ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Research Article

Differences in Self-Perceived Pain and Jaw Discomfort Between Adult and Adolescent Orthodontic Patients

Afnan Zealaiy[1], Shahd Sokhairi[1], Alaa Rhbeini[1], Bashair Alsaud[1], Waeil Batwa[2]*, Ibtesam Alzain[3] and Khalid Zawawi[2]

[1]*General Dentists, King Abdulaziz University, Jeddah, Saudi Arabia*

[2]*Orthodontic Department, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia*

[3]*Pediatric Dentistry Department, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia*

***Corresponding Author**: Waeil Batwa, Orthodontic Department, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia.

Received: October 22, 2018; **Published:** November 15, 2018

Abstract

Objective: The purpose of this study was to assess differences in the perception of orthodontic pain and jaw discomfort resulting from fixed-appliance adjustment in adult and adolescent patients.

Materials and Methods: Adult (17 years and over) and adolescent (12 - 17 years) patients undergoing orthodontic fixed-appliance treatment were asked to complete a questionnaire regarding their pain experience after an orthodontic adjustment visit. The questionnaire was divided into three sections: section 1 dealt with perceived pain, section 2 focused on jaw discomfort, and section 3 covered patients' reaction to pain.

Results: Ninety orthodontic patients were recruited: 54 (60%) females and 36 (40%) males; 45 were adults and 45 were adolescent patients. Both groups reported a moderate level of pain after the adjustment visit, with no statistical difference found between the groups ($p = 0.70$). Adult patients reported a moderate level of jaw discomfort, while adolescents reported a mild level, with a significant difference between the groups ($p = 0.038$). The jaw discomfort was significantly different between the two groups when biting on their anterior teeth ($p = 0.034$). Patients who reported headaches also reported a higher level of pain perception ($p = 0.002$).

Conclusions: Orthodontic treatment is associated with a moderate level of pain, and tolerable mild to moderate levels of discomfort, which is perceived differently by adult and adolescent patients. Proper communication with patients about the nature of the pain and its effect on jaw function, in particular the discomfort felt in anterior teeth while biting, might help them know what to expect.

Keywords: *Discomfort; Fixed Appliance; Orthodontic Treatment; Pain; Quality of Life*

Introduction

Pain and discomfort are reported as two of the most common complaints associated with dental treatment. Around 77% of dental patients claim to experience different degrees of pain during their dental treatment [1,2]. The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential damage".

Pain associated with orthodontic treatment has an impact on daily life [3] that can manifest as difficulty in swallowing and the impairment of speech and jaw function [4]. Moreover, chewing hard food can be more challenging due to reduced masticatory ability [5] and all of these problems combined can lead to psychological discomfort [6]. Orthodontic pain has been associated with different types of treatments, such as separator placement, fixed-appliance adjustments, using rapid maxillary expansion (RME), chin cup therapy, and soft tissue injuries [7,8]. Sandhu and Sandhu [9] found that most patients experienced some pain within the first four hours after the insertion of the first arch-wire during fixed-appliance treatment, and 95% of patients reported pain within the first day. Furthermore, 20% of patients experienced sleep-disrupting severe pain during the first two days after orthodontic activation.

Pain during orthodontic treatment is mainly caused by pressure, ischemia, inflammation, and edema in the periodontium [10], with the pain experienced in two stages - immediate and delayed [11]. Immediate pain is induced by the placement of the wire, which leads to the initial compression of the periodontal ligaments (PDL). In contrast, the delayed pain response is experienced after a few hours due to the response to hyperalgesia of the PDL. Hyperalgesia has been related to prostaglandins (PGEs), which makes the PDL sensitive to released algogens such as histamine, bradykinin, PGEs, serotonin, and substance P [12,13].

It has been argued that orthodontists lack sufficient pain management skills [14]. One study demonstrated the difficulty in defining the level of pain, or even predicting it, during simple communication between orthodontists and patients [15]. Moreover, the pain experience resulting from orthodontic treatment is a significant reason for patients discontinuing their treatment [16].

