Content available at: https://www.ipinnovative.com/open-access-journals

Journal of Contemporary Orthodontics

Journal homepage: https://www.jco-ios.org/

Original Research Article

A comparative evaluation of different pain control methods during debonding of orthodontic brackets: An in vivo study

Vaibhav Kumar Choudhary[1]*, Madhur Navlani[2], P.G. Makhija[3], Amit Bhardwaj[3], Rakesh Thukral[2]

[1]Dept. of Orthodontics, Triveni Institute of Dental Sciences, Hospital & Research Centre, Bodri, Chhattisgarh, India.
[2]Dept. of Orthodontics, College of Dental Science & Hospital, Madhya Pradesh, India.
[3]Dept. of Orthodontics, Modern Dental College and Research Centre, Indore, Madhya Pradesh, India.

Abstract

Aim: The objective was to assess the influence of various pain control methods on patients' perception of pain during debonding.
Settings and Design: A cross-sectional comparative study was carried out on 60 subjects (n = 60), comprising 46 females and 14 males, from our institution who were in the finishing stage and ready to be debonded. The participants were randomly divided into three groups: Finger Pressure (FP), Elastomeric Wafer (EW) and Stress Relief (SR).
Materials and Methods: For every tooth, pain perception was documented with the help of a 100 mm Visual Analog Scale (VAS). Pain Catastrophizing Scale (PCS) was further employed to assess the general cognitive-emotional attitude of patients toward pain. To maintain uniformity, a curved debonding plier was used for all procedures with the same operator and armamentarium across subjects.
Statistical Analysis Used: Inter and intra-group differences in pain scores were analyzed using the Kruskal–Wallis test. To evaluate correlations between VAS scores and the various pain point control methods, linear regression analysis was used.
Results: Inter-group analysis showed that FP group reported the lowest total pain scores (P = 0.043). Intra-group analysis indicated that significantly higher pain scores were observed in the mandibular anterior region across all three groups (P = 0.02). A moderate correlation was identified between pain control approaches and VAS scores.
Conclusions: The FP technique proved to be an effective strategy for reducing pain during debonding. Furthermore, anteriors when compared to posteriors in both arches were found to be more pain sensitive

Keywords: Finger Pressure, Elastomeric Wafer, Stress Relief, Pain control, Orthodontic debonding

Received: 28-08-2025; **Accepted:** 08-09-2025; **Available Online**: 14-10-2025

1. Introduction

Despite advances in modern dentistry, pain and discomfort remain among the most frequent concerns expressed by patients following different dental procedures, including orthodontic therapy.[1,2] Pain, being inherently subjective, varies across patients and may be encountered in both the active orthodontic treatment phase and at the time of fixed appliance debonding.[1,3]

Survey data from 2000 revealed that pain was perceived as the most disliked element of orthodontic care and the fourth most common source of fear or anxiety before treatment initiation.[4,5] Studies have reported that nearly 70–95% of orthodontic patients experience some degree of pain throughout treatment, and in certain cases, this has even led to premature discontinuation of therapy.[6-11]

Patients commonly report discomfort after procedures such as separator placement, insertion of orthodontic implants, archwire engagement and adjustments, banding, elastic wear, and bracket removal. These sensations are frequently described as pressure, tension, tooth soreness, or generalized pain.[6] The underlying mechanisms may involve alterations in periodontal ligament blood flow[10,1314,15] and are thought to be associated with mediators such as

*Corresponding author: Vaibhav Kumar Choudhary
Email: vaibhav.04july@gmail.com

https://doi.org/10.18231/j.jco.13092.1758355907

prostaglandins, neuropeptides (e.g., substance P), cytokines, and other inflammatory agents.[10,13-15]

The earliest investigation of pain during debonding was conducted by Williams and Bishara[3] who demonstrated that intrusive forces were best tolerated by patients. Normando et al.[16] later evaluated discomfort associated with different debonding instruments and found that lift-off pliers resulted in nearly half the pain levels compared to wire-cutting pliers. Mangnall et al.[17] studied the role of soft acrylic bite wafers and observed that pain perception was lower in posterior regions than in anterior segments.

The findings of these earlier studies have highlighted the need to explore strategies for pain control during debonding. as well as the influence of tooth location and individual patient differences on discomfort. Hence, the present study aimed to evaluate the influence of different pain control strategies on patients' perception of pain associated with orthodontic bracket removal. The objectives were to evaluate the relative efficacy of three distinct debonding pain-control techniques and to analyze additional determinants of pain perception such as personality traits, tooth location, and sex.

