


Evaluation of pain experienced by orthodontic patients following elastomeric separator insertion: A cross-sectional study

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Objective: Pain following the insertion of separators and archwires varies with age, sex, race, ethnicity, threshold, and health status. This study aimed to evaluate the characteristics of pain in orthodontic patients after the insertion of elastomeric separators, its effects on daily life, and its association with age and sex in a population not previously studied in this regard. **Methods:** A cross-sectional study of 130 patients undergoing orthodontic treatment included collecting data on demographics, pain experienced following the placement of separators, time of onset, duration, characteristics, change in dietary pattern or chewing side, intake of analgesics, and severity of pain on the Wong Baker's scale. The results are reported as counts and percentages. Associations between sex and age were evaluated using Pearson's chi-square test. **Results:** Among the 130 patients, 56.2% were 9–20 years old, 63.8% experienced pain following the insertion of separators, 22.9% had their first episode of pain at 4 hours, 56.6% experienced intermittent pain, and 37.3% experienced discomfort; 18.1% males and 81.9% females experienced pain following the insertion of separators. Pearson's chi-square test showed a significant association between pain and sex ($P = 0.04$). Most patients (37.3%) reported "hurts little more" for pain intensity on Wong Baker's scale and 21.7% reported all four quadrants as sites of pain. **Conclusions:** The pain experienced after separator insertion was associated with sex and age. Females experienced more pain than males and patients between the age range of 21 and 36 years suffered more pain during mastication than between 9 and 20 years old.

Key words: Pain, Elastomeric separators, Age, Sex

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INTRODUCTION

The International Association for the Study of Pain currently defines pain as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage”.¹ People presenting to the outpatient department of orthodontics anticipate pain even before beginning treatment, and studies suggest that their anticipated pain is higher than the actual pain experienced.² Pain is a subjective experience that is commonly experienced after certain orthodontic procedures such as separator insertion, arch wire placement and activation, and placement of springs and elastomeric chains. Pain is one of the primary reasons for treatment discontinuation. The pain experienced is due to constant pressure, ischemia, inflammation, and edema of the periodontal ligaments of the teeth.^{3,4} Pain varies with age, sex, race,

emotional state, prior experience, medical health, and cultural background.⁵⁻⁷ Previous studies have reported limited data on pain cycles/patterns experienced after the insertion of elastomeric separators. Separators are inserted during orthodontic treatment to open interdental contacts and facilitate the placement of molar bands that anchor the arch wires. The most commonly used separators are elastomeric and brass separators. Some researchers have reported that at least 42% of patients experience some degree of pain during orthodontic treatment.⁸ An unpleasant experience of pain during procedures can adversely affect the patient's quality of life, altering their dietary habits and chewing patterns, leading to increased intake of analgesics, and eventually affecting the patient's compliance with treatment.^{9,10} Its pathophysiology involves the rapid release of biochemical mediators into the gingival crevicular fluid. The same report attributed an increase in prostaglandin E2

Table 1. Descriptive statistics on separator experience, pain, and its quality

Variable	Total (n = 130)	Male (n = 31)	Female (n = 99)	P value
Age group (yr)				0.86
9-20	73 (56.2)	17 (54.8)	56 (56.6)	
21-36	57 (43.8)	14 (45.2)	43 (43.4)	
Did you experience pain following the insertion of separator/s				0.04*
Yes	83 (63.8)	15 (48.4)	68 (68.7)	
No	47 (36.2)	16 (51.6)	31 (31.3)	
Time of recording of pain (after separator placement)				0.99
4 hr	19 (22.9)	3 (20.0)	15 (22.1)	
8 hr	19 (22.9)	4 (26.7)	14 (20.1)	
12 hr	7 (8.4)	1 (6.7)	5 (7.4)	
Day 2	14 (16.9)	2 (13.3)	11 (16.2)	
Day 3	8 (9.6)	2 (13.3)	8 (11.7)	
Day 4	3 (3.6)	1 (6.7)	3 (4.4)	
Day 5	3 (3.6)	0 (0)	3 (4.4)	
Day 6	2 (2.4)	0 (0)	2 (2.9)	
Day 7	8 (9.6)	2 (13.3)	7 (10.3)	
What type of pain did you experience?				0.78
Continuous	36 (43.4)	6 (40.0)	31 (45.6)	
Intermittent	47 (56.6)	9 (60.0)	37 (54.4)	
Can you describe the quality of pain?				0.87
Discomfort	31 (37.3)	6 (40.0)	25 (36.8)	
Soreness	20 (24.1)	3 (20.0)	18 (26.5)	
Tenderness	14 (16.9)	2 (13.3)	12 (17.6)	
Tightness	17 (20.1)	4 (26.7)	13 (19.1)	