Orthodontists ought to be aware of the pain caused during orthodontic treatment, and must try to inform their patients about the nature of pain they are expected to experience and how it could influence their daily life, routine, and comfort. Furthermore, a comparison of orthodontic pain perception and jaw function between adult and adolescent patients is lacking in the literature. Thus, in this study, patients undergoing orthodontic treatment were asked to rate their own perceived pain and how it affected their jaw discomfort. Such information could be used to develop a relevant and realistic approach to advising and informing future patients of the pain expected following orthodontic treatment.

Objectives of the Study

The objectives of this study were:

- To compare differences in the perception of orthodontic pain resulting from fixed-appliance adjustment in adult and adoles cent patients.
- To compare differences in jaw discomfort between adult and adolescent patients.

Materials and Methods

The research was reviewed and approved by the Research Ethics Committee of the Faculty of Dentistry, King Abdulaziz University. It was conducted under the principles of good clinical practice, as the research only involved patients who were formally informed, both orally and in writing, about the objectives and methods of the study. Patients who were minors had the written consent of their parents/legal guardians. The respondents were similar in terms of their socioeconomic status.

Patients undergoing pre-adjusted, edgewise, orthodontic fixed-appliance treatment were selected randomly from the Department of Orthodontics within the Faculty of Dentistry. The inclusion criteria were: 1) healthy patients (non-syndromic patients) and 2) patients undergoing pre-adjusted, edgewise, orthodontic fixed-appliance therapy. The exclusion criteria were: 1) patients with special healthcare needs, 2) patients undergoing maxillary expansion or any type of growth modification, and 3) patients who have had or will require orthognathic surgery as part of their orthodontic treatment.

The participants were divided according to their age into adolescent (12 - 17 years old) and adult (older than 17 years) groups. One investigator approached all participants within the target age range to explain the purpose of the study. The participants were informed that they were under no obligation to participate and that they could withdraw from the study at any time. Participants completed the self-reporting questionnaires on an iPad Pro using Google Docs online survey software. The age and gender of each participant were recorded on the questionnaire. Ninety participants (60% female) were recruited - 45 adolescent and 45 adult patients - and each completed the questionnaire in a quiet environment with good lighting. The researcher presented the questionnaire to participants individually on the electronic device, and ensured that they completed it alone. All results were exported from Google Docs to an online database and then transferred to a Microsoft Excel file, and subsequently copied and entered into a computer using Statistical Package for Social Science software (SPSS) for analysis. All data were coded for anonymity, and were password protected.

The developed questionnaire comprised three sections and ten questions (Table 1), in addition to gathering sociodemographic data. Section 1 was used to assess the pain experience itself and was composed of four questions relating to whether the patients felt any pain, the intensity of the pain, the location of pain, and if a headache was involved. Section 2 dealt with jaw discomfort, which was assessed using four questions relating to the effect of jaw discomfort on leisure time, speech, while biting on anterior teeth, and while chewing hard food on posterior teeth. Section 3 recorded patient reaction to any pain and jaw discomfort using two questions related to whether they took any medication or considered withdrawing from treatment. Patients were instructed to describe their pain experience and jaw function following their previous orthodontic adjustment visit. The questionnaire evaluated the nature of pain and jaw discomfort after adjustment visits dealing with the pre-adjusted, edgewise orthodontic fixed appliance (MBT or Roth prescription). The questions were answered based on a six-point Likert scale [17,18]: none, mild, moderate, severe, very severe, and worst possible. Yes/no answers were used for dichotomous questions.

NO	Survey question					
Section 1: Pain experienced						
1	Did you feel any pain after the adjustment visit?					
	Yes			No		
2	How would you describe the intensity of the pain?					
	None	Mild	Moderate	Severe	Very Severe	Worst possible
3	Did you experience headaches during the treatment?					
	Yes			No		
4	Where did you feel the pain?					
	Anterior teeth	Posterior teeth		All the dentition		Can't locate
Section 2: Jaw discomfort						
5	How did the pain and discomfort in your teeth and jaw affect your leisure time?					
	None	Mild	Moderate	Severe	Very Severe	Worst possible
6	How did the pain and discomfort in your teeth and jaw affect your speech?					
	None	Mild	Moderate	Severe	Very Severe	Worst possible
7	How did the pain and discomfort in your teeth and jaw affect your ability to bite with your anterior teeth?					
	None	Mild	Moderate	Severe	Very Severe	Worst possible
8	How did the pain and discomfort in your teeth and jaw affect your ability to chew hard food?					
	None	Mild	Moderate	Severe	Very Severe	Worst possible
Section 3: Patient reaction						
9	Did you take any medication to relieve pain during the treatment?					
	Yes			No		
10	Did you consider withdrawing from treatment?					
	Yes			No		