2. Materials and Methods

Following approval from the institutional ethics committee, a total of 60 participants (n = 60), consisting 14 males and 46 females, selected from the outpatient department and randomly allocated to three study groups: Finger Pressure (FP), Elastomeric Wafer (EW), and Stress Relief (SR). **Table 2.**

FP group: During bracket removal, finger pressure was applied by the operator's thumb from the incisal or occlusal surface toward the gingival margin. A cotton roll was placed under the thumb to limit the impact of occlusal morphology of occlusal morphology (**Figure 2**).

1. **EW group:** An arch-shaped bite raiser (wafer bite)[18] fabricated using heavy-body silicone impression material, approximately 5–6 mm in thickness (**Figure 3**), served as the device. Patients were directed to bite firmly on this wafer during bracket removal (**Figure 4**). Prior to each use, the wafer was disinfected by immersion in 2% activated glutaraldehyde for 10 minutes.
2. **SR group:** Conventional debonding was performed with patients instructed to keep their mouths open and avoid occlusion during the procedure (**Figure 5**). Patients were reassured that debonding would not result in significant pain or damage to alleviate anxiety. This approach incorporated principles of cognitive behavioral management, focusing on modifying pain-related thought processes to reduce discomfort.[19]

3.1. Data collection procedure

Participants who consented to the study were provided with a Visual Analog Scale (VAS) questionnaire (**Figure 6**) to record pain intensity. The VAS consisted of a 100 mm line (scale), where 0 indicated "no pain" and 100 represented "worst imaginable pain," with intermediate values denoting proportional increases in discomfort. Following debonding of each bracket, patients placed a vertical mark along the scale to reflect pain intensity. Measurements were obtained by calculating the distance from "no pain" anchor to the patient's mark, yielding a score for each tooth. Sequential debonding was performed starting from the maxillary right quadrant progressing to the maxillary left, then the mandibular right and finally the mandibular left, with incisors, canines, and premolars debonded individually. To minimize bias, pain scores were measured by a second investigator blinded to group allocation.

Table 1). All participants were in the finishing phase of orthodontic treatment, scheduled for appliance removal, and their pain levels were recorded while debonding and a week prior debonding.

2.1. Inclusion and exclusion criteria

All the patients selected in this study group were undergoing fixed orthodontics treatment in both the arches using Ormco Mini 200 mesh-based brackets bonded with 3M Transbond XT light cured adhesive, engaging 0.019" × 0.025" stainless steel archwires with no loose brackets, in their final stage of fixed orthodontic treatment.

Patients selected had age ranging from 13 to 24 years and were able to understand, assess and complete the questionnaire.

Patients were excluded if they had consumed any medications during the previous 24 hours, especially anti-inflammatory drugs, analgesics, or anxiolytics that could influence pain perception.

Subjects were excluded if they presented with missing teeth (other than extracted premolars), any prosthetic replacement, heavily restored teeth, or teeth treated with root canal therapy. Patients with a previous history of surgical treatment (including exposure of impacted teeth) or craniofacial malformations that could compromise dentoalveolar bone characteristics (such as cleft lip and palate) were not considered. Subjects showing evidence of active periodontal pathology, including gingival recession or mobility greater than Grade I, were likewise excluded.

3. Armamentarium and Group Allocation

All patients were treated with a standardized armamentarium, consisting of a single operator using the same type of debonding pliers in each study group. Specifically, a curved debonding plier with a short lever arm from Eltee (DD-009) was employed for bracket removal (**Figure 1**). Participants were randomly assigned into three experimental groups:

Additionally, each patient completed the pain catastrophizing scale (PCS) questionnaire (**Figure 7**), which evaluates the association between cognitive-emotional factors and pain perception during debonding. The scale comprises 13 items addressing pain-related thoughts and emotions, each rated from 0 ("not at all") to 4 ("all the time"). To prevent bias from immediate pain experience, the questionnaire was administered one week before debonding. Scores were derived as an overall PCS total and across the subdomains of rumination, magnification, and helplessness.

