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Efficacy of Inferior Alveolar Nerve Block with Local Anaesthetic and Methylprednisolone in Third Molar Tooth Surgical Extraction: A Comparative Study with Conventional Therapy

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Abstract

Background: *Surgical removal of impacted lower third molar tooth is usually associated with postoperative pain, swelling and trismus. The aim of this study was to evaluate the efficacy of a single dose of 40 mg methylprednisolone injected with local anesthetic agent during inferior alveolar nerve block preoperatively in reducing postoperative pain, swelling and limited mouth opening following lower third molar surgery.*

Materials and methods: *A prospective, randomized, controlled study was designed involving sixty patients. Patients were randomly divided into two groups. Each group consists of thirty patients for which first group (Group A) was given 40mg methylprednisolone with LA during IANB (Inferior Alveolar Nerve Block) preoperatively followed by post operative NSAID's. Second group (Group B) served as control was managed by conventional LA and postoperative NSAID's. Facial swelling, mouth opening, pain on a visual analogue scale (VAS) were assessed. Descriptive statistics and the independent-samples t-test were used to compare the two groups at $p < 0.05$*

Results: *There was a significant reduction in swelling on day 2 postoperative in the methylprednisolone group. Mouth opening was also significantly greater on day 2 in the methylprednisolone group. The VAS pain score was significantly lower on the day of the operation and first postoperative day in the methylprednisolone group, but did not differ significantly between the groups on the other postoperative days.*

Conclusion: *Methylprednisolone with local anesthetic agent was more effective in reducing postoperative swelling, limited mouth opening, and pain following impacted lower third molar extraction.*

Key words

Lower third molar surgery; Local anesthetic agent; Methylprednisolone injection; Postoperative sequelae; Single dose.

Introduction

Surgical removal of impacted tooth under local anesthesia in general dental practice is usually associated with postoperative pain, swelling and trismus andaffect the patient's quality of life[1]. Surgical removal of 3rd molars causes significant pain, swelling and trismus even when teeth are removed by gentle surgical technique. The pain and swelling resulting from the surgery are generally caused by different factor such as surgical trauma or endotoxin. The use of synthetic glucocorticoids in reducing such postoperative sequelae has been investigated extensively[2]. Althoughits success is still questionable, some studies demonstrated a statistically significant improvement in post operative sequelae when corticosteroids were administered.

The use of corticosteroids/steroids (eg: methylprednisolone) is another preventive strategy for limiting postoperative pain, swelling and trismus following 3rd molar extraction. Postoperative pain, swelling and oedema may be due to the conversion of phospholipids to arachidonic acid by phospholypase A2 and the resultant production of leukotrines, prostacyclines, prostaglandin and thromboxane A2 acting as mediators of inflammatory response. The use of steroid may inhibit the initial step in this process[3]. Clinical trials in Oral surgery have also supported the hypothesis that preemptive NSAID's and corticosteroids are effective in delaying and preventing many post operative sequelae[4]. The apparent interactions between the mechanisms of action of NSAID's and steroids suggests that cotherapy may provide beneficial inflammatory and pain relief in the absence of side effects. Co-administration of methylprednisolone maximizes the drug levels at the site of action and minimizes the systemic exposure at the site of tissue injury.

Most previous studies reported on administration of methylprednisolone through oral, intramuscular, intravenous routes and local submucosal infiltration around surgical site but no study has investigated the efficacy of methylprednisolone when administrated with local anaesthetics during inferior alveolar nerve block which is near to surgical site.

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The objectives of this study is to compare the effect of co-administered methylprednisolone with local anesthetic(2% lidocaine HCL with 0.0005% adrenaline) NSAID's and LA (2% lidocaine HCL with 0.0005% adrenaline) with conventional NSAID's on the postoperative mangement of pain swelling and trismus following removal of 3rd molar tooth extraction (Impacted lower 3rd molar).

Materials and methods

A total of 60 patients who attend the Oral and Maxillofacial Surgery Department of BSMMU during the period of July 2006 to June 2008 requiring surgical removal of impacted mandibular 3rd molar teeth under LA were included. All selected candidates were free of pain and other inflammatory symptoms that included swelling, hyperemia and decreased mouth opening at the time of surgery. Patients were randomly allocated into two groups. In group A (Study group) patients were given a combination of methylprednisolone (40mg) and LAat surgical site and post operative NSAID's (Diclofenac). Group B (Control group) comprised of patients who were given post-operative conventional NSAID's (Diclofenac) only but no adjunct mythylprednisolone.