Table 1: *The questionnaire was divided into three sections to assess pain, jaw discomfort, and patient reaction.*

Statistical Analysis

The generated data were tabulated and analyzed using SPSS. The frequencies of each answer given in the questionnaires were calculated based on the number of subjects responding to each question. A comparison between the groups was performed using chi-square tests for nominal data and the independent Student's t-test for continuous data. The level of statistical significance was taken to be $p < 0.05$.

Results

All of the 45 adult patients, and 45 of the adolescent patients, reported pain. In the analysis of results, the six-point Likert scale was combined into the three categories of mild, moderate, and severe to allow for easier calculations; mild included "none" and "mild" ratings, moderate included "moderate" and "severe," while severe included "very severe" and "worst possible" ratings. The pain level was described as moderate by the majority of participants in both groups, with more adolescents than adults considering the pain to be moderate. However, the difference in levels of pain perception was not significant between the groups ($p = 0.7$) (Table 2).

Pain level	Adolescent	Adult	Chi-square variate	*p* value
Mild	7	10	0.70	0.7
Moderate	27	24		
Severe	11	11		

Table 2: *Difference in pain perception between adult and adolescent patients.*

A similar number in each group reported headaches (21 adults and 22 adolescents), but more adults than adolescents used medication to alleviate the pain (26 adults and 23 adolescents); however, the difference between the two groups was not statistically significant ($p > 0.05$; the chi-square test was used at a 95% confidence interval). Only three (3.3%) patients reported that this pain might influence them to withdraw from treatment (one adolescent and two adults).

Jaw discomfort was measured based on a composite scale comprising four indicators (using a combined score for the four questions answered): the effect of jaw discomfort on leisure time, speech, biting on anterior teeth, and chewing hard food. All four indicators were measured using a six-point scale; the total score for the four questions were combined as a marker of jaw discomfort, with a minimum score of 0 and a maximum score of 20 (4 x 5 = 20). An overall three-point scale was then structured as follows: 0 - 6: mildly compromised jaw discomfort; 7 - 13: moderately compromised jaw discomfort; and 14 - 20: highly compromised jaw discomfort.

There was a significant difference in perception between adults and adolescents when both groups were compared regarding their jaw discomfort ($p = 0.038$). More adolescents reported a mild level of discomfort, followed by moderate and severe (31, 12 and 2 respectively), while the majority of adult patients felt moderate discomfort, followed by mild and severe (23, 19 and 3 respectively) (Table 3). When each of the four indicators were analyzed independently, pain while biting on anterior teeth was the only significant indicator ($p = 0.034$), while the effect on leisure time, speech, or chewing hard food were not significant ($p > 0.05$). More adults than adolescents felt that biting on anterior teeth would moderately increase their jaw discomfort (23 adults, 12 adolescents) (Table 4).

Pain location	Adolescent	Adult	Chi-square variate	*p* value
All teeth	19	20	0.40	0.93
Anterior teeth	10	11		
Posterior teeth	7	5		
Could not locate	9	9		

Table 3: *Location of pain, as described by adult and adolescent patients.*

Jaw discomfort	Adolescent	Adult	Chi-square variate	*p* value
Mildly compromised	31	19	6.53	0.038*
Moderately compromised	12	23		
Severely compromised	2	3		

Table 4: *A significant difference was found between adults and adolescents in jaw discomfort ($p = 0.038$).*

The correlations between patients' overall jaw discomfort and gender were tested, with the results demonstrating no statistically significant correlation ($p = 0.21$) (Table 5 and 6). The means of pain intensity of patients reporting headaches against those who did not (2.96 and 2.23 respectively; independent Student's t-test) revealed a significant difference between the two groups ($p = 0.002$).

