ORIGINAL ARTICLE

Comparison of effects of preoperative piroxicam and ibuprofen on pain after separator placement: A randomized controlled trial

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ABSTRACT

Introduction: Orthodontic therapy causes significant pain for a large percentage of patients. It is one of the main reasons that discourage patients from seeking orthodontic treatment. Pain during orthodontic treatment may have a negative influence on cooperation and can also reduce the compliance. This study assessed the effectiveness of a single dose of preoperative Piroxicam in reducing the incidence and severity of pain after orthodontic separator placement when compared to ibuprofen. **Materials and Methods:** The study was a randomized, placebo-controlled, double-blind, parallel-arm study. Sixty eight patients were recruited for this study and were randomly assigned to one of the three experimental groups: 1. 20 mg of Piroxicam followed by two doses of multivitamin placebo ($n = 30$); 2. 400 mg of Ibuprofen in three doses ($n = 20$) and 3. A multivitamin placebo ($n = 18$). All the three groups were administered the first dose of the respective medication one hour prior to separator placement, the successive two doses were given at 3 hours and 7 hours after separator placement. The pain experienced by the patient was assessed at the time intervals 2 hours, 4 hours, 6 hours, bedtime, on awakening the following day and 24 hours after administration using a visual analogue scale. **Results:** A comparison of pain perception between all three groups with the repeated measures analysis of variance (ANOVA) and a comparison of pain perception between the first and second group using the Student t test revealed that preemptive Piroxicam therapy significantly lower pain levels experienced at all-time intervals starting from 2 hours after separator placement till 24 hours after placement. **Conclusion:** A single dose of Piroxicam taken 60 minutes before separator placement reduces pain due to separator placement experienced in the first 24 hours following separator placement.

Key words: Orthodontic pain, preemptive analgesic, piroxicam, separator placement

Introduction

Patients undergoing orthodontic treatment (OT) may experience some degree of pain or discomfort with fixed appliances.[1] The percentage of adolescents reporting pain during fixed orthodontic treatment has been reported to be 91 per cent, and in 39 per cent of these individuals, pain was experienced during each step of treatment.[2]

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Research indicates that patients rank pain as the worst aspect of orthodontic treatment and the foremost reason for wanting to discontinue care.[3] When compared with the pain associated with extractions, both the incidence and severity of orthodontic pain is perceived to be greater.[4] Forces applied on teeth during orthodontic treatment trigger an inflammatory response that brings about bone resorption, which constitutes the basis of tooth movement.[5-7]

Non-steroidal anti-inflammatory drugs (NSAIDs) act by inhibiting cyclooxygenase enzymes, thereby blocking the formation of prostaglandins and preventing inflammation and the sensitization of peripheral nerve receptors.[8] If NSAIDs are given before a procedure, the body can absorb and distribute the medication before tissue injury occurs. This results in an analgesic effect by reducing

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nerve sensitivity to certain inflammatory mediators and could allow for lower production of prostaglandins and thus decreasing inflammatory response.[9]

The aim of this prospective, double-blind, parallel-arm study is to evaluate the efficacy of preoperative administration of Ibuprofen and Piroxicam with regard to orthodontic pain after separator placement.

Material and Methods

This was a randomized, placebo-controlled, double blind, parallel-arm study, with block randomization technique. Sixty eight patients who were scheduled to receive fixed orthodontic treatment participated in the study. Written approval was obtained from the institution's Ethical Committee. The inclusion criteria were as follows:

Subject of either gender with age of at least 18 years and not older than 30 years, beginning orthodontic treatment for the first time or re-treatment, orthodontic treatment requiring the placement of two separators in each of the four quadrants and if the patient agreeing voluntarily participate in the study by signing an written informed consent form.

Pregnant subjects, those having contraindications to the use of piroxicam and significant medical illnesses that prevent the subject from participating in the study or subjects undergoing any oral surgical procedure before separator placement were excluded from the study.