Values are presented as number (%).

* $P < 0.05$ was considered statistically significant using Pearson chi-square test.

levels to the initial intensity of pain, and an increase in interleukin-1 to pain intensity observed on day one.¹¹ A number of studies have compared the pain experienced by elastomeric separators with brass separators and the efficiency of different methods employed for pain relief, such as chewing sugarless gum, biting wafers, vibratory stimulation, and analgesics.¹²⁻¹⁵ Only one study, carried out in the Saudi population, assessed the pain levels experienced after the insertion of elastomeric separators, considering the time interval from separator placement to the first episode of pain, its characteristics, and its effects on the patient's chewing pattern and use of analgesics.¹⁶ None of the previous studies reported pain after elastomeric separator insertion in South Asian populations. Therefore, our study aimed to examine pain perception and its characteristics and effects on patients' chewing patterns, dietary habits, and use of

analgesics following separator insertion in a South Asian population undergoing orthodontic treatment with fixed appliances. This is necessary as the perception and experience of pain vary according to race and cultural background. This will help the practicing orthodontists of the region to manage the patients, accordingly, provide proper counseling and instruction to the patients for a less painful experience, and gain the patients' trust and compliance with treatment and the treating clinician.

MATERIALS AND METHODS

This study was conducted at the Orthodontics Department of Jinnah Medical and Dental College, Karachi, Pakistan. This study was reviewed and approved by the ethical review committee of the same dental college (protocol 1 #:000118/21). Verbal consent was obtained

Table 2. Effect of separator pain on daily life activities

Variable	Total (n = 83)	Male (n = 15)	Female (n = 68)	P value
Did you experience pain at night?				0.99
Yes	40 (48.2)	7 (46.7)	33 (48.5)	
No	43 (51.8)	8 (53.3)	35 (51.4)	
Did you experience pain during chewing?				0.44
Yes	69 (83.1)	14 (93.3)	55 (80.9)	
No	14 (16.9)	1 (6.7)	13 (19.1)	
Did you modify your dietary pattern due to discomfort from the separators?				0.99
Yes	51 (61.4)	9 (60.0)	42 (61.8)	
No	32 (38.6)	6 (40.0)	26 (38.2)	
Did you change your chewing side?				0.58
Yes	44 (53.0)	9 (60.0)	35 (51.4)	
No	39 (47.0)	6 (40.0)	33 (48.5)	
Did you take any medication for pain relief?				0.99
Yes	45 (54.2)	8 (53.3)	37 (54.4)	
No	38 (45.8)	7 (46.7)	31 (45.6)	
If yes, when was it taken?				0.97
4 hr	17 (20.5)	3 (20.0)	14 (20.6)	
8 hr	9 (10.8)	2 (13.3)	7 (10.3)	
12 hr	6 (7.2)	1 (6.7)	5 (7.4)	
Day 2	7 (8.4)	1 (6.7)	6 (8.8)	
Day 3	2 (2.4)	0 (0)	2 (2.9)	
Day 4	3 (3.6)	1 (6.7)	2 (2.9)	
Day 5	0 (0)	0 (0)	0 (0)	
Day 6	0 (0)	0 (0)	0 (0)	
Day 7	1 (1.2)	0 (0)	1 (1.5)	

Values are presented as number (%).

