group II 67% and in group III 40%. For this parameter, it is striking that in the groups where dexamethasone was used (I and II), the percentage of recovery was higher and pain was less on both the second and seventh days.

Like our results, Ai Lyn found no differences regarding the pain variable for the submucosal dexamethasone group compared with other routes of administration [1]. On the other hand, and coinciding with our findings, Arora et al. reported that the effect of postoperative dexamethasone has a negligible effect for pain control [2]. Contrary to the aforementioned Chugh et al. concluded that submucosal dexamethasone

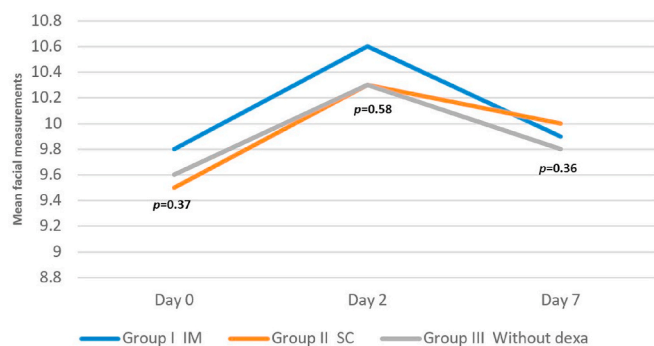


Fig. 3. Evolution of Edema
p value calculated with K.Wallis test.

Table 3

Comparison of each of the parameters that evaluated edema between the groups at the different measurement times.

Characteristics	Grupo I	Grupo II	Grupo III	P value
Tragus A ^a	7.9 (0.9)	7.5 (0.5)	7.2 (0.6)	0.07
Tragus B ^a	8.1 (0.8)	8.0 (0.5)	7.9 (0.6)	0.69
Tragus C ^b	7.9 (7.1–8.2)	7.5 (7.3–8.0)	7.4 (7.0–7.9)	0.27
Outer corner eye A ^a	11.1 (0.9)	11.0 (0.7)	10.5 (1.1)	0.13
Outer corner eye B ^a	11.6 (0.8)	11.7 (0.6)	11.3 (1.1)	0.51
Outer corner eye C ^a	11.2 (0.8)	11.1 (0.6)	10.7 (1.0)	0.23
Nasal wing A ^a	11.5 (0.9)	11.2 (1.0)	11.2 (0.8)	0.59
Nasal wing B ^b	12.5 (12.4–13.0)	12 (11.5–12.6)	12 (11.6–12.6)	0.18
Nasal wing C ^a	11.7 (1.0)	11.5 (0.8)	11.3 (0.6)	0.42
Labial commissure A ^a	8.9 (0.8)	9.0 (0.7)	8.9 (0.7)	0.81
Labial commissure B ^b	9.6 (9.2–10.0)	9.5 (9.4–10.7)	9.9 (9.5–10.2)	0.71
Labial commissure C ^a	9.1 (0.7)	9.3 (0.6)	9.2 (0.7)	0.74

^a Means and standard deviation are shown, p value calculated with Anova test.

^b Medians, 25th and 75th percentiles are shown, p value calculated with K. Wallis test.

is effective for the control of postsurgical pain in third molars, although they do not recommend it as routine use [20].

The edema behaved equally logically, since an increase was seen in all groups on the second day, and a decrease tending to normality on the seventh day. In group I, edema increased 8% on the second day with a 99% recovery on the seventh day, in group II an 8% increase on the second day and a 95% recovery, while in group III it increased 7% with a recovery of 98%. It is striking that the group that was not administered dexamethasone showed a recovery almost equal to the group with intramuscular dexamethasone and superior to the group with submucosal dexamethasone. In general terms, the behavior of edema in the three groups was very similar.

This coincides with other authors such as Ai Lyn who reported that the submucosal administration of dexamethasone after third molar surgery is not inferior for the control of edema to the application of the same drug by other routes of administration [1]. Unlike our results, Arora, Chen and Chugh reported that the administration of postsurgical dexamethasone to third molars is effective in controlling edema [2,20,21].

It is important to mention that although in some cases there were differences between the groups studied, these differences did not show statistical significance. Studies with larger sample sizes are recommended.

5. Conclusions

Derived from our results, we conclude that the administration of dexamethasone intramuscularly or submucosally does not generate important benefits for the control of edema, pain and trismus post-operatively after surgery of wisdom lower third molars.

Author contribution

Salvador Reyes Fernández: Conceptualization, Funding acquisition, Conception and design of study/review/case series, Acquisition of data: laboratory or clinical/literature search, Drafting of article and/or critical revision, Final approval and guarantor of manuscript. Alicia García Verónica: Conceptualization, Funding acquisition, Conception and design of study/review/case series, Acquisition of data: laboratory or clinical/literature search, Final approval and guarantor of manuscript. Natalia Hernández Treviño: Conceptualization, Conception and design of study/review/case series, Final approval and guarantor of manuscript. Xenia Teresa Cobos Cruz: Funding acquisition, Acquisition of data: laboratory or clinical/literature search, Final approval and guarantor of manuscript. Víctor Othón Serna Radilla: Funding acquisition, Acquisition of data: laboratory or clinical/literature search, Final approval and guarantor of manuscript. Norma Samanta Romero Castro: Conceptualization, Funding acquisition, Conception and design of study/review/case series, Acquisition of data: laboratory or clinical/literature search, Analysis and interpretation of data collected, Drafting of article and/or critical revision, Final approval and guarantor of manuscript.

Ethics statement/confirmation of patients' permission

This study followed the principles of the Declaration of Helsinki on medical protocols and ethics, and was approved by the ethics and research committee of the Faculty of Dentistry of the Autonomous University of Guerrero in a session of January 20, 2019.

The data was handled confidentially and each of the patients was asked to sign an informed consent letter. In the present study, no new techniques or experimental drugs were tested.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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