

The use of methylprednisolone versus diclofenac in the treatment of inflammation and trismus after surgical removal of lower third molars

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ABSTRACT

Objective: To compare the efficacy of methylprednisolone (corticoid) versus diclofenac (nonsteroidal anti-inflammatory -NSAID-) in the treatment of inflammation and trismus after the surgical removal of lower third molars.

Study design: Prospective study on 73 patients for the surgical removal of their lower third molars. These patients were separated in two groups at random: the diclofenac group and the methylprednisolone group. A record card was filled in with preoperative and postoperative epidemiological and clinic data about inflammation and trismus (three facial measures and mouth opening). In order to make a broad study of data, BMDP program was used for statistics.

Results: 24 hours after surgery, patients in the diclofenac group showed a more severe inflammation in one of the facial measurements ($p < 0.05$). Trismus was very similar in both groups.

Conclusions: There were no differences in trismus depending on the antiinflammatory used. Patients in the corticoid group showed less inflammation but the difference was not as important as to justify their use.

Key words: Oral surgery, methylprednisolone, diclofenac, inflammation, trismus.

RESUMEN

Objetivo: Comparar el efecto sobre la inflamación y el trismo de la metilprednisolona (corticoide) versus diclofenaco (antiinflamatorio no esteroideo-AINE-) tras la cirugía del tercer molar inferior.

Diseño del estudio: Estudio prospectivo sobre 73 pacientes sometidos a la extracción quirúrgica de los terceros molares inferiores. Fueron divididos de forma aleatoria en dos grupos: De diclofenaco y de metilprednisolona. Se cumplimentó una ficha donde se hizo constar los datos epidemiológicos y clínicos preoperatorios y postoperatorios en relación a la inflamación y el trismo (tres medidas faciales y apertura bucal).

Se usó el programa estadístico BMDP para hacer un amplio tratamiento de los datos.

Resultados: A las 24 horas el grupo tratado con diclofenaco presentaba mayor inflamación en una de las medidas faciales ($p < 0.05$), no así en las otras dos medidas. El trismo se comportó de forma similar en ambos grupos.

Conclusiones: No se encontraron diferencias en el trismo según el antiinflamatorio usado y aunque la inflamación fue algo menor en el grupo de experimentación tratado con corticoides la diferencia no fue tan significativa como para justificar su uso.

Palabras clave: Cirugía del tercer molar, metilprednisolona, diclofenaco, inflamación, trismo.

INTRODUCTION

As in every surgery, inflammation appears almost systematically after the extraction of lower third molars (1). Some of the most important substances in the inflammation process are the prostaglandins and the leukotriens, known as eicosanoids, products of the metabolism of the arachidonic acid of the harmed cells (2).

Trismus, understood as the restriction of the mouth opening capacity after the extraction of lower third molars, is caused by a combination of factors, such as pain, hematoma, edema and trauma in muscles and tendons. It can be observed until 7-10 days after surgery and can be the consequence of a voluntary act to avoid the appearance of pain. Norholt (3) believes that the psychological component really exist because the patient fears that pain can appear when opening the mouth, but there is also a physiological component because several studies show that the antiinflammatory effect is very important to reduce trismus (4-7).

NSAID work by inhibiting the cyclooxygenase enzyme, so avoiding the synthesis of prostaglandins of the arachidonic acid in the inflamed tissue. Cyclooxygenase in a constitutive form COX 1 has a physiological function in platelets (tromboxan A2 release), in the stomachal mucus (PG release to protect from acid damage) and in the kidneys (control of function). In the inductible form COX 2, released by inflammatory stimulus, it is responsible of the formation of pro-inflammatory PGs. The inhibition of the effects of COX 1 is responsible for the side effects of these drugs (8-11).

Steroids inhibit the formation of arachidonic acid. They have a powerful antiinflammatory effect whatever the origin of the inflammation is (infectious, chemical, physical or immunological) and they can inhibit the immediate manifestations of the inflammation (redness, pain, etc.) as well as the non-immediate, which are the processes of cicatrization and cell proliferation. They inhibit vascular dilatation, reduce fluid transudation and the formation of edema, diminish cellular exudation and reduce the deposit of fibrin around the inflammation area. Pharmacological doses are needed so that this action can be seen, but there is a very intense response (12). Every increase in the concentration of glucocorticoid above the daily physiological secretion causes the inhibition of the endogenous secretion (13).

The objective of this study was to assess the differences in the degree of swelling and trismus after the surgical extraction of lower third molars with the use of a NSAID like sodium diclofenac or with a corticosteroid like methylprednisolone.