Jaw discomfort component	Impact of pain	Adolescent	Adult	Chi-square variate	*p* value
Impact of pain on leisure	Mild	36	26	5.45	0.06
	Moderate	8	18		
	Severe	1	1		
Impact of pain on speech	Mild	35	29	2.06	0.35
	Moderate	9	15		
	Severe	1	1		
Impact of pain while biting on anterior teeth	Mild	21	10	6.71	0.034*
	Moderate	16	27		
	Severe	8	8		
Impact of pain while chewing hard food	Mild	22	12	4.77	0.091
	Moderate	19	28		
	Severe	4	5		

Table 5: *Association between each jaw discomfort indicator and age; a significant difference was found between adults and adolescents in biting on their anterior teeth (p = 0.034).*

Level of discomfort	Male	Female	Chi-square variate	*p* value
Mildly compromised	24	26	3.04	0.21
Moderately compromised	11	25		
Severely compromised	1	3		

Table 6: *No significant difference was found in jaw discomfort based on gender.*

Discussion

No studies have focused on comparing the pain associated with orthodontic treatment to that of other dental fields [8]. Moreover, there is confusion in terms of comparing perceived orthodontic pain and the perceived effect of pain on jaw function and discomfort [7]. In addition, one study showed there was an insufficient emphasis on pain communication and management between orthodontists and patients [19]. This situation compelled us to conduct this research in an effort to improve orthodontists' communication with their patients regarding pain perception and expectation, specifically when it comes to dealing with different groups, such adults and adolescents. One of the most important objectives of this study was to identify and define the differences in pain perception, and its effect on jaw discomfort, for adult and adolescent patients who are undergoing active pre-adjusted, edgewise, orthodontic fixed-appliance treatment.

The research questionnaire began by assessing the patients' perceived pain. It is clear from the published literature that adolescents report higher levels of pain than adults [11]. However, this was not the case in our findings, where no significant difference was found between the adult and adolescent patients (p = 0.7); most members of both groups described their pain as moderate, which is in agreement with previous studies [7,20]. The agreement between adult and adolescent patients in this study extended to include the location of pain, where the majority felt pain in all teeth, followed by the front teeth; thus, there was no significant difference between the groups regarding the location of pain (p = 0.93) (Table 3).

Jaw discomfort could be viewed differently. In this study, it was assessed by measuring different indicators and combining them into a composite scale, and the findings showed that orthodontic treatment did affect jaw discomfort. The impact of pain (associated with orthodontic treatment) on jaw discomfort was perceived differently by the young and adult patients (p = 0.038). Moreover, both groups perceived a moderate level of pain, findings similar to those of Wiedel and Bondemark [7], who reported that patients who were undergoing orthodontic treatment mainly reported mild to moderate levels of pain and discomfort. Only 3.3% of the patients said they would

consider stopping their treatment due to the intensity of the pain. While this result demonstrates that most patients will not consider terminating their orthodontic treatment because of pain, it highlights the importance of assessing their level of pain and prescribing analgesics, especially for those patients who are at risk of discontinuing their treatment.

One interesting finding to emerge from this research was the different level of jaw discomfort in both groups, despite them having a similar level of perceived pain (moderate). One way of explaining this discrepancy involves the individual's physiology and psychological susceptibility, which may become a significant factor in the intensity of tissue discomfort caused by the physical effects of appliances. It has been reported that the pain experienced by patients does not seem to be directly related to the magnitude of force exerted, but instead relies heavily on the psychological well-being of the individual [8,11,21].

No differences were found regarding pain perception based on gender, similar to what was reported in previous studies [22,23]. However, one study showed gender-related differences in pain perception during orthodontic treatment, where female patients reported more pain than their age-matched male counterparts [9].

Another interesting finding was that patients who reported headaches associated with orthodontic treatment showed a significantly higher level of pain ($p = 0.002$). Headache is associated with malocclusion in the literature [24], particularly overbite and crossbite. Moreover, patients with headaches experienced increased levels of pain in general, and more disruptions to their daily lives [6].