Methylprednisolone 40mg (Inj.Depomedrol 40mg) given parentally with LA preoperatively. Oral preoperative antibiotic (500mg Amoxicillin thrice daily + 400mg metronidazole thrice daily) were administered to all patients 24 hours prior to surgery. In both group 2% lidocaine hydrochloride with 0.0005% adrenaline are used as inferior alveolar nerve block. NSAID's (Diclofenac 50mg)given 30 min preoperatively and there after 50mg 3 times daily for 5 days. All patients were placed on a fiveday antibiotic regimen. All the medications administered orallyexceptMethylprednisolone which was administered parentally.

Standard surgical extraction of the lower 3rd molar carried with buccal guttering technique after adequate elevation and reflection of bucccal mucoperiosteal flap. Tooth delivery was followed by meticulous irrigation of the surgical site with physiological saline (0.9%). The flap was repositioned and sutures accurately.

Assessments of the pain, facial swelling and mouth opening were done on 1st, 2nd and 5th postoperative days. Visual Analogue Scale (VAS) was used to measure pain intensity. The original VAS consists of a 10 cm horizontal line with two end points labeled as no pain and worst pain ever. The patient is asked to place a mark on the 10cm line at a point which corresponds to the level of pain intensity he or she presently feels. The distance in centimeters from the lower end of the VAS to the patients mark is used as a numerical index of severity of pain.

Facial width (Swelling) is measured by using the reference points at the tip of tragus of left and right ears with the gonium in between; repeating the procedure three times on each patient made the measurement. The average measurements were taken in cm and recorded. The measurements were carried out just before the surgery and a post operative day 1,2 and 5.

A vernier calibrated sliding caliper was used to measure maximum interincisal mouth opening ability of the patient. The reference points used was incisal edge of the maxillary central incisor and incisal edge of mandibular central incisor at maximum opening available. The measurements were made in triplicate and the average was recorded in millimeters (mm). The measurements were carried out just before surgery and at post operative day 1, 2 and 5.

Ethical guidelines of Helsinki Declaration VI (2000) were followed throughout the study. Written consent from all the subjects was taken. A standardized structured data collection sheet was used to collect necessary information of the study subjects.

Analysis of data was performed with the statistical software SPSS version 26 for windows (IBM). Both qualitative and quantitative tests were performed. For comparison between groups chi-square test was performed for qualitative variables and student't' test was performed for quantitative variables. Data were interpreted accordingly and were presented in tables, charts and bar diagrams.

Results

The case group was consisting of 20 male and 10 female patients and the control group was consisting of 15 male and 15 female participants. In case group minimum age was 20 and maximum age was 40 years. In control group minimum age was 18 years and maximum age was 40 years. The mean ± SD age of the case group was 28.17±5.91 years and the mean ± SDage of the control group was 26.80±5.69 years.

Surgical extraction of mesioangular impaction was performed in 13 (43.3%) patients of case group and in 15 (50%)patients of control group. 9 (30%) patients in case group and 8 (26.7%) patients in control group had vertical impaction. Distoangular impaction operation was done in 4 (13.3%) patients of case group and in 2 (6.7%) patients of control group. 4 (13.3%) patients in both groups underwent horizontal impaction operation. One patient of control group was done linguoversion impaction operation.

The mean of difference in pain on 1st POD in control and case were 59.77±12.1 and 49.23±6.73 respectively. The differences of pain intensity, before surgery and 1st POD was significantly low in case group than in control group ($p<0.001$). The mean of difference in measurement of facial width on 1st POD in control and case were 2.3±0.23 and 1.51±0.79 respectively. The differences of measurement of facial width before surgery and 1st POD was significantly low in case group than in control group ($p<0.001$). The mean of difference in measurement of mouth opening on 1st POD in control and case were 21.03±1.92 and 15.97±3.46 respectively. The differences of measurement of mouth opening before surgery and 1st POD was significantly low in case group than in control group ($p<0.001$) (Table I).

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The mean of difference in pain on 2nd POD in control and case were 51.83±5.36 and 28.93±8.11 respectively. The differences of pain intensity, before surgery and 2nd POD was significantly low in case group than in control group (p<0.001). The mean of difference in measurement of facial width on 2ndPOD in control and case were 2.09±0.27 and 1.31±0.71 respectively. The differences of measurement of facial width before surgery and 2nd POD was significantly low in case group than in control group (p<0.001). The mean of difference in measurement of mouth opening on 2nd POD in control and case were 16.37±1.59 and 12.07±3.52 respectively. The differences of measurement of mouth opening before surgery and 2nd POD was significantly low in case group than in control group (p<0.001) (Table II).

