

Evaluation of pain felt by patients during orthodontic diagnostic material collection and direct bonding procedures

Ortodontik teşhis materyalinin toplanması ve direkt bonding işlemleri sırasında hastaların hissettiği ağrının değerlendirilmesi

Saadet ÇINARSOY CİĞERİM¹ 
Ahmet KARAMAN² 

¹Department of Orthodontics,
Faculty of Dentistry, Van Yüzüncü
Yıl University, Van, Turkey

²Department of Orthodontics,
Faculty of Dentistry, İstanbul Aydın
University, İstanbul, Turkey



ABSTRACT

Objective: The aim of this study to evaluate pain felt by patients during orthodontic diagnostic material collection and direct bonding procedures

Methods: A total of 400 individuals (250 females, 150 males) between the ages of 11 and 20. The pain values of the patients during the orthodontic diagnostic material collection and the direct bonding procedures were recorded using the VAS (Visual analogue scale).

Results: The mean values of the pain felt during the taking dental impression procedure was found to be higher than the mean value of the pain felt during dental radiography. Values of the pain felt during taking dental impression, lip/cheek retractor placement, polishing, acid etching and sealing, and bracket bonding procedures differed by age groups and the mean pain values were higher in the younger age group. There was no statistically significant difference between the pain felt during intraoral photographing and the pain felt during the lip/cheek retractor placement in the bonding procedure.

Conclusion: It was determined that patients felt more pain at various stages of orthodontic diagnostic material collection and direct bonding procedures.

Key Words: VAS, Direct Bonding, Pain, Orthodontics

ÖZ

Amaç: Bu çalışmanın amacı, ortodontik teşhis materyalinin toplanması ve direkt bonding işlemleri sırasında hastaların hissettikleri ağrı seviyelerinin incelenmesidir.

Yöntemler: Çalışmaya, 11-20 yaş arasında toplam 400 birey (250 bayan, 150 erkek) dahil edildi. Hastaların başlangıç kayıt materyalinin toplanması ve direkt bonding işlemlerinde hissettikleri ağrı değerleri VAS (Vizüel Analog Skala) kullanılarak kaydedildi.

Bulgular: Ağız içi ölçü alma işlemi sırasında hissedilen ağrı değerleri ortalaması, röntgen çekimi sırasında hissedilen ortalama ağrı değerinden daha yüksek bulundu. Ölçü alma, dudak ekartörü takılması, polisaj, asit ve sealing işlemleri ve braket yapıştırılması sırasında hissedilen ağrı değerleri yaş gruplarına göre farklılık göstermektedir ve küçük yaş grubunda ortalama ağrı değerleri daha yüksek elde edildi. Materyal toplama işlemlerinden ağız içi fotoğraf çekimi sırasında hissedilen ağrı ile bonding işleminde takılan dudak ekartörü sırasında hissedilen ağrı arasında istatistiksel olarak farklılık bulunmadı.

Sonuç: Ortodontik teşhis materyali toplama işlemleri ve bonding işlemlerinin çeşitli aşamalarında hastaların daha fazla ağrı hissettikleri belirlendi.

Anahtar Kelimeler: VAS, Direkt Bonding, Ağrı, Ortodonti

INTRODUCTION

The pain defined by the International Association for the Study of Pain (IASP) as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" can vary depending on cultural values, anxiety, attention, self-suggestion and past experiences.¹ Two main factors are known to affect the severity of the pain described by the person. These factors are primary or organic causes that cause pain and secondary or psychological factors that affect the perception of the pain in the central nervous system. These factors play a role in varying proportions in the description of the severity of the pain by the individual.²

Pain is a negative experience undergone by most of the patients having orthodontic treatment, which can sometimes be felt severe enough to cause the patient to give up the treatment.³ Patients feel discomfort, which they describe as pressure, strain, hurting teeth and pain after the placement of or-

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Corresponding Author/Sorumlu Yazar:
Ahmet Karaman
E-mail: ahmeet.ka@hotmail.com

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thodontic appliances. It is known that most patients who receive orthodontic treatment experience discomfort in some stages of the treatment. This feeling of discomfort can often be in the form of pressure sensation, sensitivity and pain in the teeth.⁴⁻⁶ The thought that pain may occur can cause patients to develop fear and anxiety reactions to orthodontic treatment. Due to this fear and anxiety, the individual's motivation for orthodontic treatment can be adversely affected.⁷