Headaches are considered a form of chronic pain and are shown to be associated with increased pain response after surgical procedures [25]. This could be because subjects affected by headache disorders are pre-sensitized to pain. Orthodontic tooth movement can be considered a noxious stimulus, and exerting orthodontic force on teeth produces periodontal inflammation [26,27] and causes the release of several pro-inflammatory cytokines, including interleukin-1beta and tumor necrosis factor alpha from macrophages and endothelial cells [27-30]. These cytokines cause prostaglandins production, which in turn acts on silent nociceptors of C-fibers to activate second messenger pathways, which decreases the nociceptor threshold [12,31]. Therefore, PDL inflammation induced by orthodontic tooth movement could play a role in the increased responses of the cortex to PDL stimulation. It is also shown that the application of orthodontic forces was not only associated with increased levels of several cytokines locally, such as interleukin-1beta, prostaglandin-E2, and substance P, but also centrally, where it was demonstrated to increase astrocyte chemokine (C-C motif) ligand 2 (CCL2), which are important in nocifensive behavior, in the modularly dorsal horn and the trigeminal ganglion. Orthodontic tooth movement induces neuroplastic changes [32], while the tetanic stimulation of the insular cortex stimulates the long-term potentiation of excitatory propagation [33]. Hence, orthodontic force could trigger neuroplastic changes leading to continuous hypersensitivity to noxious and non-noxious stimuli in the orofacial region. Therefore, we could hypothesize that the activation of tooth movement during orthodontic treatment may trigger central pathways that could elicit headache episodes in susceptible individuals.

Patients must be warned of such side effects, and analgesics could be prescribed to reduce their chances of developing headaches. Although testing for headaches was not one of the main objectives of this study, the identification of an association between headache and pain perception during orthodontic treatment should not be interpreted lightly. Further prospective clinical trials are recommended to understand the association between headache and pain intensity.

Conclusion

Similar to any other dental treatment, orthodontic treatment is generally associated with a moderate level of pain and a tolerable mild-to-moderate level of jaw discomfort. Proper communication with patients and an explicit explanation of the moderate nature of the pain, and it is effect on jaw function, particularly the discomfort in anterior teeth while biting, might aid them in knowing what to expect. Thus, they would probably choose the right time to start their orthodontic treatment so not to hinder their lifestyle or compromise their motivation to undergo the treatment.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Bibliography

1. Campos MJ., *et al*. "Assessment of pain experience in adults and children after bracket bonding and initial archwire insertion". *Dental Press Journal of Orthodontics* 18.5 (2013): 32-37.

2. Klepac RK., *et al*. "Reports of pain after dental treatment, electrical tooth pulp stimulation, and cutaneous shock". *Journal of the American Dental Association* 100.5 (1980): 692-695.

3. Scheurer PA., *et al*. "Perception of pain as a result of orthodontic treatment with fixed appliances". *European Journal of Orthodontics* 18.4 (1996): 349-357.

4. Stewart FN., *et al*. "Appliance wear: the patient's point of view". *European Journal of Orthodontics* 19.4 (1997): 377-382.

5. Feldmann I., *et al*. "Orthodontic anchoring techniques and its influence on pain, discomfort, and jaw function-a randomized controlled trial". *European Journal of Orthodontics* 34.1 (2012): 102-108.

6. Firestone AR., *et al*. "Patients' anticipation of pain and pain-related side effects, and their perception of pain as a result of orthodontic treatment with fixed appliances". *European Journal of Orthodontics* 21.4 (1999): 387-396.

7. Wiedel AP and Bondemark L. "A randomized controlled trial of self-perceived pain, discomfort, and impairment of jaw function in children undergoing orthodontic treatment with fixed or removable appliances". *The Angle Orthodontist* 86.2 (2016): 324-330.

8. Bergius M., *et al*. "Pain in orthodontics. A review and discussion of the literature". *Journal of Orofacial Orthopedics* 61.2 (2000): 125-137.

9. Sandhu SS and Sandhu J. "Orthodontic pain: an interaction between age and sex in early and middle adolescence". *The Angle Orthodontist* 83.6 (2013): 966-972.

10. Furstman L and Bernick S. "Clinical considerations of the periodontium". *American Journal of Orthodontics* 61.2 (1972): 138-155.

11. Krishnan V. "Orthodontic pain: from causes to management--a review". *European Journal of Orthodontics* 29.2 (2007): 170-179.

12. Ferreira SH., *et al*. "The hyperalgesic effects of prostacyclin and prostaglandin E2". *Prostaglandins* 16.1 (1978): 31-37.