$P < 0.05$ was considered statistically significant using Pearson chi-square test.

from all patients, and their confidentiality was assured. The treating dentists explained the questionnaires to the patients in comprehensible language. Questionnaires were administered to 130 patients in whom elastomeric separators had to be inserted. The inclusion criteria were as follows: patients consenting to orthodontic treatment with fixed appliances, patients in whom insertion of separators was indicated to facilitate placement of stainless bands on the mesial and distal sides of the molars in all four quadrants, sound molars with no associated pathology or restorations, and good gingival health. The exclusion criteria were as follows: patients who had prior experience of separator placement and fixed braces, patients who did not voluntarily consent to participate in the study, poor oral hygiene and periodontal health, history of dental pain or dentin hypersensitivity, and patients who had accidentally lost the separator before the fourth day of insertion. The questionnaire was admin-

istered to the patients after explaining its components in detail, and instructions were provided to record the characteristics of the pain immediately after it was experienced. It comprised questions related to demographic data, pain experienced following the placement of separators, time of its perception, duration, characteristics, the need to alter dietary patterns or chewing sides, and intake of analgesics. This was followed by different emoticons depicting the severity of pain to make it simpler for the patient to explain his or her experience; this was adapted from Wong Baker's faces pain rating scale.¹⁷

Statistical analysis

Data were stored and analyzed using IBM SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Counts with percentages were reported on pain experienced after insertion of elastomeric separators. Data on the site, qual-

Table 3. Outcomes of Wong Baker's scale and sites of pain

Variable	Total (n = 83)	Male (n = 15)	Female (n = 68)	P value
Which of the options below most appropriately describes your pain experience?				0.66
No hurt	0 (0)	0 (0)	0 (0)	
Hurts little bit	17 (20.1)	3 (20.0)	14 (20.6)	
Hurts little more	31 (37.3)	5 (33.3)	26 (38.2)	
Hurts even more	18 (21.7)	3 (20.0)	15 (22.1)	
Hurts whole lot	13 (15.7)	4 (26.7)	9 (13.2)	
Hurts worst	4 (4.8)	0 (0)	4 (5.9)	
Tick the site/sites of pain experience				0.33
UR	3 (3.6)	0 (0)	3 (4.4)	
UL	5 (6.0)	1 (6.7)	4 (5.9)	
LR	4 (4.8)	2 (13.3)	1 (1.5)	
LL	4 (4.8)	2 (13.3)	1 (1.5)	
LR LL	16 (19.3)	3 (20.0)	14 (20.6)	
UR UL	12 (14.5)	2 (13.3)	10 (14.7)	
UL LL	3 (3.6)	1 (6.7)	2 (2.9)	
UL LR	3 (3.6)	1 (6.7)	2 (2.9)	
UR LL	5 (6.0)	0 (0)	4 (5.9)	
UR LR	3 (3.6)	0 (0)	3 (4.4)	
UR UL LR	1 (1.2)	0 (0)	1 (1.5)	
UR UL LL	2 (2.4)	0 (0)	3 (4.4)	
UR LR LL	2 (2.4)	1 (6.7)	3 (4.4)	
UL LR LL	2 (2.4)	1 (6.7)	2 (2.9)	
UR UL LR LL	18 (21.7)	1 (6.7)	15 (22.1)	

Values are presented as number (%).

UR, upper right; UL, upper left; LR, lower right; LL, lower left.

$P < 0.05$ was considered statistically significant using Pearson chi-square test.

ity, duration, intensity, effect of separator pain on daily life activities, and outcomes on the Wong Baker's scale were also tested for association with sex and age group using Pearson chi-square test, and *P* values < 0.05 were considered statistically significant.