The mean of difference in pain on 5th POD in control and case were 25.17±4.25 and 9.83±3.95 respectively. The differences of pain intensity, before surgery and 5th POD was significantly low in case group than in control group (p<0.001). The mean of difference in measurement of facial width on 5th POD in control and case were 0.9±0.2 and 0.32±0.27 respectively. The differences of measurement of facial width before surgery and 5th POD was significantly low in case group than in control group (p<0.001). The mean of difference in measurement of mouth opening on 5th POD in control and case were 9.5+1.31 and 4.93+2.85 respectively. The differences of measurement of mouth opening before surgery and 5th POD was significantly low in case group than in control group (p<0.001) (Table III).

The mean of percentage increase in facial width at 1st POD in control and case were 7.38±1.15 and 4.66±2.57 respectively. The percentage increase in facial width at 1st POD was significantly low in case group than in control group (p<0.001). The mean of percentage increase in facial width at 2nd POD in control and case were 6.68±1.03 and 4.03±2.27 respectively. The percentage increase in facial width at 2nd POD was significantly low in case group than in control group (p<0.001). The mean of percentage increase in facial width at 5th POD in control and case were 2.87±0.66 and 0.97±0.86 respectively. The percentage increase in facial width at 5th POD was significantly low in case group than in control group (p<0.001) (Table IV).

The mean of percentage decrease in mouth opening at 1st POD in control and case were 40.30±4.68 and 32.37±5.94 respectively. The percentage decrease in mouth opening at 1st POD was significantly low in case group than in control group (p<0.001). The mean of percentage decrease in mouth opening at 2nd POD in control and case were 31.42±4.25 and 24.31±25.93 respectively. The percentage decrease in mouth opening at 2nd POD was significantly low in case group than in control group (p<0.001). The mean of percentage decrease in mouth opening at 5th POD in control and case were 18.24±3.12 and 10.12±5.83 respectively. The percentage decrease in mouth opening at 5th POD was significantly low in case group than in control group (p<0.001) (Table V).

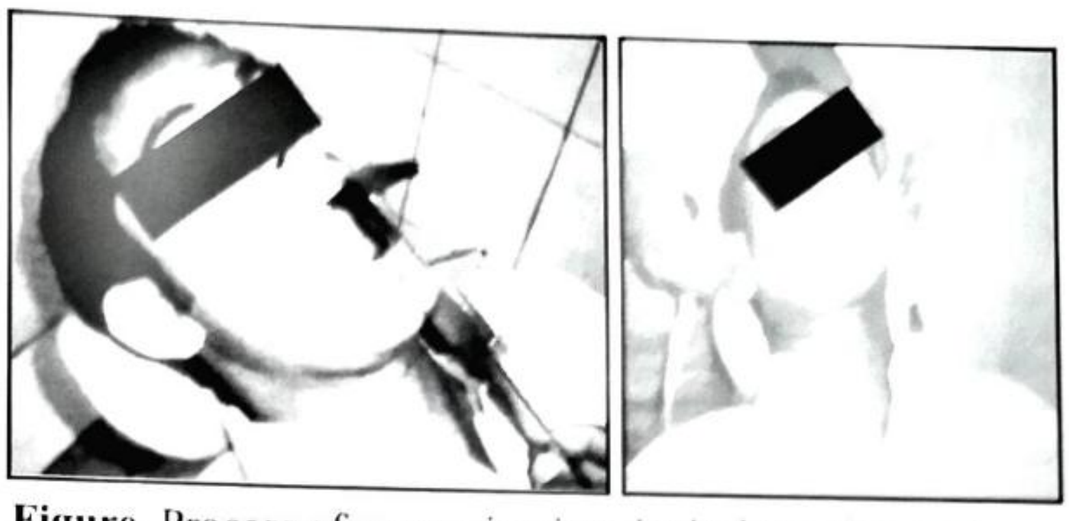

Figure Process of measuring interincisal opening and facial width

Table I Difference in pain intensity, measurement of facial width and measurement of mouth opening on 1st postoperative day (Group A= Case, Group B= Control)