13. Polat O and Karaman AI. "Pain control during fixed orthodontic appliance therapy". *The Angle Orthodontist* 75.2 (2005): 214-219.

14. Keim RG. "Managing orthodontic pain". *Journal of Clinical Orthodontics: JCO* 38.12 (2004): 641-642.

15. Krukemeyer AM., *et al*. "Pain and orthodontic treatment". *The Angle Orthodontist* 79.6 (2009): 1175-1181.

16. Panda S., *et al*. "Perception of pain due to various orthodontic procedures". *Quintessence International* 46.7 (2015): 603-609.

17. Sriwatanakul K., *et al*. "Studies with different types of visual analog scales for measurement of pain". *Clinical Pharmacology and Therapeutics* 34.2 (1983): 234-239.

18. Williamson A and Hoggart B. "Pain: a review of three commonly used pain rating scales". *Journal of Clinical Nursing* 14.7 (2005): 798-804.

19. Ngan P., *et al*. "Perception of discomfort by patients undergoing orthodontic treatment". *American Journal of Orthodontics and Dentofacial Orthopedics* 96.1 (1989): 47-53.

20. Markovic E., *et al*. "The correlation between pain perception among patients with six different orthodontic archwires and the degree of dental crowding". *Srpski Arhiv za Celokupno Lekarstvo* 143.3-4 (2015): 134-140.

21. Sergl HG., *et al*. "Pain and discomfort during orthodontic treatment: causative factors and effects on compliance". *American Journal of Orthodontics and Dentofacial Orthopedics* 114.6 (1998): 684-691.

22. Abdelrahman RS., *et al*. "Pain experience during initial alignment with three types of nickel-titanium archwires: A prospective clinical trial". *The Angle Orthodontist* 85.6 (2015): 1021-1026.

23. Fernandes LM., *et al*. "Pain and discomfort experienced after placement of a conventional or a superelastic NiTi aligning archwire. A randomized clinical trial". *Journal of Orofacial Orthopedics* 59.6 (1998): 331-339.

24. Lambourne C., *et al*. "Malocclusion as a risk factor in the etiology of headaches in children and adolescents". *American Journal of Orthodontics and Dentofacial Orthopedics* 132.6 (2007): 754-761.

25. Taenzer P., *et al*. "Influence of psychological factors on postoperative pain, mood and analgesic requirements". *Pain* 24.3 (1986): 331-342.

26. Vandevska-Radunovic V. "Neural modulation of inflammatory reactions in dental tissues incident to orthodontic tooth movement. A review of the literature". *European Journal of Orthodontics* 21.3 (1999): 231-47.

27. Krishnan V and Davidovitch Z. "Cellular, molecular, and tissue-level reactions to orthodontic force". *American Journal of Orthodontics and Dentofacial Orthopedics* 129.4 (2006): 469.e1-32.

28. Davidovitch Z., *et al*. "Neurotransmitters, cytokines, and the control of alveolar bone remodeling in orthodontics". *Dental Clinics of North America* 32.3 (1988): 411-435.

29. Alhashimi N., *et al*. "Orthodontic tooth movement and de novo synthesis of proinflammatory cytokines". *American Journal of Orthodontics and Dentofacial Orthopedics* 119.3 (2001): 307-312.

30. Baba S., *et al*. "Immunocompetent cells and cytokine expression in the rat periodontal ligament at the initial stage of orthodontic tooth movement". *Archives of Oral Biology* 56.5 (2011): 466-473.

31. Verri WA Jr., *et al*. "Hypernociceptive role of cytokines and chemokines: targets for analgesic drug development?" *Pharmacology and Therapeutics* 112.1 (2006): 116-138.

32. Sood M., *et al*. "Neuroplastic changes in the sensorimotor cortex associated with orthodontic tooth movement in rats". *The Journal of Comparative Neurology* 523.10 (2015): 1548-1568.

33. Mizoguchi N., *et al*. "Spatiotemporal dynamics of long-term potentiation in rat insular cortex revealed by optical imaging". *Neurobiology of Learning and Memory* 96.3 (2011): 468-478.

Volume 17 Issue 12 December 2018