3.2. Statistical analysis

Descriptive statistics were generated to summarize age, sex distribution, PCS scores, and pain responses across groups, with results presented in tabular format. Using IBM SPSS 25.0.0.0, the Kruskal–Wallis test was applied to evaluate significant differences in pain scores among the three pain-control methods, intra-group variations (different quadrants under the same method), and the influence of catastrophizing on pain perception. Linear regression was further conducted using the XLSTAT add-on in Microsoft Excel to evaluate correlations between VAS scores and pain-control methods, with adjustments for age and sex applied where appropriate.

4. Result

An intergroup comparison result showed a statistically significant difference in overall VAS scores among the groups, with the FP group demonstrating the lowest pain scores (P = 0.043). Median scores for the remaining groups along with corresponding P values are presented in

Intra-group evaluation showed a statistically significant influence of tooth position on VAS scores across all three groups, with consistently higher pain levels reported in the lower anterior region, yielding a P value of 0.02 in each group. Descriptive statistics about pain scores for other locations along with their *P* value given in **Table 2**.

A linear regression model was applied to determine the correlation between VAS scores and the different pain-control methods. Correlation was measured with the help of β (equivalent to Pearson's correlation), and moderate correlation between pain score and pain control methods was found. (**Table 3**)

Percentage changes in pain score due to pain control methods were measured with the help of R^2 value, whereas adjusted R^2 values shows percentage changes in pain score due to pain control methods when age and gender are matched. The regression analysis has shown a significant difference in results (i.e. the difference in pain score due to different pain control methods used). However the percentage change in pain accounts for around 14% to 18% when score were not adjusted. And after adjusted for age and gender it comes out between 12 % to 15%. (**Table 3**)

When gender was taken into account, PCS scores of females were found to be positively and significantly correlated with VAS scores (**Table 4**). Only magnification component of PCS showed non-significant correlation. **Table 2.**

Table 1: Descriptive statistics about patient distribution

		Finger Pressure	Stress Relief	Elastomeric wafer	Test value	P value
Gender	Male	4	6	4	0.37*	0.83
	Female	16	14	16		
Age		18.80	19.90	19.90	1.20^	0.54

(Origibal table) *= chi square Test ^= Anova

Table 2: Descriptive statistics for VAS scores

PCS score	Finger Pressure	Stress Relief	Elastomeric wafer	Chi Square	P value
Total VAS	6.59	7.49	12.23	6.34	0.043(S)
Upper VAS	4.21	6.25	10.51	7.08	0.039(S)
Upper right	3.47	6.53	8.41	5.08	0.08(NS)
Upper left	4.95	5.97	12.60	9.03	0.037(S)
Upper anterior	4.30	7.05	12.58	8.45	0.041(S)
Upper posterior	4.67	6.75	9.34	8.32	0.032(S)
Lower VAS	8.67	8.86	13.99	7.83	0.048(S)
Lower right	8.64	8.33	13.34	2.24	0.02(S)
Lower left	8.71	9.38	14.64	9.03	0.037(S)
Lower Anterior	10.56	9.26	14.23	10.23	0.033(S)
Lower Posterior	7.57	9.54	14.40	8.54	0.029(S)

(Original table) Kruskal Wallis Test, S- Significant, NS- Non Significant

Table 3: Regression analysis for VAS score with groups

	Mean	Lower	Upper	β	R square	Adjusted R^2	P value
Total VAS	8.77	7.31	10.62	0.27	.14	.14	0.03
Upper VAS	6.99	5.96	7.34	0.36	.13	.13	0.04
Upper right	6.14	5.30	7.04	0.34	.16	.12	0.06
Upper left	7.84	7.75	8.12	0.37	.14	.14	0.04
Upper anterior	7.97	7.44	8.06	0.41	.17	.13	0.02
Upper Posterior	7.34	6.45	8.46	0.28	.18	.14	0.03
Lower VAS	10.51	6.31	14.71	0.36	.14	.14	0.04
Lower right	10.10	5.94	14.26	0.34	.12	.12	0.06
Lower left	10.91	6.57	15.25	0.37	.17	.15	0.04
Lower Anterior	11.35	7.01	15.69	0.43	.14	.13	0.02
Lower Posterior	10.86	7.31	14.64	0.36	.16	.14	0.03

(original table)

