

## A COMPARISON OF TWO PAIN SCALES IN THE ASSESSMENT OF DENTAL PAIN DURING INITIAL PHASE OF ORTHODONTIC TREATMENT

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### Abstract

The aim of this study is to assess pain in a group of orthodontics patients during initial leveling and aligning phase of orthodontic treatment and also to compare pain measurement techniques, that is, visual analogue scale (VAS) and faces pain scale (FPS).

A cross-sectional study was conducted on 121 patients aged 19 to 25 years who had undergone initial leveling and aligning phase of orthodontic treatment. The patients were assessed for their pain sensitivity using VAS and FPS. The follow-up period was 1 month. Outcome was assessed with using both scales at baseline and 8 pre-specified follow-up points (1h, 6h, 12h, 1d, 3d, 7d, 15d, 1m). Statistical analysis was performed using Kolmogorov–Smirnov, Friedman, Wilcoxon Signed Ranks and Mann-Whitney-U test, with the significance level set at 0.05.

Pain experienced by the patients started 1 h after initial arch wire placement, peaked after 1d, and subsequently declined approximately to baseline in 1-week to 1-month time period. Mean VAS values at baseline and at the end of 1 month was 0,0,3,6,9,9,0,0 and 0, respectively. Mean FPS values at baseline and at the end of 1 month was 0,0,3,3,5,5,0,0 and 0, respectively. There was no statistically significant difference between these two scales for mean average pain across all time points.

Eventhough there was no statistically significant difference between these two scales for mean average pain across all time points, the patients had more difficulty understanding the use of FPS than that of VAS. Therefore, VAS is considered the most reliable method of pain assessment. But, as an alternative, FPS can be used interchangeably in assessment of pain during orthodontic treatment.

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### Introduction

International Pain Research Association (IASP) defines the pain as sensory and emotional experience which is not pleasing which accompanies the possible or existing tissue damage or can be defined with this damage.<sup>1</sup> Pain is an early stimulating alarm system and forces the person to give proper respond for protecting against damage. Therefore it can be

said that pain is protective mechanism.<sup>2</sup> Pain is always subjective and sensing of it may different with respect to individual. In addition to objective stimulants, individual properties may also play important role in response of individual against pain.<sup>3</sup> Therefore getting anamnesis from patients, well observation and utilizing from proper pain measurement methods will be reference for future evaluations as well as it facilities initial evaluation.<sup>4</sup>

Measurement of pain which is one of the leading reasons bringing patient to physician with common language is important for nature of pain and evaluation of treatment method. There are several methods for pain measurement.<sup>5,6</sup> Use of ruler or scale in pain evaluation, provides the opportunity to translate severity and nature of

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pain which were reported by numbers or words into objective status as much as possible.<sup>5</sup> Numerical evaluation scale which is included in this provides patient to explain his/her pain with numbers. Such scales start with absence of pain and ends with point where pain get past endurance level. Most frequent used one side Visual Analog Scale (VAS) and generally it has 10 cm length and consists of measurement ruler consisting of vertical or horizontal scales which starts with no pain and ends with not endurable pain Other used methods are Faces Pain Scale (FPS) and Color Analogue Scale (CAS).<sup>7-15</sup> While pain is expressed with face expression in FPS, pain level is mentioned with darkness of color in Scale in CAS. Use of existing scales was recommended in past studies for determination of pain level.<sup>8-10</sup> In this study grading of pain levels of patients by using visual analog scale (VAS) and Face pain scale (FPS) during orthodontics treatment and comparison of results which were obtained by both methods are aimed.

### Methods

This study has been implemented over 121 orthodontics patient (61 boy, 61 girls) with age interval 19-25 age interval who had visited to our clinics, having average 2-4 mm crowding skeletal class I mandible and maxilla, who does not have any systemic disorder and not have medication usage, past trauma history, and were not subjected orthodontics treatment before. Patients of which oral hygiene is not adequate were directed to periodontology department before their treatment, included in study groups after their treatments were completed and recovery period has ended. Detailed information was given to patients and informed consent form was signed by patients. Permission was taken from Keciören Training and Research Hospital Ethical Board for execution of study (12/2014/698) rules which were foreseen by Helsinki Declaration was followed in all stages of research.

0.018×0.025 inch slotted Roth Technique brackets (Roth prescription, Gemini Metal Brackets, 3M Unitek Corporation, Monrovia, Calif) were used in treatment of all patients which are included in our study 0,014 inch NiTi superelastic arc wire (austenitic active, preformed ovoid, superelastic arch wire, 3M Unitek Corporation) was applied to conventional

brackets in early stages of maxilla and mandible during leveling of dental arcs, they were practiced with ligature wire and average 10 g force was applied. Metal-lastic separation process was not applied to molar teeth and molar direct tubes were used. (0.018×0.025 inch slot). Orthodontic treatment of patients were realized by single dentist and assistant researcher has provided the forms including the pain scale, made necessary explanations and provided patients to mark initial measurement. Evaluations of Visual Analog scale (VAS) and face pain scale (FPS) (Figure 1,2) were planned as 1 hour, 6 hours, 12 hours, 1 day, 3 days, 7 days, 15 days, 1month following fixed apparatus implanting before orthodontic treatment (beginning).