Subject demographics were obtained and a thorough medical history was obtained especially hypersensitivity to NSAIDs and vitals (pulse, BP and respiratory rate) were recorded. The subjects were allocated treatments as per the computer-generated randomization table as shown in Table 1. One of the investigator dispensed Piroxicam/Ibuprofen/placebo so that the other investigator and the subject would be blinded to the treatment group. Study drug and placebos were dispensed in a standard opaque paper envelope. Subjects were asked to rate pain as a consequence of chewing, biting the almond on a VAS for both right and left sides.

Prior to separator placement, subjects completed a Visual Analog Scale (VAS) for expected pain. Pain upon placement was recorded on a VAS. The subjects were asked to rate their expectation of pain consequent to separator placement using a 10 cm VAS. Anchors of "no pain at all" (0 cm) and "worst pain imaginable" (10 cm) were used. Over the next 24 hours, subjects recorded discomfort when biting, chewing, fitting front teeth together, and fitting back teeth together in a VAS pain diary. Vitals were checked when the subject returned to the clinic for returning the VAS scores. Pain scores were recorded in the pain diary at: 2 hours post-separator placement (T1), 6 hours post-separator placement (T2), at bedtime (T3), at time of awakening (T4) and at 24 hours post-separator placement (T5). Subjects were asked to provide the specific times for bedtime and awakening in the pain diary. Subjects were requested to self-administer the remaining two doses at 3 hours after separator placement (D2) and at 7 hours after separator placement (D3). At 24 hours (T5), subjects were self-administering the VAS.

The completed pain diary and the chewed bagged almonds were returned to the investigator during the follow-up visits.

Statistical Analysis

Data was analyzed using SPSS version 17. Significance was pre-determined at *p* value less than 0.05. Repeated measures analysis of variance (ANOVA) was used to compare the three study groups for differences in perceived pain levels. This technique allows both for differences in conditions at the same time point, differential development across subsequent times and the general effect of time on perceived pain. Student *t* test was used later to compare between pain perception among the first and second group, and significance was set for *p* value less than 0.05.

Results

Patient recruitment is detailed in Table 1. A total of 68 patients were recruited into the study, with 20 in group 1, 30 in group 2 and the remaining 18 in group 3. The mean age of all three groups were within the same range and was not statistically significant. Within the sample, all 68 patients returned their diary, which gave a return rate of 100 percent. Descriptive statistics of randomization for the experimental groups are given in Table 2.

Visual analogue scale

Pain is a subjective feeling and there is no objective scale with which to measure the intensity of pain perceived; the VAS scale was chosen because it has been shown to be the most reliable and accurate tool in the evaluation of subjective experiences such as pain. The summary statistics for each group are shown in Tables 3–6. The individual profile plots for discomfort with each medication versus

Table 1: Treatment allocations

Group No.	Preoperative Analgesic	Preoperative Dose	Mean Age (Years)	Males	Females
Group 1	Piroxicam	20 mg	18 ± 3.4	10	20
Group 2	Ibuprofen	400 mg	19 ± 2.6	5	15
Group 3	Placebo	1 tablet	18 ± 4.2	8	10

Table 2: Treatment allocation timeline

T0	D1	Tx	T1	D2	T2	D3	T3	T4	T5
Expected Pain rating	Group A 20 mg Piroxicam Group B 400 mg Ibuprofen Group C Placebo	Experienced Pain Rating	Pain diary	Group A Placebo Group B 400 mg Ibuprofen Group C Placebo		Group A Placebo Group B 400 mg Ibuprofen Group C Placebo	Pain diary	Pain diary	Experienced pain rating *and* Pain diary
−1.25 h	−1 h	Separator Placement	+2 h	+3 h	+6 h	+7 h	Bed time	Wake up	24 h

[a]T0: prior to dosing; Tx: separator placement, T1: 2 hours after separator placement; T2: 6 hours after separator placement; T3: bedtime; T4: time of awakening; T5: 24 hours after separator placement; D1: time of f rst dosing; D2: time of second dosing; D3: time of third dosing

Table 3: Comparison of mean pain scores for chewing in study groups (Mean ± SD)