Table 4: Correlations of component and total scores of PCS with VAS scores

	Rumination			Magnification			Helplessness			Total PCS		
	M	F	T	M	F	T	M	F	T	M	F	T
Overall	.37*	.38*	.38*	.09	.10	.09	.36*	.34*	.34*	.37*	.38*	.37*
Upper Total	.31*	.33*	.31*	.08	.08	.08	.29*	.27*	.27*	.30*	.30*	.30*
Upper right	.27*	.23*	.25*	.02	.04	.02	.30*	.30*	.30*	.24	.22	.22
Upper left	.34*	.34*	.34*	.17	.16	.15	.23	.26	.23*	.27*	.37*	.34*
Upper anterior	.33*	.31*	.31*	.10	.09	.09	.26*	.29*	.27*	.31*	.30*	.30*
Upper Posterior	.31*	.28*	.30*	.10	.12	.10	.25*	.31*	.29*	.25	.29	.27
Lower Total	.40*	.42*	.42*	.64	.56	.61	.35*	.31*	.32*	.38*	.37*	.37*
Lower right	.44*	.42*	.42*	.69	.71	.71	.34*	.33*	.33*	.33*	.39*	.38*
Lower left	.43*	.39*	.40*	.55	.50	.50	.36*	.30*	.32*	.37*	.36*	.36*
Lower Anterior	.41*	.42*	.42*	.74	.69	.70	.29*	.27*	.27*	.30*	.39*	.36*
Lower Posterior	.40*	.43*	.43*	.63	.62	.62	.32*	.34*	.32*	.35*	.39*	.38*

(Original table) * Significant p≤0.05. M = male, F = female, T= total

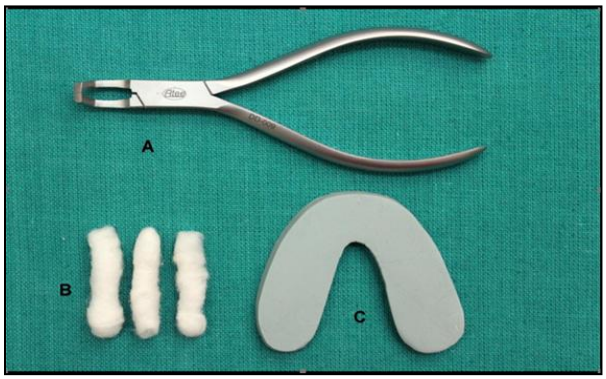


Figure 1: Armamentarium used for debonding. (original photo) A- Eltee debonding pliers DD-009, B- Cotton roll, C- Elastomeric bite.

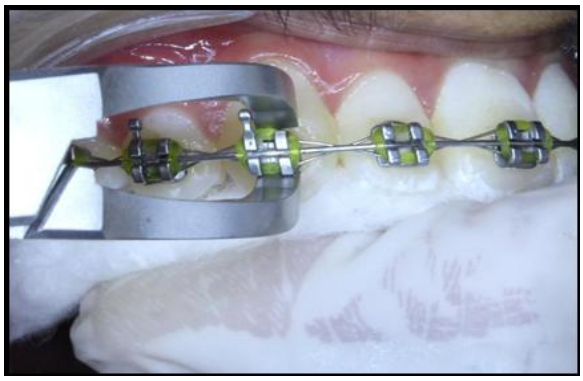


Figure 2: Bracket debonding of maxillary canine with finger pressure method. (original photo)

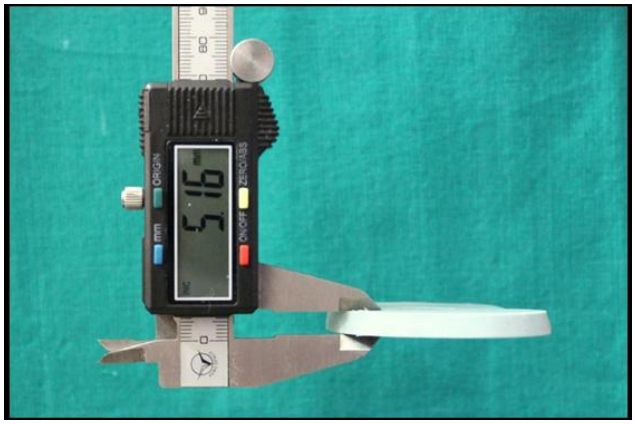


Figure 3: Thickness of elastomeric wafer bite. (original photo)

Figure 4: Bracket debonding of maxillary canine with elastomeric wafer method. (original photo)