PATIENTS AND METHODS

A clinic study that was controlled, prospective, at random and double-blind was carried out in Phase IV on 73 patients who came to the Oral Surgery Unit (Department of Medicine and Oral Surgery) in the Faculty of Odontology of the Universidad Complutense de Madrid for the surgical removal of their lower third molars. This study lasted one year.

Inclusion criteria were as follows: patients with ages between 18 and 42, who gave their consent to participate in the study and who signed the informed consent, without systemic pathology and without clinical symptoms in the third molar.

Exclusion criteria were the following: patients with systemic pathology, pregnant women or women in the breastfeeding period and patients with symptomatology in the third molar or who have taken some anti-inflammatory 7 days before.

The patients were randomly distributed into two groups by means of a random number table: The 36 patients in group A took oral diclofenac sodium (Voltaren®) at doses of 50 mg every 8 hours during the first three days after surgery; and the 37 patients in group B took oral methylprednisolone (Urbason®) at doses of 4 mg every 8 hours also during three days. All patients received antibiotic treatment with oral amoxicilin at doses of 750 mg every 8 hours during 7 days after surgery. Those who still have pain may request the oral administration of a rescue drug called magnesium metamizol (Nolotil®) at doses of 575 mg every 6 or 8 hours for pain relief.

The clinical procedure was carried out in a regulated manner and always by the same surgeon.

Inflammation assessment was made by using the method described by Amin and Laskin (14), it is used by many authors nowadays (15,16), that is, making some determined measurements with a suture floss 00 tied with two mosquito forceps and with some concrete reference points that will be hereinafter described. These determinations were repeated three times: immediately before surgery, 24 hours after surgery and 7 days after surgery together with the removal of the suture points. The distances were measured as follows: The distance in millimeters from the palpebral external angle to the goniac angle of the operated side, known as angle of eye-angle of jaw (AE-AJ).

The distance in millimeters from the lower margin of the tragus to the external angle of the buccal commissure, known as tragus-angle of mouth (T-AM).

And last, the distance from the lower margin of the tragus to the middle point of the symphysis menti, known as tragus-pogonio (T-P).

In order to assess the level of trismus we used a caliber, which measured the interincisal distance, the patient being with the mouth wide opened. This measurement was measured before surgery and 24 hours and 7 days after it.

The statistical assessment was made in the Data Processing Center of the Universidad Complutense de Madrid, where BMDP program was used, making a detailed description of data, tables of frequencies, bivariate graphics, t-Tests and repeated measures analysis of variance. For quantitative or continuous variables, Student's t-Test (parametric test for comparing means) and Mann-whitney test (non-parametric test) were used. Chi-square test and Yates' correction were used for qualitative or categorical variables. It was confirmed that there were no significant differences between both groups.

RESULTS

Inflammation:

- Distance tragus-angle of mouth (DT-AM)

It is the distance from the lower margin of the tragus to the external angle of the buccal commissure, measured in three different moments: 1 (preoperative), 2 (24 hours after surgery) and 3 (7 days after surgery).

As it can be seen in table 1, in the diclofenac group there is a more severe inflammation 24 hours after surgery and 7 days after surgery, with a significant difference for $p < 0.05$ at the 24 hours.

In both groups, the most severe inflammation can be seen at the 24 hours and 7 days after surgery patients have not yet recovered the preoperative T-AM distance.

- Distance tragus-pogonio (DT-P)

It is a distance that is lower than the previous one because it doesn't reach the buccal commissure but the symphysis or the pogonio.

As it happened with the previous measure, inflammation grows 24 hours after surgery and decreases 7 days after it but without reaching the preoperative level. As it can be seen in table 1, there are no significant differences between both groups.

- Distance angle of eye-angle of jaw (DAE-AJ)

It is the distance from the external palpebral angle to the angle of jaw.

It is maybe the most difficult to be measured because the angle of jaw disappears due to inflammation in this area.

In table 1 we can see the results of the descriptive statistical study, showing the same behaviour that the two previous

distances, with an increase of inflammation 24 hours after surgery (being it higher in the diclofenac group), and a decrease 7 days after surgery but without reaching the preoperative levels. The differences were not significant.

In order to assess the level of trismus, the maximal mouth opening was registered at different moments of the study (before surgery, 24 hours after surgery and 7 days after surgery). The results are shown in table 2, where we can observe that preoperative mouth opening was very similar in both groups due to the homogeneity of the sample (there were no significant differences between both groups) and that there was an important decrease of mouth opening capacity 24 hours after surgery. 7 days after surgery the patient has not yet recovered the preoperative mouth opening. At this moment, patients in the glucocorticoid group show a slightly bigger mouth opening capacity than those in the NSAID group.