RESULTS

Table 1 reports the descriptive parameters of the separator experience, pain, and quality for 130 patients. Of these patients, 56.2% were aged 9–20 years, 63.8% experienced pain following the insertion of separators, with the first episode of pain frequently at 4 hours, intermittent in duration, and discomfort in character.

Pearson's chi-square test showed a significant association between pain and sex (*P* = 0.04). More females than males experienced pain, but both had the first episode of pain at 4 hours, intermittent in duration, and

discomfort in character.

Table 2 shows that, among 130 patients, 48.2% experienced nocturnal pain, 83.1% had pain during chewing, 61.4% modified their dietary pattern, 53.0% changed their chewing side, 54.2% took analgesics, and 20.5% took medication 4 hours after placement of separators. Pearson's chi-square test did not give any significant association of these variables with sex (*P* > 0.05).

Table 3 shows that, among 130 patients, 37.3% reported "hurts little more" for pain description using Wong Baker's scale and 21.7% reported all four quadrants as sites of pain. There was no significant association of Wong Baker's outcome and reported sites of pain with sex (*P* > 0.05).

Table 4 shows that, among 56.2% patients aged 9–20 years, 76.7% were females and 64.4% of the respondents in this group experienced pain following the insertion of separators with the first episode at 8 hours,

Table 4. Association of separator experience, pain, and its quality with age group

Variable	9–20-year-old (n = 73)	21–36-year-old (n = 57)	<i>P</i> value
Sex			0.99
Male	17 (23.3)	14 (24.6)	
Female	56 (76.7)	43 (75.4)	
Did you experience pain following the insertion of separator/s?			0.99
Yes	47 (64.4)	36 (63.2)	
No	26 (35.6)	21 (36.8)	
Time of recording of pain (after separator placement):			0.08
4 hr	15 (31.9)	14 (38.9)	
8 hr	19 (40.4)	10 (27.8)	
12 hr	8 (17.0)	3 (8.3)	
Day 2	13 (27.7)	9 (25.0)	
Day 3	4 (8.5)	9 (25.0)	
Day 4	1 (2.1)	3 (8.3)	
Day 5	1 (2.1)	3 (8.3)	
Day 6	0 (0)	2 (5.6)	
Day 7	12 (25.5)	4 (11.1)	
What type of pain did you experience?			0.83
Continuous	17 (36.1)	19 (52.8)	
Intermittent	24 (51.1)	23 (63.9)	
Can you describe the quality of your soreness?			0.39
Discomfort	21 (44.7)	11 (30.6)	
Soreness	11 (23.4)	10 (27.8)	
Tenderness	5 (10.6)	8 (22.2)	
Tightness	10 (21.3)	7 (19.4)	

Values are presented as number (%).

P < 0.05 was considered statistically significant using Pearson chi-square test.

intermittent in duration, and discomfort in character. Meanwhile, among 43.8% patients aged 21–36 years, 75.4% were females and 63.2% experienced pain following the insertion of separators, with the first episode at 4 hours, intermittent in duration, and discomfort in character. Pearson's chi-square test did not give a significant association of these parameters with age group ($P > 0.05$).

Table 5 shows that, among 9–20-year-old patients, 46.8% experienced nocturnal pain, 76.6% experienced pain during chewing, modified their dietary pattern, changed chewing side, took analgesics, and reported to have taken medication at 4 hours. These findings were more common in older (21–36-year-old) patients than in 9–20-year-old patients. Pearson's chi-square test did not give a significant association of these parameters with age group ($P > 0.05$).

Table 6 shows that, among 9–20-year-old patients, 37.0% reported “hurts little more” for pain description using Wong Baker's scale and 21.1% reported pain in all four quadrants. There was no significant association of Wong Baker's outcome and reported sites of pain with age group ($P > 0.05$).