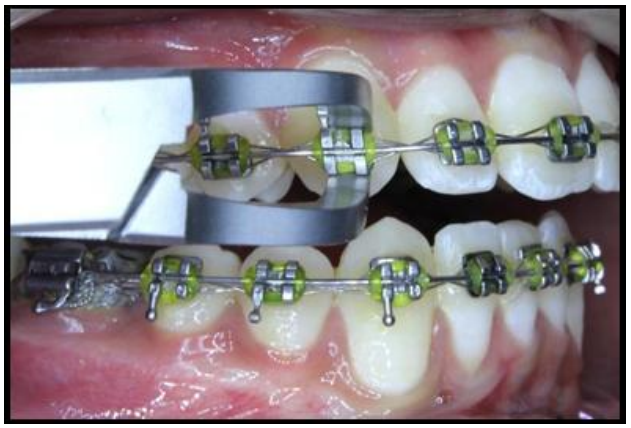
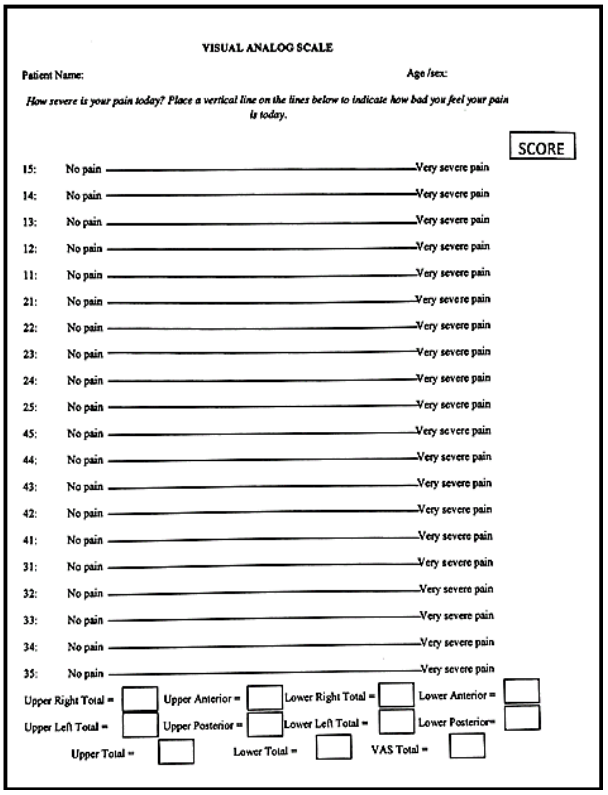


Figure 5: Bracket debonding of maxillary canine with Stress Relief method. (original photo)



VISUAL ANALOG SCALE

Patient Name: Age /sex:

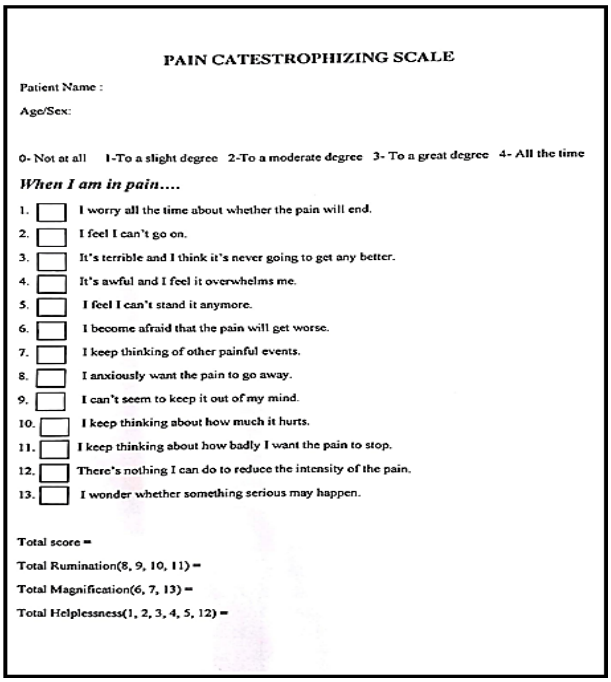
How severe is your pain today? Place a vertical line on the lines below to indicate how bad you feel your pain is today.

