Research Paper

The Association Between Motivation and Pain in Patients Undergoing Orthodontic Treatment

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ABSTRACT

Background and Purpose: Success in orthodontic treatment is achieved by using devices and techniques to minimize patient discomfort. This study was designed to investigate the relationship between treatment motivation and pain intensity reported by the patient in the early stages of orthodontic treatment.

Materials and Methods: In this cross-sectional study, 194 orthodontic candidates for fixed treatment were included. In the first part, the patients' motivation was measured using a 27-item researcher-made questionnaire with 5 sections related to the patient's motivation. In the second part, patients' pain intensity was recorded using a pain visual analog scale (VAS). The obtained data were analyzed using SPSS software, version 26.

Results: Findings suggested that the highest and lowest motivation scores were related to the importance of occlusion (91.75±12.79) and the degree of understanding of the problem (66.39±22.44), respectively. No statistically significant difference was observed between the components of motivation by gender, marital status, employment status, age, and smoking (P>0.05). Moreover, there was no significant association between the intensity of dental pain and any treatment motivation components. However, there was a statistically negative correlation between the intensity of mucosal pain and the understanding of the treatment process.

Conclusion: No significant relationship between treatment motivation and pain intensity was reported by patients in the early stages of orthodontic treatment. Orthodontists are encouraged to increase their flexibility and patient management skills to avert their patients' desire to cease their therapy due to intrusive factors such as pain.

Keywords: Pain intensity, Treatment motivation, Orthodontics

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Introduction

According to the "International Association for the Study of Pain (IASP)," pain is a disagreeable sensory and emotional experience related to potential or actual tissue damage or described regarding such damage. In dental treatments, pain is experienced as a response to harmful stimuli, influenced by general and individual factors [1, 2].

Studies show that almost 90% of patients experience pain during their orthodontic treatment. It has been reported that the intensity of pain peaks in the first 24 hours after applying orthodontic forces. Most people report discomfort during the first week, and 25%-42% continue experiencing it even after one week. It is not a big deal for most patients, but initial pain experiences have caused 10% of patients to stop their treatment. Correspondingly, the expectation of a painful experience has made some patients quit the procedure despite the actual need for orthodontic treatment [3, 4].

Discomfort and pain are observed in orthodontics due to the force used to stimulate tooth movement. These forces cause transitory pulpitis, compression of the periodontal ligament (PDL), local ischemia in the PDL, direct mechanical traumas, and pain-inducing factors in the treatment procedures [4]. Patients who are sensitive to pain overreact to dental pain. Moreover, factors such as negative dental experience and anxiety have increased reporting pain from general dental treatments [1, 2].

Since pain severity depends on the patient's personality, emotional aspects, such as motivation, affect pain reports during treatment. In addition, subjective factors such as a patient's perception of the dental situation and esthetics affect their willingness to undergo orthodontic treatment. The treatment motivation comprises these factors and the patient's information on the orthodontic treatment [3, 5].

Perceiving the patient's characteristics and psychological motivations is necessary for a successful treatment. In addition, these factors may affect the patient's satisfaction and adherence to treatment. Therefore, clinicians must investigate the relationship between treatment motivation and pain severity reported by patients in the early stages of orthodontic treatment to expand their understanding. This research can improve the patient's treatment experience and result in successful treatment [6].

Some studies have suggested that the patient's motivation in receiving orthodontic treatment is effective in the level of pain reported by them [7]. However, others found that the level of motivation is not significantly associated with the patient's pain [8, 9]. Considering the importance of patient management in dental settings and the existing controversies over the role of motivation, this study aimed to investigate the relationship between treatment motivation and pain severity reported by the patient in the initial stages of orthodontic treatment.