Post operative day 1	Group	Mean	Std. Deviation	t	Df	p
Difference in pain intensity (100 mm VAS)	Group A	49.233	6.72967	-4.167	58	0.000
	Group B	59.766	12.0992			
Difference in measurement of facial width (in cm)	Group A	1.5133	0.79339	-5.214	58	0.000
	Group B	2.3000	0.23119			
Difference in measurement of mouth opening (in mm)	Group A	15.966	3.45895	-7.014	58	0.000
	Group B	21.033	1.92055			

Table II Difference in pain intensity, measurement of facial width and measurement of mouth opening on 2nd postoperative day (Group A= Case, Group B= Control)

Post operative day 2	Group	Mean	Std. Deviation	t	df	p
Difference in pain intensity (100 mm VAS)	Group A	28.933	8.10676	-12.90	58	0.000
	Group B	51.833	5.35681			
Difference in measurement of facial width (in cm)	Group A	1.3050	0.71394	-5.633	58	0.000
	Group B	2.0917	0.27452			
Difference in measurement of mouth opening (in mm)	Group A	12.066	3.52267	-6.096	58	0.000
	Group B	16.366	1.58622			

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Table III Difference in pain intensity, measurement of facial width and measurement of mouth opening on 5th postoperative day (Group A= Case, Group B= Control)

Post operative day 5	Group	Mean	Std. Deviation	t	df	p
Difference in pain intensity(100 mm VAS)	Group A	9.8333	3.94866	-14.47	58	0.000
	Group B	25.1667	4.25144			
Difference in measurement of facial width (in cm)	Group A	0.3150	0.26979	-9.48	58	0.000
	Group B	0.9000	0.20342			
Difference in measurement of mouth opening (in mm)	Group A	4.9333	2.85190	-7.974	58	0.000
	Group B	9.5000	1.30648			

Table IV Percentage increase in facial width at 1st, 2nd and 5th POD in case and control group.

	Group	Mean	Std. Deviation	t	df	p
Percentage increase in facial width at 1st POD	Group A	4.6631	2.56731	-5.286	58	0.000
	Group B	7.3773	1.14838			
Percentage increase in facial width at 2nd POD	Group A	4.0337	2.27236	-5.809	58	0.000
	Group B	6.6798	1.03019			
Percentage increase in facial width at 5th POD	Group A	0.9697	0.86281	-9.549	58	0.000
	Group B	2.8682	0.66450			

Table V Percentage decrease in mouth opening at 1st, 2nd and 5th POD in case and control group

	Group	Mean	Std. Deviation	T	df	p
Percentage decrease in mouth opening at 1st POD	Group A	4.6631	2.56731	-5.286	58	0.000
	Group B	7.3773	1.14838			
Percentage decrease in mouth opening at 2nd POD	Group A	4.0337	2.27236	-5.809	58	0.000
	Group B	6.6798	1.03019			
Percentage decrease in mouth opening at 5th POD	Group A	0.9697	0.86281	-9.549	58	0.000
	Group B	2.8682	0.66450			

Discussion

Surgical procedures for extraction of unerupted 3rd molars are associated with significant morbidity including pain, swelling and trismus together with the possibility of temporary or permanent nerve damage resulting in altered sensation of lip or tongue[5]. These surgical procedures results in the release of chemical mediators, increase nerve ending sensitivity and retention of a protein rich fluid in the extravascular area[6]. It has been reported that post oral surgery pain is controllable with some NSAID's[7]. Nevertheless NSAID's are sometimes ineffective in preventing swelling associated with pain[8]. For this reason the use of diclofenac combined with methylprednisolone can be a good choice in terms of reducing the respective drug doses. Diclofenac is known to possess both analgesic and anti-inflammatory effect. Due to its anti-inflammatory effects, the administration of steroids may synergize the anti-inflammatory effect of diclofenac and contribute to the reduction of inflammatory exudates as well as oedema and pain. Therefore, the co-administration of diclofenac and steroid may be expected to reduce post operative pain more than that achieved with diclofenac alone[9].

A study reported that post-operative oedema decreased with the use of methylprednisolone during the extraction of a third molar tooth, yet swelling increased on postoperative days 2 and 3 although it was statistically less significant than the placebo group[10]. They stated that this could be attributed to the rapid metabolization and shortlasting effect of methylprednisolone.

In determining the optimal time to administer preoperative steroids, the time sequence of the permeability changes in inflammation must be taken into consideration. The major type of permeability response associated with the surgical trauma is called the early response. In this type, a strong permeability response may begin within few minutes of injury and reach a peak within 15 to 30 minutes or within 60 minutes with weaker stimuli since methylprednisolone onset is 30-60 mins[11]. It would seem rational on a pharmacologicalbasis to administer methylprednisolone dose at the start of operation.