SCORE

15: No pain ——— Very severe pain
14: No pain ——— Very severe pain
13: No pain ——— Very severe pain
12: No pain ——— Very severe pain
11: No pain ——— Very severe pain
21: No pain ——— Very severe pain
22: No pain ——— Very severe pain
23: No pain ——— Very severe pain
24: No pain ——— Very severe pain
25: No pain ——— Very severe pain
45: No pain ——— Very severe pain
44: No pain ——— Very severe pain
43: No pain ——— Very severe pain
42: No pain ——— Very severe pain
41: No pain ——— Very severe pain
31: No pain ——— Very severe pain
32: No pain ——— Very severe pain
33: No pain ——— Very severe pain
34: No pain ——— Very severe pain
35: No pain ——— Very severe pain

Upper Right Total = Upper Anterior = Lower Right Total = Lower Anterior =
Upper Left Total = Upper Posterior = Lower Left Total = Lower Posterior=
Upper Total = Lower Total = VAS Total =

Figure 6: 100 mm visual analog scale (original photo)



PAIN CATESTROPHIZING SCALE

Patient Name :

Age/Sex:

0- Not at all 1-To a slight degree 2-To a moderate degree 3- To a great degree 4- All the time

When I am in pain....

1. ☐ I worry all the time about whether the pain will end.
2. ☐ I feel I can't go on.
3. ☐ It's terrible and I think it's never going to get any better.
4. ☐ It's awful and I feel it overwhelms me.
5. ☐ I feel I can't stand it anymore.
6. ☐ I become afraid that the pain will get worse.
7. ☐ I keep thinking of other painful events.
8. ☐ I anxiously want the pain to go away.
9. ☐ I can't seem to keep it out of my mind.
10. ☐ I keep thinking about how much it hurts.
11. ☐ I keep thinking about how badly I want the pain to stop.
12. ☐ There's nothing I can do to reduce the intensity of the pain.
13. ☐ I wonder whether something serious may happen.

Total score =
Total Rumination(8, 9, 10, 11) =
Total Magnification(6, 7, 13) =
Total Helplessness(1, 2, 3, 4, 5, 12) =

Figure 7: Pain catestrophizing scale (original photo)

5. Discussion

The present investigation was conducted to assess the effectiveness of various pain reduction approaches during orthodontic bracket debonding, along with evaluating other critical determinants of discomfort such as patients' cognitive attitudes, tooth position, and demographic characteristics including age and sex.

Inter-group comparisons demonstrated that participants in the FP group reported significantly lower discomfort during bracket removal compared with those in the SR and EW groups, highlighting the relative advantage of FP in minimizing pain perception.

Evaluation of pain patterns across tooth regions demonstrated that maximum pain intensity was observed in the mandibular anterior segment, followed by the maxillary anterior segment, while the posterior teeth of both arches consistently exhibited lower pain levels regardless of group assignment.

When pain-control techniques were compared across specific quadrants, FP emerged as a more effective method relative to SR and EW in both arches, with the sole exception observed in maxillary right quadrant.

Nehir et al.[18] demonstrated comparable results in evaluating discomfort during debonding, accounting for pain-relief approaches, sex, and personal characteristics, concluding that FP was particularly effective in the mandibular arch.

Our observations were also consistent with previous literature[6,7,10,13] regarding the role of sex in pain perception, where females reported higher VAS scores than males. Age has likewise been highlighted as an important variable in earlier studies.[20] Therefore, an age range was taken into account during recruitment, and statistical adjustments were performed to minimize its confounding influence.

Since pain catastrophizing has been recognized as a predictor of pain perception across age[21,21] sex[23,24] and personality traits, the Pain Catastrophizing Scale (PCS) proposed by Sullivan et al.[25] was incorporated as part of the present study. The PCS was evaluated one week in advance of debonding to avoid contamination of responses by acute treatment-related pain.

The mean of VAS scores observed in the present study were lower compared with previously reported for other orthodontic procedures such as separator placement and initial archwire insertion[10,26,27] The median total VAS scores across groups ranged from 6.59 to 12.23. This variability could be attributed either to inherent biological mechanisms modulating nociception or to an adaptive effect in which prior orthodontic experiences diminish pain perception.[18]

The FP method, where we apply intrusive force during debonding, shows greater efficacy relative to SR and EW, demonstrated by reduced overall VAS values in both maxillary and mandibular arches, except for the maxillary right quadrant. During bracket removal, these findings highlight the beneficial role of intrusive thumb pressure on occlusal or incisal surfaces.

It remains unclear what magnitude of VAS reduction constitutes a "clinically meaningful" improvement in orthodontic pain management. Todd suggested that a decrease of 13 mm on a 100-mm VAS should be interpreted as clinically significant. According to this definition, none of the strategies assessed in the current investigation can be deemed fully effective. Nevertheless, FP stands out as a practical and efficient technique, particularly for anterior teeth, as it is cost-effective, quick, and requires minimal technical expertise.

