Original Article

A randomized, single-blind, placebo-controlled trial to evaluate the effectiveness of verbal behavior modification and acetaminophen on orthodontic pain

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ABSTRACT

Objectives: To evaluate the effectiveness of verbal behavior modification, acetaminophen, and the combined effectiveness of verbal behavior modification along with acetaminophen on orthodontic pain.

Materials and Methods: One hundred and forty orthodontic fixed appliance patients were randomly assigned to four groups. Group A was administered acetaminophen, group B was given verbal behavior modification, group C was administered acetaminophen as well as verbal behavior modification, and group D was placebo-controlled. A visual analog scale was used to assess pain intensity after 1 week of separator placement.

Results: Group A had less mean pain intensity when compared to group B at 6 hours ($P < .001$) and at 1 ($P < .001$) and 2 ($P = .002$) days. Group C patients encountered less mean pain intensity when compared to group B patients at 6 hours ($P < .001$) and at 1 ($P < .001$), 2 ($P < .001$), and 4 ($P = .001$) days. There was a statistically significant difference between groups A and C (group C experienced less pain intensity) after 6 hours ($P = .004$) and at day 4 ($P = .009$) after separator placement.

Conclusions: Acetaminophen is the main agent of orthodontic pain reduction after separator placement, with verbal behavior serving as an adjunct to it. (*Angle Orthod.* 2019;89:617–623.)

KEY WORDS: Acetaminophen; Verbal behavior modification; Orthodontic pain

INTRODUCTION

Pain, evoked by noxious stimuli, is often associated with almost all orthodontic procedures, such as separator placement,[1–4] archwire activation,[5–7] and orthopedic appliances.[8,9] Ninety-one percent of orthodontic patients experience pain,[10] of which 39% report pain at each step of treatment.[11] Pain deters many potential patients and is also one of the main reasons for interruption of treatment in a significant number (10%) of orthodontic patients.[12–16] Consequently, orthodontic pain should be well managed.

Nonsteroidal anti-inflammatory drugs (NSAIDS) and acetaminophen are the most commonly used agents for the management of orthodontic pain.[2,17–21] NSAIDS act by inhibiting prostaglandin synthesis[2,17,19] and, thus, have been reported to reduce orthodontic tooth movement.[22–24] In view of the existing literature, acetaminophen[25–27] is a safe choice for relieving orthodontic pain, as it acts by inhibiting cyclooxygenase-3 in the brain and causes only weak inhibition of peripheral prostaglandin synthesis.[28]

Pain is a multidimensional subjective sensory phenomenon that is not only influenced by underlying pathology but also by many other biophysiological and psychosocial factors.[29] A longitudinal study[30] found a strong association between perceived pain and psychological factors. Dental anxiety, with a prevalence ranging from 4% to 20%,[31] lowers the dental pain threshold.[32–34] It has been shown[35,36] that patients who were well informed about the treatment procedure required less pain medication compared to those who were not informed. Thus, psychological management

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in the form of verbal behavior modification (VBM) can be helpful in alleviating orthodontic pain. Only two studies[37,38] have considered using VBM for the management of orthodontic pain. However, the effectiveness of VBM has not been compared with that of acetaminophen. The combined effectiveness of VBM and acetaminophen has not been evaluated after separator placement.[39,40] Therefore, the purpose of this study was to compare the effectiveness of VBM and acetaminophen on orthodontic pain and to evaluate the combined effectiveness of VBM and acetaminophen on orthodontic pain.

MATERIALS AND METHODS

This study was conducted according to the CONSORT 2010 guidelines.[41] Ethical committee approval was obtained from the review board of the Genesis Institute of Dental Sciences (GIDSR), Punjab (India). Consent forms were completed by patients and their parents prior to participation. Fixed orthodontic appliance patients who presented to the GIDSR during the 2015–2016 year with the following inclusion criteria were admitted to the study: patients (1) requiring orthodontic treatment; (2) in the adolescent age group; (3) with an anxiety score of $\leq$8 on general anxiety disorder (GAD-7); (4) no pain-related disease; (5) access to a telephone; (6) no pain before treatment; and (7) fully erupted second molars. Patients who had undergone previous orthodontic treatment and those on analgesics were excluded from the study.