Groups	2 h	6 h	Bedtime	Awakening	24 h
Piroxicam	1.80±3.06	4.40±5.04	4.23±3.11	5.20±3.89	5.79±4.75
Ibuprofen	3.40±2.41	8.10±5.72	6.45±4.32	7.85±4.80	8.40±5.64
Placebo	8.66±6.46	4.25±3.09	9.66±5.98	10.77±5.96	12.05±5.59

Table 4: Comparison of mean pain scores for biting in study groups (Mean± SD)

Groups	2 h	6 h	Bedtime	Awakening	24 h
Piroxicam	1.93±3.56	3.46±3.35	4.13±3.13	5.20±3.83	5.48±3.8
Ibuprofen	3.40±2.72	6.80±5.59	6.40±4.24	7.50±4.32	8.03±5.25
Placebo	8.11±5.42	14.88±8.11	9.88±5.79	10.72±5.84	11.44±5.80

Table 5: Comparison of mean pain scores for fitting front in study groups (Mean± SD)

Groups	2 h	6 h	Bedtime	Awakening	24 h
Piroxicam	0.44 ± 0.64	0.57 ± 0.55	0.73 ± 0.60	1.12 ± 1.13	0.67 ± 0.55
Ibuprofen	1.04 ± 0.99	1.55 ± 1.30	2.18 ± 1.21	2.15 ± 1.59	2.50 ± 1.21
Placebo	3.88 ± 2.86	4.32 ± 2.65	4.44 ± 3.16	5.15 ± 2.40	5.36 ± 2.53

Table 6: Comparison of mean pain scores for fitting back in study groups (Mean ± SD)

Groups	2 h	6 h	Bedtime	Awakening	24 h
Piroxicam	1.86 ± 3.35	1.27 ± 1.74	3.23 ± 1.99	4.24 ± 2.89	4.41 ± 4.28
Ibuprofen	2.75 ± 2.42	1.76 ± 1.39	5.35 ± 3.74	6.25 ± 3.66	6.45 ± 3.97
Placebo	7.88 ± 5.41	4.58 ± 3.09	9.11 ± 5.83	10.16 ± 5.45	11.0 ± 5.22

time demonstrated that, as a general trend, perceived discomfort decreased as a function of time over the observation period.

Analgesic use

The diary also allowed the subject to note any analgesic used during the study period. No group used self-prescribed analgesics or other OTC drugs.

Differences in Pain Experienced between Experimental Groups in "Pain on chewing"

The results of ANOVA demonstrated significant differences in pain experienced on chewing at all-time intervals after separator placement ($P < .05$); repeated comparisons revealed that at 6 hours, nighttime and 24 hours piroxicam group experienced less ''pain on chewing'' compared with patients in the placebo and ibuprofen group ($P < .05$). At 6 hours the pain experienced by the placebo group was in consensus with the rest two groups.

Differences in Pain Experienced between Experimental Groups in "Pain on Biting"

The results of ANOVA reveal significant differences among the ibuprofen and piroxicam groups and the placebo group at the 2-hour and 6-hour intervals with reference to the placebo group ($P < .05$). Calculations of pain scores at nighttime and 24 hours after the separator placement appointment did not show significant difference between the placebo, ibuprofen, and piroxicam groups ($P < .05$)

Differences in Pain Experienced between Experimental Groups in "Pain on Fitting the Front Teeth"

With respect to pain experienced on fitting front teeth, patients administered piroxicam and ibuprofen showed significantly less pain with regard to this activity within the placebo group at 2-hour, 6-hour and nighttime intervals ($P < 0.05$). However, at the 24-hour time interval, patients in the piroxicam group reported significantly less pain than did patients in the ibuprofen group ($P < 0.05$)

Differences in Pain Experienced between Experimental Groups in "Pain on Fitting the Back Teeth"

On measuring the differences in pain experienced on fitting the back teeth at the 2-hour and 6-hour intervals, patients on the placebo reported higher pain scores than did patients on ibuprofen and piroxicam. However, at 6 hours interval, placebo also showed lower pain scores. At all times the

patients in the placebo group showed the highest VAS scores, while patients on piroxicam showed the lowest VAS scores.