In figure 1, we can see the results of the repeated measures analysis of variance, with a significant difference ($p=0$) due to the influence of the time effect on the mouth opening capacity. However, there were no differences between groups (patients treated with diclofenac and with methylprednisolone had the same mouth opening) nor in the interaction between both groups (that is, that changes in time are very similar in both groups and that both curves have a very similar behaviour).

And last, we studied the relation between trismus and inflammation. The cases in which this relation was significant can be seen in bold letters in table 3.

Table 1. Inflammation. -distance in centimetres-

Distance tragus-angle of mouth		1 (preoperative)	2 (24 hours)	3 (7 days)
METHYLPRED. GROUP	AVERAGE	10.8973	11.2135	11.0459
DICLOFENAC GROUP	AVERAGE	11.1250	11.5694	11.2750
MEANING		0.1528	0.0361 (SIGN.)	0.1435
Distance tragus-pogonio		1 (preoperative)	2 (24 hours)	3 (7 days)
METHYLPRED. GROUP	AVERAGE	14.7324	15.0189	14.8054
DICLOFENAC GROUP	AVERAGE	14.9333	15.3361	15.0917
MEANING		0.3996	0.1687	0.1885
Distance angle of eye-angle of jaw		1 (preoperative)	2 (24 hours)	3 (7 days)
METHYLPRED. GROUP	AVERAGE	10.9730	11.4162	11.0811
DICLOFENAC GROUP	AVERAGE	11.0250	11.5750	11.1972
MEANING		0.7720	0.4045	0.5003

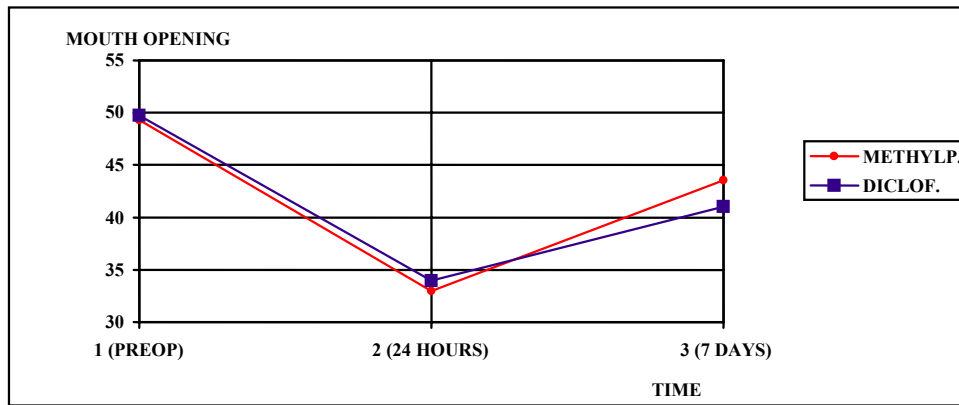


Fig. 1. Mouth opening degree comparing both groups.

Table 2. Mouth opening (mm).

APERTURA		1 (preoperatorie)	2 (24 hours)	3 (7 days)
METHYLPRED. GROUP	AVERAGE	49.3243	32.9459	43.5405
DICLOFENAC GROUP	AVERAGE	49.7500	33.9444	41.0278
MEANING		0.7714	0.6562	0.2347

Table 3. Correlation between trismus and inflammation.

TRISMUS/T-AM (24 H)	Methylprednisolone	N=37	R=0.594	P<0.001	SIGNIF.
	Diclofenac	N=36	R=0.333	P=0.04	SIGNIF.
TRISMUS/T-P (24 H)	Methylprednisolone	N=37	R=0.561	P<0.001	SIGNIF.
	Diclofenac	N=36	R=0.160	P=0.351	N.S
TRISMUS/AE-AJ (24 H)	Methylprednisolone	N=37	R=0.473	P=0.003	SIGNIF.
	Diclofenac	N=36	R=0.237	P=0.164	N.S
TRISMUS/T-AM (7 DAYS)	Methylprednisolone	N=37	R=0.512	P=0.001	SIGNIF.
	Diclofenac	N=36	R=0.243	P=0.154	N.S
TRISMUS/ T-P (7 DAYS)	Methylprednisolone	N=37	R=0.411	P=0.01	SIGNIF.
	Diclofenac	N=36	R=0.163	P=0.343	N.S
TRISMUS/AE-AJ (7 DAYS)	Methylprednisolone	N=37	R=0.380	P=0.02	SIGNIF.
	Diclofenac	N=36	R=0.374	P=0.025	SIGNIF.