Materials and Methods

This cross-sectional descriptive study investigated 194 candidates for fixed orthodontic treatment referring to private medical centers in Amol, Babol, and Sari cities in Mazandaran Province, Iran, in 2020-2021. The sample size was calculated according to Campos et al.'s investigation [5]; the test power was considered 80%, and the measurement error was 0.05, using the Equation 1:

$$1. \quad n \geq \left[\frac{z_{1-\frac{a}{2}} + z_{1-\beta}}{\frac{1}{2} \log_e \frac{1+r}{1-r}} \right]^2 + 3$$

The inclusion criteria consisted of fixed orthodontic candidates aged 15 to 30 years who were willing to participate in the study and had completed primary school education so that they could complete the questionnaire. On the other hand, those with mental or systemic diseases, a history of previous orthodontic treatment, high buccal canine, and any painful factors other than brackets and archwire during the evaluation that affected the patient pain and cooperation, such as caries, pulpal lesions, separator, mini screw, intraoral appliances (e.g. Nance and transpalatal arch [TPA]), and extra-oral appliances (e.g. facemask and headgear), patients who used analgesics and anti-inflammatory drugs, and patients who were not originally from Mazandaran Province were excluded from the study [10].

The researchers conducted the study in two parts. First, they measured the patients' motivation using a questionnaire with 27 questions and five sections: Perceived severity, dental esthetic, willingness to treat, treatment perception, and occlusion importance [5]. To assess the validity and reliability of the questionnaire, it was translated using the forward-backward method. The initial translated questionnaire was assessed and edited by two experts individually. Subsequently, the edited version was evaluated by 10 orthodontists indi-

Ghasemi T, et al. Motivation and Pain in Orthodontics. Iran J Health Sci. 2024; 12(3):231-239.

vidually. The internal consistency was investigated using the Cronbach α coefficient in each domain. The inter-class correlation coefficient (ICC) was calculated using variance analysis to determine reliability. To evaluate the reliability, the questionnaire was completed by 30 selected participants based on the inclusion criteria. They completed the questionnaire again after a week while maintaining the conditions. The reliability test showed good to excellent accuracy (ICC=88%) and a Cronbach α value of 93% for all questionnaire domains.

Subsequently, the visual analog scale (VAS) was used to record the patient's pain severity. The VAS is the most widely used pain measurement instrument, whereby the patient determines the pain severity level on a 10-cm line from 0 (no pain) to 10 (severe pain). Scores 1-3 indicate mild pain, 4-7 show moderate pain, and 8-10 represent severe pain. Khosravi et al. confirmed the validity and reliability of this scale in Iran [11].

For scoring the questionnaire, the patient wrote the score for each item based on VAS from 0-100. The total score for each person ranged from 0 to 2700. The researchers calculated the maximum score for each section (five sections) of the questionnaire separately. To obtain the mean score, they divided the recorded scores by the number of items and got the arithmetic mean of each person in general and separately for each part of the questionnaire. The mean pain for each patient on each day was obtained by dividing the total score obtained from VAS for dental pain and buccal mucosal pain by two.

After completing the above procedures, the researchers explained the process and obtained written informed consent from the patients in the first treatment session. Next, the patients completed the motivation evaluation questionnaire. To evaluate the pain severity on the first day, the clinician fixed the 0.022-inch slot MBT bracket on the teeth and attached the archwire (NiTi 14). Following the placement of brackets and archwire, the patient received the required information about the mucosal and dental pain. They were instructed to record pain severity every morning after waking up using VAS separately for dental and mucosal pain from the 1st to the 10th day.

The obtained data were analyzed using SPSS software, version 26, and the descriptive statistics included Mean±SD, frequency, and ratio. The t-test, the chi-square test, and Pearson correlation analysis were used to evaluate the existing relationships with a significance level of 0.05.

Results

This study recruited 194 participants, 84% females, who had signed an informed consent. The mean age of the participants was 21.58±7.4 years. Demographic features of the patients are presented in Table 1.

Furthermore, Table 2 separately presents the Mean±SD of dental and mucosal pain intensity scores (from 0 to 10) for the first 10 days after orthodontic treatment. The severity of dental and mucosal pain is the highest on the 2nd day, and it reaches its lowest value on the 10th day with a decreasing trend from the 2nd day (Figures 1 and 2).

Table 1. Demographic features of the participants

Variables		No. (%)
Sex	Male	31(16)
	Female	163(84)
Marital status	Single	152(78.4)
	Married	42(21.6)
Job	Studying	122(62.9)
	Working	41(21.1)
	None	31(16)
Smoking status	Yes	4(2)
	No	190(98)

Ghasemi T, et al. Motivation and Pain in Orthodontics. Iran J Health Sci. 2024; 12(3):231-239.