The SR method, however, also deserves consideration. Previous evidence suggests that patient reassurance and trust in the clinician can substantially improve comfort during orthodontic interventions.[18] Hence, combining FP and SR approaches may optimize patient comfort during bracket removal.

Anatomical location and root morphology may also explain variations in pain across quadrants. Mangnall et al.[17] reported that 39% of patients experienced the highest discomfort within the mandibular anterior segment during debonding, which aligns with the observations of the present study.

This study demonstrated significant correlations of PCS total and rumination subscale scores with VAS outcomes in most regions, except for the maxillary right quadrant at which debonding commenced. The lower score in this quadrant can be explained by under-reporting of pain at the start of debonding or by the orthodontist's advantageous ergonomic positioning in the right side, which permits better access and controlled plier use. In contrast, Nehir et al.[18] observed reduced pain in lower quadrants distant from the starting site, attributing this to the "monotony factor," where patients gradually lose attentiveness to discomfort after the initial teeth are debonded.[3]

Patients' pain perception is multifactorial, influenced by variables such as type of instruments used, practitioner's skill and position, periodontal health, previous use of analgesics, and even cultural background. Further investigations may be needed to explore these associations.

The present study had certain limitations. The use of a standardized bite wafer across all EW participants may have restricted adaptability; individualized wafers could potentially provide more precise intrusive force distribution. Additionally, a split-mouth design might have enhanced the reliability of inter-group comparisons.

6. Conclusion

When compared with other pain control techniques, namely SR and EW methods, it may be inferred that FP serves as an effective approach for reducing perceived discomfort at the time of debonding. Anterior teeth in both maxillary and mandibular arches exhibited greater sensitivity compared with posterior teeth, independent of the pain-control technique utilized. Furthermore, patient-specific psychological attitudes toward pain, as well as sex-based differences, emerged as important determinants of pain response during bracket removal with females generally reporting higher pain scores.

7. Source of Funding

None.

8. Conflict of Interest

None.