Allocation Concealment and Randomization

Patients were assessed for eligibility, and a random sequence was generated using a computer random number generator. One hundred and forty opaque envelopes (35 for each intervention) were kept inside a bowl. Each patient selected one envelope. Each patient was assigned the intervention based on his envelope. Patients were randomized into four groups: group A: acetaminophen intervention; group B: VBM; group C: acetaminophen intervention and VBM; or group D: placebo-control. GAD-7 was used to ascertain the patients' anxiety levels. Separators were placed mesial and distal to the first molar in all four quadrants. Group A was administered a 500-mg acetaminophen tablet preoperatively and one tablet 6 hours after separator placement. Patients were given an "attention call"[38] at 6 and 24 hours after the treatment. Group B patients were informed preoperatively that separator placement could be associated with discomfort and were further reassured that discomfort would eventually subside. A "structured call"[35] was made at 6 and 24 hours after treatment. Placebo lactose tablets were given preoperatively and 6 hours after treatment. Group C patients were conveyed the same information as that of patients in group B preoperatively. Additionally, acetaminophen was administered 1 hour before and 6 hours after separator placement, with a "structured call" at 6 and 24 hours posttreatment. Group D patients were provided with a lactose tablet preoperatively and 6 hours after treatment along with an "attention call" at 6 and 24 hours after treatment (Figure 1).

VBM, adapted from Touyz[35] and Bartlett et al.,[38] included a "structured call" that was made in a polite manner, during which patients were (1) asked about their general well-being; (2) reminded of the need for a soft diet; (3) reassured that the discomfort they were experiencing was within the normal range of bodily reaction; and (4) encouraged to stay positive for orthodontic treatment. On the other hand, during the "attention call" (adapted from Bartlett et al.)[38] patients were thanked for their participation and reminded to complete questionnaires. Both the "structured calls" and the "attention calls" took less than 3 minutes of time.

The patients were given a booklet with a visual analog scale (VAS), to be filled out at home after 6 hours and after 1, 2, 3, 4, 5, 6, and 7 days and were asked to return the booklet at the next appointment. Further, patients were informed that they would get a telephone call at 6 and 24 hours after treatment.

Blinding

The patients were blinded in the following manner: telephone calls, either "structured" or "attention," were made to all patients, and all patients were administered placebo tablets. However, placebo tablets were different in packaging as well as in taste from the acetaminophen tablets. The outcome assessor was blinded to the treatment allocation.

Outcome Assessment

The primary outcome measurement was assessment of pain intensity measured by 100-mm VAS[28,42] at day 1 of the separator placement. The secondary outcome was pain intensity at 6 hours and at 2, 3, 4, 5, 6, and 7 days. The VAS is widely used for pain measurements and is highly sensitive and reliable.[43] Patients were instructed on how to complete the VAS scale by marking a vertical line on the VAS that best represented their perceived pain at the time of scale completion. Pain measurements were made as the distance from the left end of the line to the vertical line marked by the patient and measured to the nearest millimeter with a stainless-steel ruler.