233

Table 2. The Mean±SD of dental and mucosal pain intensity

Variables	Mean±SD	
	Dental Pain	Mucosal Pain
Day 1	4.48±3.07	3.41±3.32
Day 2	4.6±2.86	3.64±3.21
Day 3	3.75±2.79	3.04±3.09
Day 4	2.94±2.64	2.48±2.68
Day 5	2.46±2.52	2.16±2.49
Day 6	2.09±2.34	1.76±2.23
Day 7	1.69±2.13	1.49±2.11
Day 8	1.34±1.89	1.34±1.95
Day 9	1.2±1.8	1.09±1.89
Day 10	1.12±1.82	0.95±1.7
Total	2.57±1.9	2.13±2.08

The participants' treatment motivation components were compared based on the demographic variables. There was no significant relationship between motivation components and the participant's gender and age. Table 3 presents the demographic variables' Mean±SD of treatment motivation components.

A comparison of the mean dental and mucosal pain severity regarding demographic variables reveals that it is higher in women than men, though it is not statistically significant. In addition, the severity of dental and mucosal pain increases with age, showing a positive and significant relationship (r=0.141, P=0.049; r=0.212, P=0.003, respectively). Table 4 illustrates the Mean±SD of the pain severity of participants by demographic features.

Examining the relationship between the dental and mucosal pain severity and the components of treatment motivation demonstrates no significant relationship between the dental pain severity and any treatment motivation components. However, a negative and significant relationship is observed between the severity of mucosal pain and treatment perception (r=-0.143, P=0.047). Table 5 presents the correlation test results between the dental and mucosal pain severity and treatment motivation components.

Discussion

A high frequency of pain after orthodontic treatment can result in failure and prevention of the patients to continue with their treatment. Therefore, it seems crucial to find factors associated with controlling their pain [5]. This study revealed that none of the treatment motivation components were significantly associated with pain severity. Similarly, Campos et al., investigating the relationship between orthodontic pain severity and patients' motivation, did not report a significant relationship between motivation and pain severity [5]. Moreover, Tauheed et al. could not find a significant relationship between a higher level of motivation and less perception of pain [8].

In the present study, none of the treatment motivation components had a significant relationship with pain intensity; however, the dental esthetics component had the lowest P (0.247) with a positive correlation. The leading cause of this correlation was related to question number 8 (A beautiful smile is essential), which had the highest average among 27 questions related to patients' motivation for orthodontic treatment.

The study results show that the maximum severity of dental and mucosal pain occurs 24-48 hours after orthodontic treatment. Then, it decreases continuously until the 10th day but does not reach zero. Previous studies have reported that pain, except in the tongue, contin-
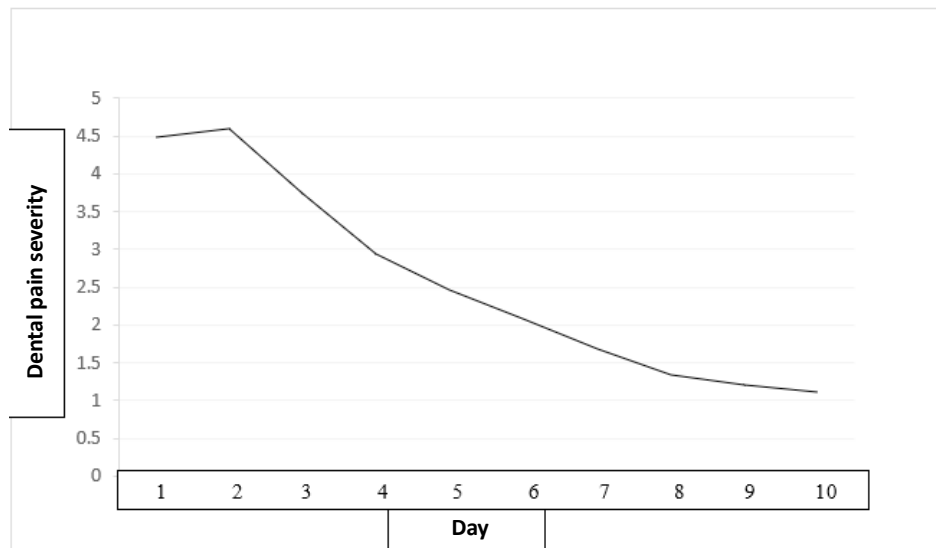
Figure 1. The dental pain severity in the 1st ten days after orthodontic treatment

ues for at least over a month after the start of orthodontic treatment in most cases [12]. Similar to the present study, Johal et al. reported that the pain severity peaks between 24 hours and 3 days after orthodontic treatment [13].