DISCUSSION

In relation to inflammation, the diclofenac group presented a bigger distance tragus-angle of mouth. This difference was statistically significant 24 hours after surgery (<0.05). In the other two facial measures there was not a significant difference.

A lot of research has been done on the efficacy of NSAID and corticoids in the treatment of postoperative inflammation, but is very difficult to compare the results of the different studies due to the great variety of inflammation assessment system used (17), the variations in the compounds administered and the different ways of administration and doses. The most frequently used route of administration of corticoids is the intravenous one at high and only doses. This was the one used by Esen (18), who used to administer 125 mg before surgery, by Peillon (19), with 1.5mg/kg also before surgery, and by Hyrkäs (20) and Neupert (7) or Tiwana (21), with smaller doses. Other route of administration is the oral one chosen by us, which has a great variability of doses (22). Like Bystedt (23), we have used for our study the lowest dose of 12 mg/day during 3 days. We chose this dose and this time interval in order to avoid the suppression of the hypothalamic-pituitary-adrenal axis. This suppression would occur with the administration of higher doses during at least five days (13).

However, we must underline that in the analyzed cases the corticoid group has the best postoperative, as it happens in Holland's study (24) who reduced the inflammation in a 56% and also reduced the pain with the administration of 40 mg of methylprednisolone iv. Milles (22) also obtained a great reduction of inflammation by administering 16 mg of methylprednisolone the night before surgery and 20 mg just before starting it, but trismus and pain did not suffer any alteration.

While there is not an effective and objective method for measuring inflammation, in the case of trismus all authors use the same method that we do: The maximal mouth opening between the incisal borders of the lower and upper incisors was registered with a calibre before surgery and in each one of the reviews.

In our study, we observed that there was a severe trismus 24 hours after surgery, that is, a severe reduction of the mouth opening capacity, and that 7 days after surgery patients have not yet recovered their preoperative mouth opening capacity. There were not significant differences between the NSAID group and the corticoid group. However, Troullos (4) observes less trismus in patients treated with methylprednisolone than in those treated with ibuprofen.

Anyway, it is important to highlight that there was a significant correlation between inflammation and trismus in the methylprednisolone group at the 24 hours in the three facial measures used to evaluate inflammation: significant correlation between trismus and distance tragus-mouth angle ($r=0.594$; $p<0.001$), between trismus and distance tragus-pogonio ($r=0.561$; $p<0.01$) and the distance angle of eye-angle of jaw ($r=0.473$; $p=0.003$), what means that a more severe inflammation is always accompanied by a more severe trismus. The same thing occurred 7 days after

surgery: the more severe the inflammation was, the more severe the trismus was.

In the diclofenac group, although there was also a positive correlation between trismus and the three facial measures made 24 hours after surgery, this was only significant in the distance tragus-angle of mouth ($r=0.333$; $p=0.04$). 7 days after surgery the correlation was still positive but it was significant only between trismus and angle of eye-angle of jaw ($r=0.374$; $p=0.02$).

This positive correlation could mean that there is a casual relation between trismus and inflammation. There are several studies that show there is a relation between trismus and inflammation: when an effective anti-inflammatory or an steroid are compared with a placebo (4,5,25), less reduction of the mouth opening can be observed within the first 7 days after surgery (7). Moreover, several studies with paracetamol have revealed the little effect it has on trismus (26), showing that the anti-inflammatory effect is very important for the reduction of trismus.

We consider important to highlight that there are several authors who are in favour of combining NSAID and corticoids for the treatment of inflammation and trismus after the surgical extraction of lower third molars because they think it is the way to reduce inflammation and to avoid the limitation of mouth opening (25). In fact, Hyrkäs and collaborators (20) used a combination of both antiinflammatories compared in our study: 40 mg of methylprednisolone iv with diclofenac, compared with diclofenac alone, obtaining less pain when using both antiinflammatories combined.

CONCLUSIONS

- 1.- With the use of methylprednisolone less inflammation was observed although there was not a severe difference.
- 2.-Both antiinflammatories acted in a similar way in the reduction of trismus.