Patients may experience discomfort due to conditions such as a sensation of twinge, pressure and strain in the teeth that cause the pain associated with orthodontic treatment.⁸ Although it is reported that approximately 70-95% of orthodontic patients experience pain during the treatment, pain is not a major problem for most patients.^{9,10} In spite of this, approximately 8% of the patients who experience pain during the initial period of orthodontic treatment are reported to give up the treatment. In addition, some patients with painful experiences avoid orthodontic treatment despite the obvious functional need. It has been reported that there is a relationship between pain and factors such as age, gender, cultural past and physiological state (anxiety).¹¹ Emotional state and psychological predisposition of individuals significantly affect the severity of the pain caused by orthodontic procedures.¹²

Since pain is a complex phenomenon and a personal experience, it can be evaluated only indirectly. Therefore, different methods have been developed to assess pain.¹³ In studies, various scales such as VAS (visual analog scale), FPS (facial pain scale) and CAS (color analog scale) are used in the evaluation of pain, which is a subjective phenomenon. The pain felt by the individual is determined by facial expression in the FPS scale, by the darkness of the color in the CAS scale, and by the numbers between 0 and 10 in the VAS scale.^{9,13-15} Although there are many studies evaluating the level of pain felt by patients at various stages of orthodontic treatment, we have not been able to find any study in the literature on the evaluation of levels of pain felt related to orthodontic diagnostic material collection and direct bonding procedures. This study aims to evaluate the pain levels felt by patients during the procedures of orthodontic diagnostic material collection and direct bonding.

MATERIAL AND METHODS

A total of 400 randomly selected patients within the age range of 11-20, who were admitted for treatment at the Van Yüzüncü Yıl University, Faculty of Dentistry Orthodontics Clinic between the years 2018-2021, were included in the study. Since the patients who applied to the clinic for orthodontic treatment were generally between the ages of 11-20, the patients were selected from this age group. Sufficient sample size was calculated as 250 in the power analysis for this study performed with G*Power 3.1 software (alpha error probability = 0.05). Following the planning of the study, Clinical Research Ethics Committee approval was obtained (Decision number: 10-25/04/2018). The patients were informed in detail about the scale to be used in the study, the method to be applied, the duration and purpose of the study. The levels of the pain felt by the patients related to the procedures during the session before the orthodontic treatment in which orthodontic diagnostic material collection and direct bonding were performed were recorded using VAS.

During the material collection procedure, routine orthodontic records were collected from all the patients, including intra- and extraoral photographs, panoramic, cephalometric and hand-

wrist films, taking dental impression and models, anamnesis and clinical examination forms. Orthodontic diagnostic material collection procedures include intraoral photographing, dental impression and dental radiography, while direct bonding procedures include lip/cheek retractor placement, polishing, acid etching and sealing and bracket bonding. While collecting the material, lip/cheek retractors (Hager & Werken), mouth mirrors (Ortho Technology) and digital camera (Canon 450D) were used. All the radiographs were taken with X-ray unit (Dentsply Sirona). The VAS we used consists of vertical lines from 0 to 10. One of the 2 end-points of these lines is indicated as the 'no pain' point and the other as the 'severe pain' point. The patient defines the pain she/he feels by determining a point between these two ends.

Statistical Analysis

After the evaluation of VAS by the patients, the descriptive statistics emphasized in terms of the features were expressed as mean and standard deviation for continuous variables, and as number and percentage for categorical variables. Statistical analyses were performed using IBM SPSS Version 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.) statistical package program. Mean, standard deviation, minimum and maximum values of each measurement were calculated. The conformity of data to normal distribution was examined with the Shapiro-Wilk test. The Mann-Whitney U test was used to compare the data not conforming to normal distribution between the groups, while the Wilcoxon signed-rank test and Friedman tests were used for intra-group comparison. Analysis results were presented as the median (min-max). The level of statistical significance was set as $P < .05$. The findings were evaluated at a 90% confidence interval.

RESULTS

The age distribution and mean age of the patients participating in the study in terms of gender are shown in Table 1. The mean age of female patients ($n=250, 62.5\%$) is 15.17, while the mean age of male patients ($n=150, 37.5\%$) is 14.56. The mean age of all the patients is 14.94 years. 220 patients were in the 11-15 age group and 180 patients were in the 16-20 age group. Descriptive statistics are shown in Table 2.

Comparison of VAS values according to different orthodontic procedures is shown in Table 3. A significant difference is observed in the comparison of VAS values for orthodontic diagnostic material collection and direct bonding procedures ($P < .001$). There is no statistical difference between the pain during intraoral photographing and the pain during lip/cheek retractor placement ($P > .05$). The value of the pain felt during intraoral photographing and lip/cheek retractor placement is higher.