DISCUSSION

This study assessed the pain experienced after the insertion of elastomeric separators in patients who consented to undergo orthodontic treatment with fixed appliances and participate in this research. Most previous studies have focused on the experience of pain, its duration, relation with age and sex, comparison of medications to relieve pain caused by separators, comparison of different kinds of separators in relation to the experience

Table 5. Effect of separator pain on daily life activities with respect to age group

Variable	9–20 yr with pain (n = 47)	21–36 yr with pain (n = 36)	P value
Did you experience pain at night?			0.99
Yes	22 (46.8)	16 (44.4)	
No	25 (53.2)	20 (55.6)	
Did you experience pain during chewing?			0.23
Yes	36 (76.6)	32 (88.9)	
No	11 (23.4)	4 (11.1)	
Did you modify your dietary pattern due to discomfort from the separators?			0.99
Yes	28 (59.6)	22 (61.1)	
No	19 (40.4)	14 (38.9)	
Did you change your chewing side?			0.66
Yes	24 (51.2)	21 (58.3)	
No	23 (48.9)	15 (41.7)	
Did you take any medication for pain relief?			0.34
Yes	27 (57.4)	17 (47.2)	
No	20 (42.6)	19 (52.8)	
If yes, when was it taken?			0.44
4 hr	11 (23.4)	6 (16.7)	
8 hr	5 (10.6)	3 (8.3)	
12 hr	5 (10.6)	1 (2.8)	
Day 2	3 (6.4)	4 (11.1)	
Day 3	0 (0)	2 (5.6)	
Day 4	1 (2.1)	1 (2.8)	
Day 5	1 (2.1)	0 (0)	
Day 6	0 (0)	0 (0)	
Day 7	1 (2.1)	0 (0)	

Values are presented as number (%).

* $P < 0.05$ was considered statistically significant using Pearson chi-square test.

Table 6. Outcomes of Wong Baker's scale and sites of pain with respect to age group

Variable	9-20 yr (n = 47)	21-36 yr (n = 36)	P value
Which of the options below most appropriately describes your pain experience?			0.97
No hurt	0 (0)	0 (0)	
Hurts little bit	9 (19.1)	9 (25)	
Hurts little more	18 (38.3)	14 (38.9)	
Hurts even more	11 (23.4)	7 (19.4)	
Hurts whole lot	7 (14.9)	5 (13.9)	
Hurts worst	2 (4.3)	2 (5.6)	
Tick the site/sites of pain experience			0.72
UR	1 (2.1)	1 (2.8)	
UL	4 (8.5)	1 (2.8)	
LR	1 (2.1)	2 (5.6)	
LL	1 (2.1)	2 (5.6)	
LR LL	10 (21.3)	6 (16.7)	
UR UL	5 (10.6)	7 (19.4)	
UL LL	1 (2.1)	2 (5.6)	
UL LR	3 (6.4)	1 (2.8)	
UR LL	3 (6.4)	1 (2.8)	
UR LR	1 (2.1)	2 (5.6)	
UR UL LR	1 (2.1)	0 (0)	
UR UL LL	2 (4.3)	0 (0)	
UR LR LL	2 (4.3)	0 (0)	
UL LR LL	2 (4.3)	1 (2.8)	
UR UL LR LL	10 (21.3)	10 (27.8)	

Values are presented as number (%).

UR, upper right; UL, upper left; LR, lower right; LL, lower left.

$P < 0.05$ was considered statistically significant using Pearson chi-square test.

of pain, and comparison of the effectiveness of different modalities to relieve pain, such as wafer chewing, chewing gums, lasers, and vibratory stimulation.^{12,13,18,19} This study reports the time of the first episode of pain experienced following the insertion of separators, its site/s, quality, effects on routine life, intensity on the Wong Baker's scale, measurements taken by patients in terms of intake of analgesics to cope with it, and the time of experiencing it. Furthermore, this study relates patients' age and sex to the above-mentioned overall experience of pain in the South Asian population.