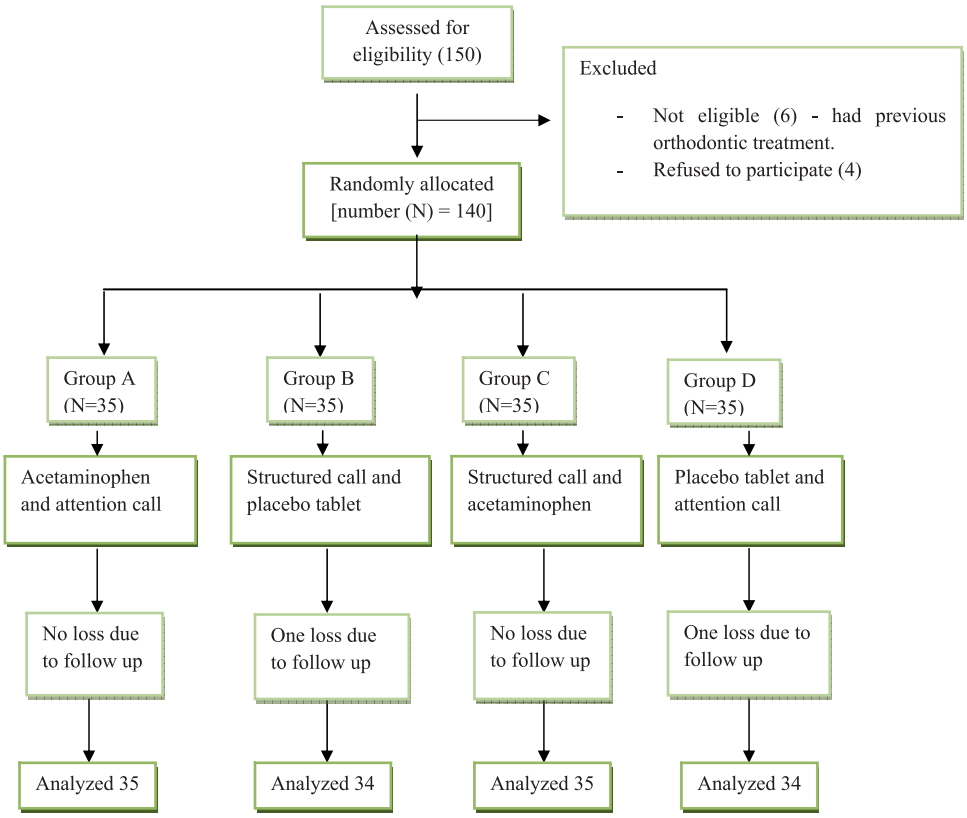

Figure 1. CONSORT flowchart.

Sample Size

Based on the mean difference of 15 mm[35] and standard deviation (19.6, calculated from a previous study),[38] a power analysis determined that in maintaining $\alpha = .05$ and a power of 80%, a sample size of 27 per group was required. To compensate for potential dropouts, 35 patients were enrolled in each group.

Statistical Analysis

Descriptive statistics were determined for experimental and control groups. Normality of the data was tested using Kolmogorov-Smirnov and Shapiro-Wilk tests. Data were not normally distributed; thus, the nonparametric Kruskal-Wallis, analysis of variance, and post hoc Mann-Whitney tests were used for analysis. As multiple analyses were conducted on the same dependent variable, there were greater chances of committing a Type I error, which was prevented using Bonferroni corrections. All analyses were done using SPSS 17.0.

Table 1. Baseline Characteristics of Four Groups[a]

	Group A	Group B	Group C	Group D	*P*-Value
n	35	35	35	35	
Age, y	15.44	15.54	15.44	15.56	.82
Gender, No.[b]					.89
Female	26	24	25	23	
Male	9	11	10	12	
Ethnicity	Asian	Asian	Asian	Asian	

[a] Analysis of variance; n = number of patients.
[b] Chi-square test.

RESULTS

Of 140 patients enrolled in the study, two patients subsequently dropped out, and, thus, 138 patients (response rate of 98.5%) were analyzed. Baseline characteristics of all four groups are described in Table 1. Mean pain intensity for all the groups were at peak on day 1, with a gradual decrease from day 1 to day 7 (Figure 2).

Primary Outcome

After 24 hours of separator placement, groups B and D experienced severe pain intensity (mean 70 ± 13.3 and 74.7 ± 13.5, respectively; $P = .09$). In contrast, groups A and C had moderate pain intensity (mean 56.3 ± 14.4 and 52.9 ± 13.4, respectively; $P = .30$). There was a statistically significant difference between groups A and B ($P < .001$) as well as between groups A and D ($P < .001$). Similarly, there was a statistically significant difference between groups C and B ($P < .001$) and groups C and D ($P < .001$) (Table 2).