Comparison of VAS values according to gender is shown in Table 4. When the VAS values measured in orthodontic diagnostic material collection and direct bonding procedures are compared in terms of gender, there is no difference between females and males regarding pain values ($P > .05$). When female and male groups are evaluated within themselves, a difference is observed in the VAS pain values measured in orthodontic diagnostic material collection and direct bonding procedures ($P < .001$). Among

Table 1. Age distribution and average age of all patients by gender

Gender	n	%	Age range	Average age
Female	250	62.5	11-20	15.17
Male	150	37.5	11-20	14.56
Total	400	100	11-20	14.94

Table 2. Descriptive statistics of VAS (visual analog scale) values

Gender	Age	Intraoral photograph	Dental impression	Dental radiography	lip/cheek retractor placement	Polishing	Acid etching and sealing	Bracket bonding	Total mean values of orthodontic diagnostic material collection	Total mean values of Direct bonding		
Male	11-15	Mn.	13.27	3.63	2.35	.77	3.85	1.77	1.71	1.73	2.25	2.27
		Sd.	1.410	3.078	2.869	1.777	2.843	1.789	2.492	1.987	2.154	1.688
	16-20	Mn.	16.85	2.74	.89	.59	2.07	.59	.78	1.00	1.41	1.11
		Sd.	1.199	3.580	2.063	1.421	2.269	.971	1.601	1.617	1.864	1.281
	Total	Mn.	14.56	3.31	1.83	.71	3.21	1.35	1.37	1.47	1.95	1.85
		Sd.	2.182	3.271	2.688	1.650	2.772	1.640	2.247	1.884	2.082	1.642
Female	11-15	Mn.	13.31	4.19	2.34	.45	4.02	2.05	1.69	2.08	2.33	2.46
		Sd.	1.409	3.348	2.764	.953	2.922	2.486	2.406	2.657	1.774	1.723
	16-20	Mn.	17.02	3.54	1.76	.43	2.83	1.33	1.08	1.22	1.91	1.60
		Sd.	.975	3.182	2.448	1.187	2.562	1.741	1.579	1.689	1.590	1.317
	Total	Mn.	15.18	3.86	2.05	.44	3.42	1.69	1.38	1.65	2.12	2.03
		Sd.	2.218	3.268	2.615	1.073	2.800	2.164	2.047	2.255	1.690	1.585
Total	11-15	Mn.	13.29	3.95	2.35	.59	3.95	1.93	1.70	1.93	2.29	2.38
		Sd.	1.403	3.231	2.797	1.377	2.876	2.204	2.433	2.384	1.940	1.703
	16-20	Mn.	16.97	3.30	1.50	.48	2.60	1.11	.99	1.16	1.76	1.45
		Sd.	1.043	3.306	2.362	1.256	2.490	1.583	1.583	1.662	1.682	1.319
	Total	Mn.	14.95	3.66	1.97	.54	3.34	1.56	1.38	1.58	2.05	1.96
		Sd.	2.220	3.273	2.638	1.322	2.784	1.986	2.118	2.120	1.843	1.605

Table 3. Comparison of VAS values according to different orthodontic procedures

	Median (min-max)	Test Statistics *	P
Intraoral photograph	3 (0 - 10)c	302.409	< .01
Dental impression	1 (0 - 10)b		
Dental radiography	0 (0 - 10)a		
Lip/cheek retractor placement	3 (0 - 10)ac		
Polishing	1 (0 - 9)ab		
Acid etching and sealing	0 (0 - 10)ab		
Bracket bonding	1 (0 - 10)ab		

a-c: there is no difference between the VAS values of procedures with the same letter.
*Friedman test statistics, VAS (visual analog scale)

Table 4. Comparison of VAS values by gender

	Male	Female	Test Statistics **	P
Intraoral photograph	3 (0 - 10)b	4 (0 - 10)b	4223.0	0.235
Dental impression	0 (0 - 10)c	1 (0 - 10)a	4352.0	0.367
Dental radiography	0 (0 - 10)a	0 (0 - 7)c	4540.0	0.598
Lip/cheek retractor placement	3 (0 - 10)b	3 (0 - 10)b	4487.0	0.610
Polishing	1 (0 - 5)ac	1 (0 - 9)a	4446.5	0.521
Acid etching and sealing	0 (0 - 9)ac	1 (0 - 10)a	4416.5	0.459
Bracket bonding	1 (0 - 8)ac	1 (0 - 10)a	4634.0	0.886
Test statistic *	980.25	205.572		
P	< .01	< .01		

a-c: In any gender, there is no difference between the VAS values of procedures with the same letter.
*Friedman test statistic, **Mann Whitney U test, VAS (visual analog scale)