Pain is caused by inflammation and ischemia in the periodontal ligament spaces of teeth that are displaced by separators to create spaces for orthodontic bands interdentally.^{20,21} In our study sample, among the 130 patients, most were between 9 and 20 years old (56.2%), and a majority of them experienced pain post separator insertion (63.8%). The first episode of pain was felt

at 4 and 8 hours by most patients, and 22.7% reported both. This finding corroborated with the results of previous studies where pain started 4 hours post-insertion of separators in the majority of patients.^{16,18} This was in line with a study in which 94.7% of patients reported pain 4 hours after separator placement.¹⁶

Intermittent pain was felt by most patients in this study (56.6%), and discomfort was mostly reported (37.3%). This is in contrast to the findings of a previous study in which patients reported continuous pain until the third day, when it became intermittent.^{16,22} Discomfort has been reported by Ngan et al.²³ too. Pain sensations that initiated at 4 hours, peaked at 24 hours, and subsided over a period of 7 days have also been reported.^{8,18,23,24} A significant association of pain experience was found with the sex of patients, as more females than males in our sample experienced pain, mostly reporting intermittent pain and discomfort,

which was the same for males. This was clearly in line with the existing literature, in which females complained of more pain compared to males.^{5,6,24} However, no sex differences have been reported in this regard.^{7,22,25} Most patients in this study did not experience nocturnal pain, except for 46.9%. Females suffered more than males did. This could not be compared, as no other study, to our knowledge, has been conducted to date.

In this study, 83.1% of the patients experienced pain during mastication, leading to a change in the chewing side by 53.0%. Among these patients, 61.4% modified their dietary habits. This is supported by the literature, in which participants had similar experiences.^{10,16,19,26} Of the patients, 54.6% reported taking analgesics for pain relief, and 38% took them 4 hours after insertion of separators, coinciding with the first episode of pain. This is similar to previous studies' findings in which patients resorted to medication for pain relief.^{9,10,19}

Patients' pain intensity was assessed using the Wong Baker's scale. This was shown in the form of emoticons with different facial expressions depicting the intensity of the pain experienced. In this study, 38.3% of patients marked "hurts little more" which corresponds to the pain score of 4. This pain score was predominant in both sexes, with no statistically significant differences. Nevertheless, pain was experienced in all four quadrants of the oral cavity. Previously, visual analog scale was used in other studies to assess the severity of pain, and varied responses were received, with relatively higher pain levels at all points in time.^{22,27} The disparity in the sites experiencing pain could not be compared, as no literature to date has reported the latter.

Our patient sample had a wide age range, and when post-separator insertion experience was compared, the younger group (9–20 years) differed from the older (21–36 years). The younger group had more nocturnal pain and required more analgesics at 4 hours. The older group experienced more pain during mastication and modified their diet and chewing sides.

Understanding patients' experiences, the most common of which is pain during orthodontic treatment, is important for orthodontists or clinicians for patient selection, information, education, and counseling beforehand. In addition to advising patients, effective pain control measures at appropriate times are vital for a pain-free experience and to gain the trust of the patient, as pain can deter them from seeking treatment.^{3,4} Because this experience varies with age, sex, ethnicity, psychological status, physical and mental health, prior experiences, and pain thresholds, knowledge of different races and ethnicities is integral.

The Wong Baker's scale was used in this study as it is easy for people to understand, especially children, and where a language barrier exists.

This study has some limitations, including a smaller sample size and female predominance in the sample. The results could not be generalized as the study was conducted in a single region. Lastly, we used the Wong Baker's scale, which cannot record precise pain levels.

CONCLUSIONS

The pain experienced after the insertion of separators was associated with sex and age. Females experienced more pain than males and 21–36-year-old patients experienced more pain during mastication than 9–20-year-old did.

AUTHOR CONTRIBUTIONS

Conceptualization: HS. Data curation: HS, HP, SM, WSZ. Formal analysis: WSZ. Investigation: HS. Methodology: HS, HP, SM, WSZ. Validation: SM. Writing—original draft: HS. Writing—review & editing: HP, SM, WSZ.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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