In the present study, the severity of dental and mucosal pain in women was higher than in men, though it was not statistically significant. The pain threshold is lower in women, and research shows that men suffer less pain than women after surgery. This difference can be attributed to sex hormones as well as the difference in their sensory mechanism [14, 15].

Improved appearance and function of the teeth are the highest orthodontic treatment expectations, and patients' perceptions of their appearance, age, and the severity of their malocclusion are the main reasons for seeking treatment [14, 16]. It seems that both adults and children have basic knowledge and practical expectations of orthodontic treatment, but parents are more realistic about the effect of treatment than children. This difference might be attributed to the fact that orthodontic treatment is relatively common nowadays, and parents have more access to different sources to learn more about this type of treatment. However, studies have reported very different results between increasing age and pain intensity [17, 18]. In the present study, there was a positive significant correlation between age
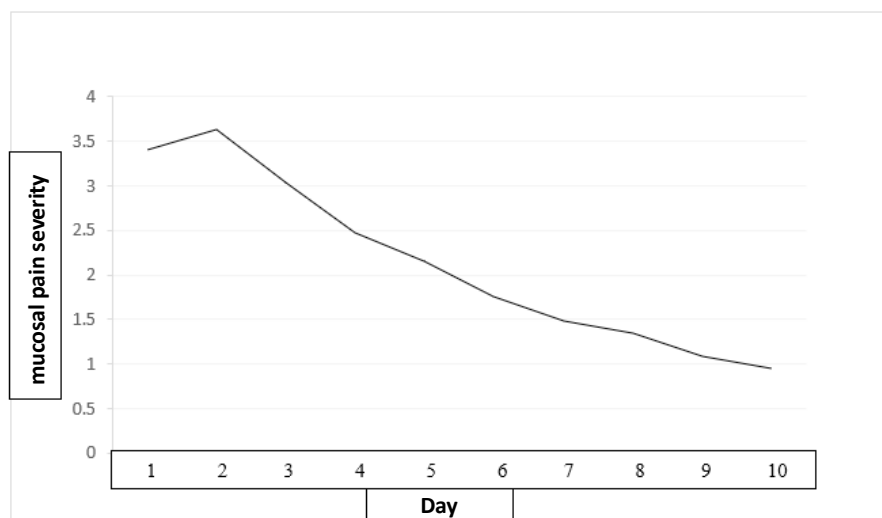

Figure 2. The mucosal pain severity in the 1st ten days after orthodontic treatment

Ghasemi T, et al. Motivation and Pain in Orthodontics. Iran J Health Sci. 2024; 12(3):231-239.

235

Table 3. Mean±SD of treatment motivation components by the demographic features

Variables		Mean±SD				
		Perceived Severity	Dental Esthetics	Willingness to treat	Treatment Perception	Occlusion Importance
Gender	Male	68.63±23.64	82.35±24.12	80.55±18.13	77.89±15.01	89.70±12.43
	Female	66.01±22.33	87.78±15.38	77.77±14.50	78.37±17.19	92.11±12.88
	P	0.657	0.225	0.485	0.920	0.477
Age	Pearson coefficient	0.162	-0.07	-0.031	0.001	0.111
	P	0.086	0.460	0.747	0.995	0.239
Job	Studying	63.81±22.78	8.64±17.63	77.26±14.81	76.77±15.41	91.21±13.82
	Working	68.1±22.21	83.5±18.6	80.39±14.45	81.95±18.71	92.63±10.71
	None	74.42±20.22	86.97±16.94	79.56±16.81	80.42±19.96	93.02±10.8
	P	0.161	0.328	0.655	0.404	0.813
Marital status	Married	94.27±22.81	86.82±18.32	77.54±14.58	76.63±15.52	19.62±12.96
	Single	71.38±21.03	87.35±13.4	79.7±16.18	82.14±19.24	92.08±12.56
	P	0.122	0.887	0.486	0.110	0.869
Smoking status	No	66.05±22.41	86.87±7.5	78.2±15.16	78.53±16.86	91.83±12.78
	Yes	85.35±20.7	92±10.6	77.5±5.3	64.28±4.04	87.5±17.67
	P	0.230	0.644	0.948	0.237	0.637

and the intensity of dental (r=-0.141, P=0.049) and mucosal pain (r=-0.212, P=0.003).