Table 5. Comparison of VAS values by age groups

	11-15 age group	16-20 age group	Test Statistics **	P
Intraoral photograph	3 (0 - 10)b	3 (0 - 10)bd	4293.5	0.102
Dental impression	1 (0 - 10)a	0 (0 - 10)c	3995.0	0.012
Dental radiography	0 (0 - 10)c	0 (0 - 7)a	4777.5	0.548
Lip/cheek retractor placement	4 (0 - 10)b	2 (0 - 10)b	3581.5	0.001
Polishing	1 (0 - 9)a	0 (0 - 8)ac	3927.5	0.008
Acid etching and sealing	1 (0 - 10)a	0 (0 - 7)ac	4156.5	0.035
Bracket bonding	1 (0 - 10)a	0 (0 - 6)acd	4122.0	0.030
Test statistic*	174.626			
P	< .01	< .01		

a-d: In any age groups, there is no difference between the VAS values of procedures with the same letter.
*Friedman test statistic, **Mann Whitney U test, VAS (visual analog scale)

female and male patients, the values of pain felt during intraoral photography and lip/cheek retractor placement were higher than the others.

Comparison of VAS values by age groups is shown in Table 5. Values of pain felt during the procedures of taking dental impression, lip/cheek retractor placement, polishing, acid etching and sealing, and bracket bonding were different in 11-15 and 16-20 age groups, and pain values were higher in the 11-15 age group. A difference is observed in the values of pain felt in orthodontic diagnostic material collection and direct bonding procedures in the 11-15 age group ($P < .001$). The lowest value was obtained in the pain felt during dental radiography. The values of pain felt during intraoral photographing and lip/cheek retractor placement have been found to be the highest. There was a difference in the median values of the patients in the 16-20 age group ($P < .001$). The highest mean values were obtained in the pain felt during intraoral photographing and lip/cheek retractor placement.

DISCUSSION

Pain is a subjective response that shows individual variations depending on factors such as age, gender, individual pain threshold, the magnitude of applied force, current emotional state and stress, cultural differences, and previous pain experiences. Studies have shown that orthodontic procedures such as separator placement, archwire placement and activation, application of orthopedic force and extraction cause pain in patients.¹⁶

Various discomforts experienced by patients after placement of appliances are often defined as sensations such as pain, pressure, tension, and toothache.⁸ Orthodontic pain affects the daily lives of patients. The main reason for this is the aesthetic and functional effects of the mechanics used. In a study conducted on 116 patients, pain occurred in 18% of the patients during clinical sessions, and 58.5% within 1-2 days following the session. Only 26.5% of these patients use painkillers. As a result of the study, it was observed that orthodontists do not know and care about the severity of pain in their patients.¹⁷

Studies have reported that there is little or no relationship between the objective severity of a pain stimulus and the response or personal experience of pain. Therefore, pain experience is affected not only by emotional and cognitive factors but also by environmental factors such as culture, gender and age.¹⁸ In clinical pain studies, it was determined that women were more intolerant

to pain and felt pain longer.^{9,19} However, in some studies, no difference was found between genders.^{18,20,21} Also in our study, no difference was found between the pain values of females and males.

In dentistry, concerns and fears of the patients are among the most prominent emotional factors. Depending on different target populations and research methods, 3-21% of children and adolescents have been reported to be fearful or anxious when visiting a dentist.²² In addition, various psychological factors such as depression, anxiety, poor body image and low self-esteem, which are associated with increased pain perception during adolescence, have important effects primarily on postpubertal girls.²³ In a population-based study, adolescents (aged 11-18) were investigated for factors that affected depression prevalence and depression, and the prevalence of depression in girls was reported to be higher than that of boys, while pubertal onset was more likely to affect the severity of depressive symptoms in girls.²⁴ Litt²⁵ argues that anxiety and pain may not be distinguished from one another. According to Litt,²⁵ anxiety lowers the pain threshold and may cause stimulants that are normally painless to be perceived as painful. This is mainly explained by the fact that anxiety increases the future pain expectation created by previous pain experiences.²⁶ It is often noted that increased anxiety levels are parallel with increased pain reports.^{27,28} In our study, patients differed in the VAS values measured for orthodontic diagnostic material collection and direct bonding procedures. While there was no statistical difference between the value of the pain felt during intraoral photographing and the value of the pain felt during lip/check retractor placement, the value of the pain felt during intraoral photography and the value of the pain felt during lip/check retractor placement were higher than the others.