REFERENCES

1. Sands T, Pynn BR, Nenniger S. Third molar surgery: current concepts and controversies. Part 2. Oral Health 1993;83:19,21-2,27-30.
2. Ferreira SH. Peripheral analgesic sites of action of anti-inflammatory drugs. Int J Clin Pract Suppl 2002;128:2-10.
3. Nørholt SE. Treatment of acute pain following removal of mandibular third molars. Use of the dental pain model in pharmacological research and development of a comparable animal model. Int J Oral Maxillofac Surg 1998;27 suppl:1-41.
4. Troullos ES, Hargreave KM, Burler 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;48:945-52.
5. Bailey BMW, Zaki G, Rotman H, Woodward RT. A double-blind comparative study of soluble aspirin and diclofenac dispersible in the control of postextraction pain after removal of impacted third molars. Int J Oral Maxillofac Surg 1993;22:238-41.
6. Van der Westhuyzen AJ, Roelofse JA, Becker PJ. Randomized double-blind comparison of tiaprofenic acid and diclophenac sodium after third molar surgery. Oral Surg Oral Med Oral Pathol 1994;78:557-66.
7. Neupert EA, Lee JW, Philput CB, Gordon JR. Evaluation of dexamethasone for reduction of postsurgical sequelae of third molar removal. J Oral Maxillofac Surg 1992;50:1177-82.
8. Jordan S, White J. Non-steroidal anti-inflammatory drugs: clinical issues. Nurs Stand 2001;15:45-52.

9. Hawkey CJ. COX-1 and COX-2 inhibitors. *Best Pract Res Clin Gastroenterol* 2001;15:801-20.
10. McGettigan P, Henry D. Current problems with non-specific COX inhibitors. *Curr Pharm Des* 2000;6:1693-724.
11. Mitchell JA, Warner TD. Cyclo-oxygenase-2: Pharmacology, physiology, biochemistry and relevance to NSAID therapy. *Br J Pharmacol* 1999;128:1121-32.
12. Gersema L, Baker K. Use of corticosteroids in Oral Surgery. *J Oral Maxillofac Surg* 1992;50:270-7.
13. Ciruelo Monge E, González Crespo MR, Blanco FJ, de la Mata Llord J. Manejo clínico de esteroides y antiinflamatorios no esteroideos. En: Carnevali Ruiz D, ed; *Manual de diagnóstico y terapéutica médica*. Madrid. 1994. p. 53-66.
14. Amin MM, Laskin DM. Prophylactic use of indomethacin for prevention of postsurgical complications after removal of impacted third molars. *Oral Surg* 1983;55:448-51.
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;53:2-7.
16. Üstün Y, Erdogan Ö, Esen E, Karsli ED. Comparison of the effects of 2 doses of methylprednisolone on pain, swelling and trismus after third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;96:535-9.
17. Venta I, Hyrkas T, Paakkari I, Ylipaavalniemi P. Thermographic imaging of postoperative inflammation modified by anti-inflammatory pre-treatment. *J Oral Maxillofac Surg* 2001;59:145-8.
18. Esen E, Tasr F, Akhan O. Determination of the anti-inflammatory effects of methylprednisolone on the sequelae of third molar surgery. *J Oral Maxillofac Surg* 1999;57:1201-6.
19. Peillon D, Dubost J, Roche C. La corticothérapie et l'hémodilution diminuent-elles l'inflammation postopératoire après chirurgie maxillofaciale?. *Ann Fr Anesth Réanim* 1996;15:157-61.
20. 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* 1993;51:634-6.
21. Tiwana PS, Foy SP, Shugars DA, Marciani RD, Conrad SM, Phillips C et al. The impact of intravenous corticosteroids with third molar surgery in patients at high risk for delayed health-related quality of life and clinical recovery. *J Oral Maxillofac Surg* 2005;63:55-62.
22. Milles M, Desjardins PJ. Reduction of postoperative facial swelling by low-dose methylprednisolone: an experimental study. *J Oral Maxillofac Surg* 1993;51:987-91.
23. Bystedt H, Nordenram A. Effect of methylprednisolone on complications after removal of impacted mandibular third molars. *Swed Dent J* 1985;9:65-9.
24. Holland CS. The influence of methylprednisolone on post-operative swelling following oral surgery. *Br J Oral Maxillofac Surg* 1987;25:293-9.
25. Gallardo F, Carstens M, Ayarza M. Analgesic and anti-inflammatory effects of glucamethacin (a nonsteroidal anti-inflammatory analgesic) after the removal of impacted third molars. *Oral Sug Oral Med Oral Pathol* 1990;69:157-60.
26. Puche F, Martínez-González JM, Blanco L, Gómez Font R, Donado M. Estudios de los efectos del diclofenaco sódico en el control de la inflamación y trismo postoperatorio del tercer molar inferior. *Av Odon-toestomatol* 1995;11:225-33.