The role of age in pain has yet to be understood. It may be because of the different measurement methods that there is no clear relationship [19]. Some studies have reported higher pain levels in older people [20], while others have found no association between pain and age [13]. For example, adolescents experience higher pain levels than youth and adults. Although researchers have reported a negative linear correlation between age and general pain up to 25 years, this relationship is not linear in orthodontics, and the most critical age is between 12 and 18 years old [9].

Previous studies suggest that patients may adapt to persistent pain as the treatment progresses since this sensation ceases or they are distracted. A dentist should know exactly and explain to the patient how much time is required for adaptation, and that malocclusion and dentofacial abnormalities can cause physical, social, and psychological discomfort. The patient's expectations of the orthodontic treatment procedure and its effect on the quality of life (QoL) are essential in many ways. Their expectations of treatment, unrealistic orthodontic treatment perception, and its consequences can affect their adaptation to treatment. Orthodontic treatments affect the patient's life, especially in the initial stages of treatment. A study showed that more than 85% of patients believed their QoL had changed after starting fixed orthodontic treatment [12].

The present investigation found that the patient's motivation is not statistically associated with his or her pain level during orthodontic treatment. Notably, since the data were collected based on the patient's self-report of their pain intensity, the results may have been influenced by the subjective interpretations of the participants and recall bias. Moreover, a small sample size and a lack of patient cooperation were other limitations of the current study.

Ghasemi T, et al. Motivation and Pain in Orthodontics. Iran J Health Sci. 2024; 12(3):231-239.

Table 4. Mean±SD of pain severity of participants by the demographic features

Variables		Mean±SD	
		Dental Pain	**Mucosal Pain**
Gender	Male	2.12±1.50	2.00±2.04
	Female	2.81±1.85	2.33±2.18
	P*	0.054	0.546
Age	Pearson coefficient	0.141	0.212
	P**	0.049	0.003
Job	Studying	2.27±1.78	1.73±2.05
	Working	3.04±1.87	3.07±1.15
	None	3.24±2.21	2.78±2.3
	P***	0.063	0.013
Marital status	Single	2.17±1.62	1.74±1.92
	Married	3.49±2.21	3.07±2.16
	P*	0.001	0.02
Smoking status	No	2.6±1.9	2.16±2.09
	Yes	0.75±1.06	0.65±0.91
	P*	0.175	0.310

*Independent t-test, **Pearson correlation test, ***Analysis of variance.

Conclusion

The severity of dental pain in orthodontic patients was unrelated to their treatment motivation during the first ten days after placing the appliance. On the other hand, the severity of mucosal pain was lower in patients familiar with the orthodontic treatment process. Therefore, the orthodontist should spend enough time explaining the possible discomfort during the treatment and use the need for treatment as a motivational stimulus. In addition, more communication between the patient and the orthodontist regarding pain management can improve the patient's QoL during orthodontic treatment and increase their therapeutic cooperation and satisfaction.

Table 5. The correlation between the dental and mucosal pain severity with the components of treatment motivation

Variables		Perceived Severity	Dental Esthetics	Willingness to Treat	Treatment Perception	Occlusion Importance
Mucosal pain severity	Pearson coefficient	0.049	0.027	-0.046	-0.143	0.029
	P*	0.495	0.706	0.522	0.047	0.84
Dental pain severity	Pearson coefficient	0.050	0.084	0.070	-0.017	0.026
	P*	0.492	0.247	0.332	0.810	0.715

*The Pearson correlation test.

Ghasemi T, et al. Motivation and Pain in Orthodontics. Iran J Health Sci. 2024; 12(3):231-239.

237

Ethical Considerations

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