Discussion

Pain relief in dentistry has been fairly well studied in the literature but the management of pain associated with orthodontic treatment is less well known. As clinicians we are often asked whether it will be necessary for the patients to take analgesics during orthodontic treatment and if so, which is likely to be the most effective. Some studies have shown that pretreatment doses of NSAIDs may help to reduce the amount of pain experienced immediately after treatment.[10-13] This study was done with the aim to compare the efficacy of two analgesics, Piroxicam and Ibuprofen in their standard doses in the management of orthodontic pain as a preemptive analgesic one hour before the procedure.

Piroxicam[14] was the analgesic chosen for this study because it has been in use for a long time and its dosage is very convenient. It only needs to be used once a day because of its long elimination half-life with good results in controlling acute pain of mild or moderate intensity, such as the pain triggered by orthodontic activation, without presenting any significant adverse effects. Although single preoperative doses of 20 mg of piroxicam and 400 mg of ibuprofen were similar in terms of onset of action, piroxicam provided pain relief for a longer duration, until the 24 hours; this allows for a single preoperative dose, without the need for an additional postoperative dose. Our study subjects did not have the need to use the rescue medication as the pain caused by separator placement was not of great intensity.

This study analyzed perceived discomfort after initial placement of separators and measured the pain perceived using 10 cm Visual Analogue Scale over a period of 2 hours, 6 hours, bedtime, awakening and at 24 hours. Discomfort was measured using a VAS, which is one of the most commonly used tools in the measurement of perceived discomfort during orthodontic treatment. The inclusion criteria ensured that the type of orthodontic treatment was approximately the same for all subjects in both groups.

The findings seem to indicate that, in general, regardless of the type of medication used, pain is higher during the first two hours and increases with time and peaks at 24 hours. These results are consistent with those of several investigations that evaluated pain associated with orthodontic treatment.[15] There was 100% return rate of the diaries issued, which was almost certainly due to them being provided at the very start of treatment when subject compliance is likely to be at a premium. However, in spite of randomization, the gender distribution was different, with twice as many females in the study groups.

It is common for patients to experience discomfort on placement of separators during fixed orthodontic appliances. In our study, there were no significant difference in the levels of expected pain for males and females with regard to both the VAS and analgesia logbook. This is in agreement with previous studies, which have shown that gender does not affect perceived pain during orthodontic treatment.[16-18] Gender discrimination was therefore excluded and both males and females were evaluated together for the rest of the data.

The results of this investigation reveal that patients who had been administered 20 mg of piroxicam 1 hour preoperatively exhibited significantly lower pain scores than did patient in the other groups until 24 hours after separator placement. This finding could be attributed to the absorption of the NSAIDs and the high bioavailability of the drug, which blocks the synthesis of prostaglandins and consequently decreases the inflammatory response.

Our study revealed that in comparison with patients in the placebo group, the patients on preoperative courses of ibuprofen and piroxicam experienced lower pain levels at all-time intervals; however, the measurements were statistically significant for the piroxicam group at all-time intervals and in all functional activity. Moreover, the placebo effect cannot be neglected. Analgesia induced by suggestion is a known phenomenon that occurs through patients expectations when taking a tablet that they believe is an analgesic.

Previous studies on the preoperative use of analgesics in orthodontics have investigated the use of ibuprofen and naproxen sodium. Law *et al*.[15] in their study observed that preemptive ibuprofen significantly decreased pain upon chewing at 2 hours, compared with postoperative ibuprofen or placebo. Polat *et al*.[19] found that naproxen sodium significantly decreased the perceived pain level compared to ibuprofen. Our study found that piroxicam exhibited a superior analgesic effect compared to ibuprofen and the placebo.

Conclusions

1. There is no difference in perceived discomfort experienced by subjects during initial separator placement among the three groups
2. Age and gender has no effect on perceived discomfort experienced by subjects undergoing fixed appliance orthodontic treatment.