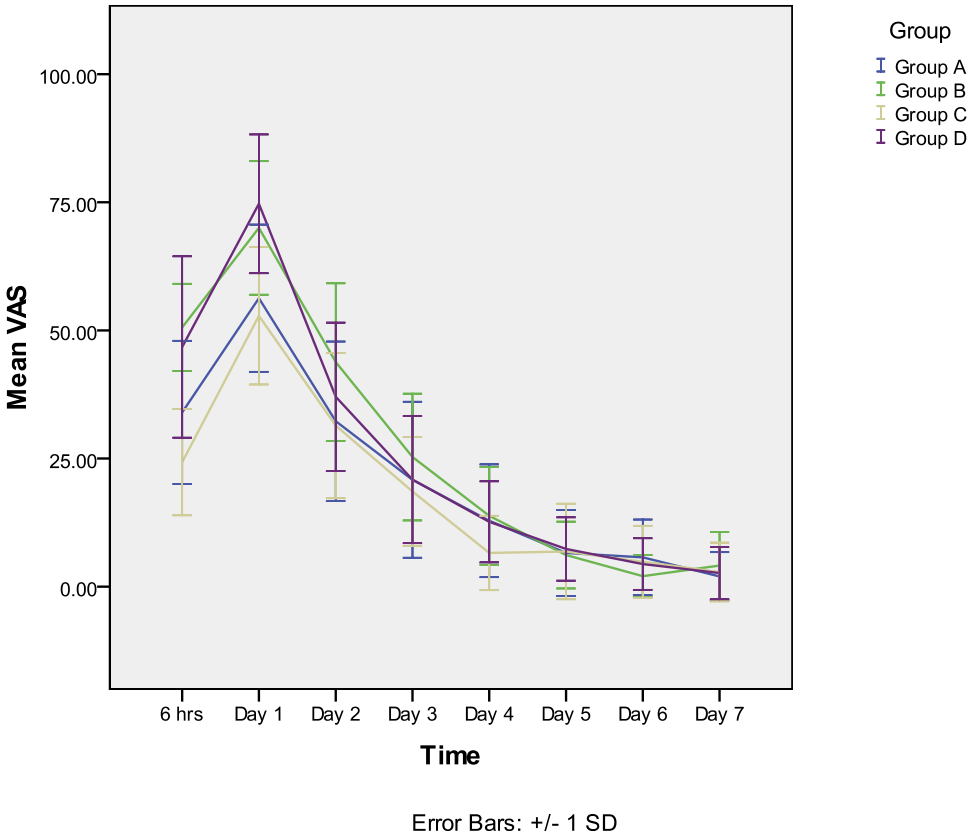

Figure 2. Pain intensity among various groups at 6 hours and at 1, 2, 3, 4, 5, 6, and 7 days after separator placement.

Secondary Outcome

Group C experienced the least amount of pain among all groups during the first week of separator placement. However, there was a statistically significant difference between groups A and C only after 6 hours ($P = .004$) and at day 4 following separator placement ($P = .009$) (Table 3). Group C patients encountered less pain compared to group B patients at 6 hours ($P < .001$) and at 2 ($P < .001$) and 4 days ($P = .001$). Group A had statistically less pain compared to group B at 6 hours ($P < .001$) and at 2 days ($P = .002$). When comparing the VAS scores, there was no statistically significant difference between groups B and group D except at day 6 ($P = .04$).

DISCUSSION

This study demonstrated that psychological treatment was successful solely as an adjunct to acetaminophen in the management of orthodontic pain. Patients who were given combined acetaminophen as well as VBM experienced less mean pain intensity compared to other groups, except for group A. There was a statistically significant difference between groups A and C after 6 hours and at day 4 following separator placement, but a clinically significant difference (10 mm) between the two groups was observed only at 6 hours. Patients who were given VBM alone experienced more mean intense pain compared to patients who were given either acetaminophen alone or combined therapy with psychological management.

Table 2. Primary Outcome—Mean Pain Scores (mm) at 24 Hours After Separator Placement

	Group A	Group B	Group C	Group D
Pain scores	56.3	70.0	52.9	74.7
SD[a]	14.4	13.0	13.4	13.5
95% CI[b]	51.4–61.2	65.5–74.5	48.3–57.5	70.0–79.4
Mean difference in pain scores (*P*-value)	(A–B) 13.7 (<.001**)		(C–A) 3.4 (.301) (C–B) 17.1 (<.001**)	(A–D) 18.4 (<.001**) (B–D) 4.7 (.090) (C–D) 21.8 (<.001**)

[a] SD indicates standard deviation. [b] CI, confidence interval.
** Clinically significant difference = 10 mm.