In their studies, Berguis et al.¹⁸ and Scheurer et al.⁹ stated that girls felt pain more often than boys. In their study, Tauheed et al.²⁹ asked patients to rate the pain they felt during pre-treatment recording, separator placement, band and bracket bonding, and after wire activation visits. There was no statistically significant difference between males and females. Various biophysiological and psychosocial factors can contribute to age and gender differences in perception of pain during adolescence.^{30,31} It has been shown that, in response to a painful stimulus, the contralateral prefrontal cortex, contralateral insula, and thalamus of girls have significantly higher activation compared to boys, and that there is a natural sexual dimorphism against pain.³² Also, the difference in perception of pain by gender varies significantly after the onset of puberty and menarche due to complex central and peripheral interactions between pain-specific neurotransmitters and ovarian hormones.^{31,33} In our study, when the orthodontic diagnostic material collection and direct bonding procedures were compared in terms of gender, no difference was found between the pain values of females and males. When female and male groups are evaluated within themselves, a difference was observed in the values of the pain felt during orthodontic diagnostic material collection and direct bonding procedures. Among female and male patients, the values of the pain felt during intraoral photography and lip/check retractor placement were found to be higher than the others.

Pain is considered as a subjective and unpleasant condition that is not always associated with a stimulant. Even when there is no direct tissue damage, pain may be reported, and it may be caused by emotional or cognitive factors. In a subjective report, there is no way to distinguish pain experiences without any pathophysio-

logical cause from those caused by tissue damage. This may also be true for orthodontic patients when complaining of sudden pain in the absence of physical causes. However, although pain is an unreliable indicator of pathology, reporting of pain by the patient is an important diagnostic tool in orthodontics and dentistry in general.³⁴

In the literature, the effects of different types of (fixed and functional) appliances on pain have been investigated. Oliver and Knapmann³⁵ found no difference in the amount of discomfort caused by fixed or removable appliances. Sergl et al.¹² have reported that fixed and functional appliances cause more discomfort than removable appliances. Stewart et al.³⁶ have shown that fixed appliances cause more pain than removable appliances. Sergl et al.¹² followed the adaptation to new appliances in their study on 84 individuals with orthodontic treatment and evaluated the relationship between the appliance and the pain/discomfort experience. Sandhu and Leckie³⁷ have shown in their study that there is a significant positive interaction effect between age and gender and that the effect of gender on pain is age-dependent. They indicate that pain is at the highest level in the female group aged 15-18, and the lowest mean pain is in the male group aged 12-15. In our study, values of the pain felt during taking dental impression, lip/check retractor placement, polishing, acid etching and sealing, and bracket bonding differed in the 11-15 and 16-20 age groups, and pain values were higher in the 11-15 age group. A difference is observed in the values of the pain felt in orthodontic diagnostic material collection and direct bonding procedures in the 11-15 age group. The highest mean values for the 11-15 and 16-20 age groups were obtained in the pain felt during intraoral photographing and lip/check retractor placement. During the placement of a mirror for a photo shoot, patients may feel pain due to direct trauma to the lips, cheeks and other soft tissues in the mouth. In addition, stretching of the lip and cheek creates stress in patients, it is possible that this tension is perceived and reported as pain. Pain may occur due to pulling of the cheeks and lips during the retraction process. Even if a photo mirror or retractor is selected in the appropriate size for patients, they may not fit each patient one to one. For this reason, the probability of pain and discomfort increases. In addition, mirrors placed in the mouth during photography can cause pain by pressing directly on the retromolar area of the lower jaw and the tuberos and soft palate area of the upper jaw. The limitations of this study are that not all the stages of orthodontic treatment have been examined, pain measurements have been evaluated only once right after the procedures, and the duration of orthodontic procedures performed has been ignored.

CONCLUSION

Intraoral photographing and lip/check retractor placement were determined to be the most painful procedures. These results have shown that different procedures performed during orthodontic treatment cause different levels of pain. Knowing in advance which procedure is more painful will increase the success of the management of the pain and hence ensure the compliance of the patients to orthodontic treatment. Further studies are needed, in which the pain levels of different orthodontic procedures are evaluated, and the number of patients is higher.

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