3. Peak orthodontic perceived discomfort occurs between 2 and 24 hours following separator placement and hence preemptive analgesia seems better than postoperative analgesia.
4. Piroxicam 20 mg has an edge over Ibuprofen 400 mg as an analgesic in terms of longer duration of action and patient compliance.

References

1. Ngan P, Wilson S, Shanfeld J, Amini H. The effect of ibuprofen on the level of discomfort in patients undergoing orthodontic treatment. Am J Orthod Dentofacial Orthop 1994;106:88-95.
2. Lew KK. Attitudes and perceptions of adults towards orthodontic treatment in an Asian community. Community Dent Oral Epidemiol 1993;21:31-5.
3. Oliver RG, Knapman TM. Attitudes to orthodontic treatment. Br J Orthod 1985;12:179-88.
4. Jones ML, Chan C. Pain in the early stages of orthodontic treatment. J Clin Orthod 1992;26:311-3.
5. Ransjö M, Marklund M, Persson M, Lerner UH. Synergistic interactions of bradykinin, thrombin, interleukin 1 and tumor necrosis factor on prostanoid biosynthesis in human periodontal-ligament cells. Arch Oral Biol 1998;43:253-60.
6. Kanzaki H, Chiba M, Shimizu Y, Mitani H. Periodontal ligament cells under mechanical stress induces osteoclastogenesis by receptor activator of nuclear factor kappa β ligand up- regulation via prostaglandin E 2 synthesis. J Bone Miner Res 1998;17:210-20.
7. Alhashimi N, Frithiof L, Brudvik P, Bakhiet M. Orthodontic tooth movement and *de novo* synthesis of proinflammatory cytokines. Am J Orthod Dentofacial Orthop 2001;119:307-12.
8. Mehlisch DR. The efficacy of combination analgesic therapy in relieving dental pain. J Am Dent Assoc 2002;133:861-71.
9. Jackson DL, Moore PA, Hargreaves KM. Preoperative nonsteroidal anti-inflammatory medication for the prevention of postoperative dental pain. J Am Dent Assoc 1989;119:641-7.
10. Dionne RA, Cooper S. Evaluation of preoperative ibuprofen for postoperative pain after removal of third molars. Oral Surg Oral Med Oral Pathol 1978;45:851-6.
11. Dionne RA, Campbell RA, Cooper SA, Hall DL, Buckingham B. Suppression of postoperative pain by preoperative administration of ibuprofen in comparison to placebo, acetaminophen, and acetaminophen plus codeine. J Clin Pharmacol 1983;23:37-43.
12. Furst DE, Munster T. Nonsteroidal anti-inflammatory drugs, disease modifying anti rheumatic drugs, non-opioid analgesics and drugs used in gout. In: Katzung BG, editor. Basic and Clinical Pharmacology, 8th ed. New York, NY: Lange McGraw Hill; 2001. p. 596-624.
13. Wilson S, Ngan P, Kess B. Time course of the discomfort in young patients undergoing orthodontic treatment. Pediatr Dent 1989;11:107-10.
14. Kohli SS, Kohli VS. Effectiveness of piroxicam and ibuprofen premedication on orthodontic patients' pain experiences. Angle Orthod 2011;81:1097-102.
15. Law SL, Southard KS, Law AS, Logan HL, Jakobsen JR. An evaluation of ibuprofen treatment of pain associated with orthodontic separator placement. Am J Orthod Dentofacial Orthop 2000;118:629-35.
16. Ngan P, Kess B, Wilson S. Perception of discomfort by patients undergoing orthodontic treatment. Am J Orthod Dentofacial Orthop 1989;96:47-53.
17. Jones ML. An investigation into the initial discomfort caused by placement of an archwire. Eur J Orthod 1984;6:48-54.
18. Erdinç AM, Dinçer B. Perception of pain during orthodontic treatment with fixed appliances. Eur J Orthod 2004;26:79-85.
19. Polat O, Kararam AI, Durmus E. Effects of preoperative ibuprofen and naproxan sodium on orthodontic pain. Angle Orthod 2005;75:791-6.

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