References

1. Pithon MM, Figueiredo DSF, Oliveira DD, Coqueiro RDS. What is the best method for debonding metallic brackets from the patient's perspective? Progress in Orthodontics. 2015;16(1).88. Doi: 10.1186/s40510-015-0088-7.
2. Sobouti F, Rakhshan V, Chiniforush N, Khatami M. Effects of laser-assisted cosmetic smile lift gingivectomy on postoperative bleeding and pain in fixed orthodontic patients: a controlled clinical trial. *Prog Orthod*. 2014;15(1):66. DOI: 10.1186/s40510-014-0066-5
3. Williams OL, Bishara SE, Ortho D. Patient discomfort levels at the time of debonding: A pilot study. *Am J Orthod Dentofac Orthop*. 1992;101(4):313–7. DOI: 10.1016/S0889-5406(05)80324-5
4. O'Connor, Patrick J. Patients' perceptions before, during, and after orthodontic treatment. *J Clin Orthod*. 2000;34(10):591-2.
5. Krishnan V. Orthodontic pain: from causes to management-a review. *Eur J Orthod.* 2007;29(2):170–9. DOI: 10.1093/ejo/cjl081
6. Firestone A. Patients anticipation of pain and pain-related side effects, and their perception of pain as a result of orthodontic treatment with fixed appliances. *Eur J Orthod*. 1999;21(4):387–96. DOI: 10.1093/ejo/21.4.387
7. Oliver RG, Knapman YM. Attitudes to orthodontic treatment. *Brit J Orthod.* 1985;12(4):179-88. DOI: 10.1179/bjo.12.4.179
8. Polat Ö. Pain and Discomfort After Orthodontic Appointments. *Semin Orthod*. 2007;13(4):292–300. DOI: 10.1179/bjo.12.4.179
9. Scheurer PA, Firestone AR, Bürgin WB. Perception of pain as a result of orthodontic treatment with fixed appliances. *Eur J Orthod.* 1996;18(4):349–57. DOI: 10.1093/ejo/18.4.349.
10. Kvam E, Gjerdet NR, Bondevik O. Traumatic ulcers and pain during orthodontic treatment. *Commun Dent Oral Epidem*iol. 1987;15(2):104–7. DOI: 10.1111/j.1600-0528.1987.tb00493.x
11. Koyama T, Mchaffie JG, Laurienti PJ, Coghill RC. The subjective experience of pain: Where expectations become reality. Proceedings of the National Acad Sci. 2005;102(36):12950–5.
12. Ngan P, Kess B, Wilson S. Perception of discomfort by patients undergoing orthodontic treatment. American J Orthod Dentofac Orthop.1989;96(1):47–53. https://doi.org/10.1073/pnas.0408576102
13. Smith RJ, Burstone CJ. Mechanics of tooth movement. *Am J Orthod.* 1984;85(4):294–307. DOI: 10.1016/0002-9416(84)90187-8
14. White LW. Pain and cooperation in orthodontic treatment. *J Clin orthod.* 1984(8):572-5.
15. Normando TS, Calcada FS, Ursi WJ, Normando D. Patients' report of discomfort and pain during debonding of orthodontic brackets: a comparative study of two methods. *World J Orthod*. 2010;11(4):e29–34.
16. Mangnall LAR, Dietrich T, Scholey JM. A randomized controlled trial to assess the pain associated with the debond of orthodontic fixed appliances. *J Orthod.* 2013;40(3):188–96. DOI: 10.1179/1465313313Y.0000000045
17. Bavbek NC, Tuncer BB, Tortop T, Celik B. Efficacy of different methods to reduce pain during debonding of orthodontic brackets. *Angle Orthod*. 2016;86(6):917–24. DOI: 10.2319/020116-88R.1
18. Wang J, Jian F, Chen J, Ye N, Huang Y, Wang S. Cognitive Behavioral Therapy for Orthodontic Pain Control. *J Dent Res.* 2012;91(6):580–5. DOI:10.1177/0022034512444446.
19. Brown DF, Moerenhout RG. The pain experience and psychological adjustment to orthodontic treatment of preadolescents, adolescents, and adults. *Am J Orthod Dentofac Orthop*. 1991;100(4):349–56. DOI: 10.1016/0889-5406(91)70073-6
20. Sullivan MJL, Bishop SR, Pivik J. The Pain Catastrophizing Scale: Development and validation. *Psychol Assess.* 1995;7(4):524–32. DOI:10.1037/1040-3590.7.4.524.
21. Sullivan MJL, Thorn B, Haythornthwaite JA, Keefe F, Martin M, Bradley LA. et al. Theoretical Perspectives on the Relation Between Catastrophizing and Pain. *Clin J Pain*. 2001;17(1):52–64. DOI: 10.1097/00002508-200103000-00008.
22. Thorn BE, Clements KL, Ward LC, Dixon KE, Kersh BC, Boothby JL. et al. Personality Factors in the Explanation of Sex Differences in Pain Catastrophizing and Response to Experimental Pain. *Clin J Pain.* 2004;20(5):275–82. DOI: 10.1097/00002508-200409000-00001
23. Vervoort T, Eccleston C, Goubert L, Buysse A, Crombez G. Childrens catastrophic thinking about their pain predicts pain and disability 6 months later. *Eur J Pain*. 2010;14(1):90–6. DOI: 10.1016/j.ejpain.2009.03.001
24. Sullivan MJL. The pain catastrophizing scale: user manual. Montreal: McGill University. 2009: 1–36. DOI:10.1037/1040-3590.7.4.524
25. Sandhu SS, Sandhu J. A randomized clinical trial investigating pain associated with superelastic nickel–titanium and multistranded stainless steel archwires during the initial leveling and aligning phase of orthodontic treatment. *J Orthod*. 2013;40(4):276–85. DOI:10.1179/1465313313Y.0000000072
26. Beck VJ, Farella M, Chandler NP, Kieser JA, Thomson WM. Factors associated with pain induced by orthodontic separators. *J Oral Rehabil.* 2014;41(4):282–8. DOI: 10.1111/joor.12144
27. Todd KH, Funk KG, Funk JP, Bonacci R. Clinical Significance of Reported Changes in Pain Severity. *Ann Emer Med*. 1996;27(4):485–9. DOI: 10.1016/s0196-0644(96)70238-x.

Cite this article: Choudhary VK, Navlani M, Makhija PG, Bhardwaj A, Thukral R. A comparative evaluation of different pain control methods during debonding of orthodontic brackets: An in vivo study. *J Contemp Orthod*. 2025;9(4):495–501.