Postsurgical facial oedema is difficult to quantify accurately, since it requires a threedimensional measurement with an irregular convex surface and can manifest itself internally as well as externally. Over the years numerous researchers have tried various techniques in an effort to objectively measure oedema most of which are indirect assessments of the altered contours of skin surface.Measurement tools mentioned in the literature have include visual analogue scales, trismus recordings, standardized stereo-radiographic or photographic measurements, computerized tomography, modified face bow devices, ultrasonography, facial plethysmographs or various other means of taking direct facial measurements[12]. In present study, a single measurement from the tip of tragus to gonium to the tip of contrataleral tragus was taken. It is noteworthy to mention herein that the cheek swelling following third molar surgery is

diffuse in different planes and is very difficult to measure accurately. The administration of methylprednisolone preoperatively produce a clear reduction in postoperative pain and cheek swelling. The mean increase in facial swelling on day 1,2 and 5 in study group was significantly less than that of control group. This result shows that administration of methylprednisolone enhances the control of post operative facial swelling.

In relation to inflammation in our study, the control group presented a bigger distance from tragus to tragus of the face and this difference was statistically significant 24 hours after surgery.

A lot of research has been done on the efficacy of NSAID's and glucocorticoids in the treatment of post operative inflammation, but is very difficult to compare the results of the different studies due to the great variety of inflammation assessment system used[13]. However, in our study, in the analyzed cases the methylprednisolone group has the best post operative, as it happens in Hollands study who reduced the inflammation in a 56% and also reduced the pain with the administration of 40mg methylprednisolone iv[10].

While there is not an effective and objective method for measuring inflammation, in the case of trismus all authors used the same method that we have done. The maximal mouth opening between the incisal borders of the lower and upper incisors was registered with a slide caliper before surgery and in each of the follow up.

In our study, the mean of difference in pain on 1st POD in case and control were 49.23±6.73 and 59.77±12.1, in 2nd POD 28.93±8.11 and 51.83±5.36, in, 5thP OD 9.83±3.45 and 25.17±4.25 respectively which was significantly low in case group than in control group ($p<0.001$).

The mean of difference in measurement of facial width on 1st POD in case and control were 1.51±0.79 and 2.3±0.23, in 2nd POD 1.31±0.71 and 2.09±0.27, in 5th POD 0.32±0.27 and 0.9±0.2 respectively which was significantly low in case group than in control group ($p<0.001$).

The mean of difference in measurement of mouth opening on 1st POD in case and control were 15.97±3.46 and 21.03±1.92, in 2nd POD 12.07±3.52 and 16.37±1.59, in 5th POD 4.93±2.85 and 9.51±1.31 respectively which was significantly low in case group than in control group ($p<0.001$).

In our study, we have observed that there wasa severetrismus 24 hours after surgery, that is, severe reduction of the mouth opening capacity, and that 5 days after surgery patients have not yet recovered their preoperative mouth opening capacity. There was significant difference between case and control group. Troullos et al. (1990) observes less trismus in patients treated with methylprednisolone than treated with ibuprofen[12].

Any way, it is important to highlight that there was a significant correlation between inflammation and trismus in the methylprednisolone group after 24 hours of surgery, facial swelling measures to evaluate inflammation. Significant correlation between trismus and distance from tragus to tragus, means that a more severe inflammation is always accompanied by a more severe trismus. The samething occurred 5 days after surgery, the more severe the inflammation, the more severe the trismus was.

We have given importance to highlight that there are several authors who are in favour of combining NSAID's and corticosteroids for the treatment of inflammation and trismus after the surgical extraction of lower third molar because they think it is the way to reduce inflammation and to avoid the limitation of mouth opening[13,14].

Limitations

Limited number of respondents was the first drawback in this study. Indirect assessment of the altered contours of skin surface in post surgical facial oedema is difficult to quantify accurately. Psychological component really exists because the patient fears that pain can appear when opening the mouth.

Conclusion

The purpose of this study was to assess the effectiveness and acceptability of inferior nerve block with methylprednisolone for controlling post operative pain, swelling and trismus after lower 3rd molar tooth surgical extraction and to compare the result with conventional method. In this study effectiveness and acceptability of methyl prednisolone with LA in inferior alveolar nerve block found better than conventional local anesthetics alone.

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Recommendations

Further studies with larger number of samples are recommended for more reliable information.

Disclosure

All the authors declared no competing interest.

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