Table 3. Secondary Outcome—Visual Analog Scale Scores Among Groups A (n = 35), B (n = 34), C (n = 35), and D (n = 34)[a]

Groups	Mean, mm	SD, mm	95% CI
6 h			
A	34	13.97	29.2–38.8
B	50.6	8.51	47.6–53.6
C	24.3	10.37	20.7–27.8
D	46.8	17.70	40.6–52.9
2 d			
A	32.3	15.55	26.9–37.6
B	43.8	15.38	38.5–49.2
C	31.4	14.17	26.6–36.3
D	37.1	14.47	32–42.1
3 d			
A	20.9	15.22	15.6–26.1
B	25.3	12.37	21–29.6
C	18.6	10.61	14.9–22.2
D	20.9	12.40	16.6–25.2
4 d			
A	12.9	11.00	9.1–16.6
B	13.8	9.54	10.5–17.2
C	6.6	7.25	4.1–9.1
D	12.6	7.90	9.9–15.4
5 d			
A	6.6	8.38	3.7–9.5
B	6.2	6.52	3.9–8.5
C	6.9	9.32	3.7–10.1
D	7.4	6.18	5.2–9.5
6 d			
A	5.7	7.39	3.2–8.3
B	2.1	4.10	0.6–3.5
C	4.9	7.02	2.4–7.3
D	4.4	5.04	2.7–6.2
7 d			
A	2	4.73	0.4–3.6
B	4.1	6.57	1.8–6.4
C	2.9	5.72	0.9–4.8
D	2.6	5.11	0.9–4.4

[a] SD indicates standard deviation; CI, confidence interval.

Hence, VBM alone did not demonstrate an effect better than that of the placebo.

These results were similar to those of a previous study[35] that found reduced use of analgesics after periodontal surgery for patients who received a follow-up telephone call for reassurance. It would seem prudent to maintain postoperative communication with patients to benefit the best from psychological support to aid the effect of acetaminophen. With VBM that included reassurance, dilution of apprehension, and an elaborate explanation of the procedure, the patients' ability to cope with pain was increased.

This study agreed with the findings of a previous study[38] that showed that patients given a "structure call" had similar pain intensity to the group given an "attention call." However, in the current study, the impact of a "structured phone call" was less compared to that described in previous studies.[37,38] Patients experienced moderate pain at day 1 after treatment in previous studies.[37,38] Conversely, in this study, the patients in groups B and D had severe pain at day 1. This could be explained by the possibility that (1) patients in previous studies used analgesics that would have reduced pain intensity but, in this study, patients in groups B and D did not report any use of analgesics or (2) previous studies showed an effect of VBM after initial wire placement, while the current study evaluated consequences after separator placement. Because separators are often the first step in orthodontic treatment, anxiety levels could be higher, and, thus, the pain may also be greater.[38] A third possibility is that cultural differences could have resulted in variance. The samples collected in previous studies were from Europe and North America. On the contrary, the current sample included an Asian population.

It is common for orthodontists to simply ask patients to take analgesics as needed, thereby leaving pain management decisions mostly to adolescent patients. There is a need for a pain management protocol, at least for the first day of orthodontic treatment, when patients have maximum pain intensity. Good-quality evidence[25,44] suggested acetaminophen as the treatment of choice for orthodontic pain. Acetaminophen is considered safe at the usual therapeutic doses of 325 to 1000 mg/dose (10–15 mg/kg/dose in children), given every 4 to 6 hours, with a maximum recommended daily dose of 3250 mg.[45] It has been shown[25,46] that if analgesics are given before the procedure, the body absorbs the medication before tissue damage and thereby prevents pain. Therefore, this study suggested the administration of acetaminophen preoperatively and 6 hours after separator placement.

The study results should be considered along with the study limitations. Acetaminophen consumption was assessed based on the patient's self-report. Thus, there were chances of information bias in the study. Different people respond differently to the same procedure under the same circumstances.[39] Thus, to overcome selection bias, a randomized controlled trial was conducted. There was no statistically significant difference seen in age and sex of the patients among the four groups. There were two patient dropouts from groups B and D. The reason given by the patients for dropping out of the study was discomfort from orthodontic treatment. The results also showed that both groups had higher pain intensities compared to the other two groups. Thus, the results could demonstrate selection bias, with an underestimation of results.

CONCLUSIONS

- Acetaminophen is the mainstay of orthodontic pain control and should be administered preoperatively as well as 6 hours after separator placement.

- Psychological management can be used as an adjunct to analgesics for orthodontic patients. Nevertheless, psychological management alone is not effective for management of orthodontic pain after separator placement.

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