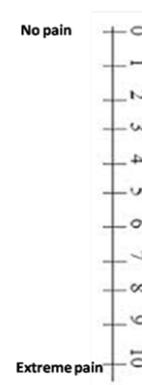


Figure 1. Visual analogue scale (VAS)

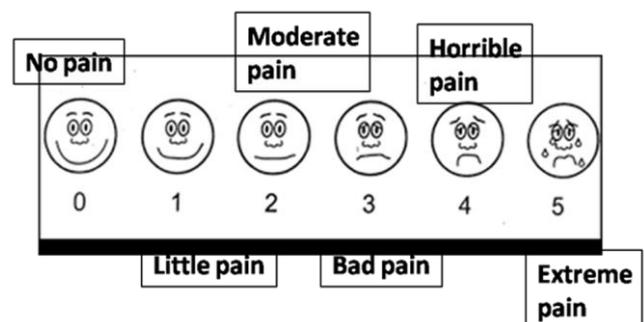


Figure 2. Faces pain scale (FPS)

VAS consists of vertical or horizontal line having 10 mm length where there is " no pain" in one edge and " not endurable pain level " at other edge.<sup>6</sup> Patients are requested to mark a location which reflects his/her pain. In this scale 1-3 mentions slight pain, 4-7 mentions moderate level pain, 8-10 mentions severe pain. However there 6 different face expressions in FPS which starts with "no pain" expression and ends with "pain" at not endurable level " (0: no pain, 1: slightly, 2: disturbing, 3: at moderate level, 4:

severe, at not endurable level). Pain scale measurement rulers were received from patients in their control appointments which were realized one month later and detailed information was taken about which scales is easy to use and more understandable.

### Statistics

MS-Excel 2003 (MS-Excel 2003 ©1985-2003, Microsoft Corporation) and SPSS for Win. Ver. 20.00 (SPSS Inc., Chicago, IL., USA) package programs were used for all statistical analysis and calculations. Normality of distributions were evaluated with Kolmogorov-Smirnov test. Comparison between repeated tests was implemented with Friedman Test and Wilcoxon Signed Ranks Test. Comparison between boy and girl patients were implemented by Mann Whitney U tests and Chi Square test. Conformity between VAS and FSP was evaluated with Spearman's rho. Significance level was considered as  $p > 0.05$ .

### Results

Complications have evolved in no patient and all patients filled the forms completely. 41 patients (33.9%) mentioned that FPS scale is easier and 80 (66.1%) patients mentioned that VAS is easier (Table 1).

	N	%
VAS	80	66.1
FSP	41	33.9
Total	121	100.0

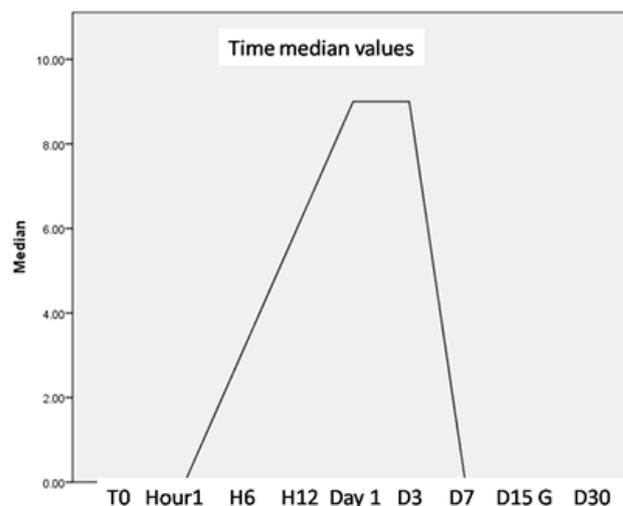
**Table 1.** Preference of the use of scale.

Average age values were presented in table 2.

	Total	Median	Min.	S.D.	Max.
Age	121	22.00	19.00	1.49	25.00

**Table 2.** Average age means.

Trend indication the change of VAS with respect to time period is presented in graphic 1. According to this most severe pain has occurred in 1. and 3. days, it decreased in 7. day and become normal in 15 day. Change of FPS with respect to time period is presented in table 3.



**Graphic 1.** Shows the mean VAS values with regard to the time points

FPS	Initial	Hour1	H6	H12	Day1	D3	D7	D15	D30
N	121	121	121	121	121	121	121	121	121
Mod	.00	.00	3.00	3.00	5.00	5.00	.00	.00	.00
Min.	.00	.00	2.00	3.00	4.00	.00	.00	.00	.00
Max.	2.00	1.00	4.00	4.00	5.00	5.00	1.00	1.00	1.00

**Table 3.** FPS measurements according to time points in the study group

According to this most severe pain has occurred in 1. and 3. days, it decreased in 7. day and become normal in 15 day. Highest and lowest values in VAS scale according time period by considering the gender difference were indicated in table 4.

VAS	Girl					Boy				
	n	Median	SS	Min.	Max.	n	Median	S.S	Min.	Max.
Initial	60	.00	.54	.00	2.00	61	.00	.50	.00	1.00
Hour 1	60	.00	.50	.00	1.00	61	.00	.50	.00	1.00
H6	60	3.00	.64	2.00	4.00	61	3.00	.64	2.00	4.00
H12	60	5.50	.85	4.00	7.00	61	6.00	.85	4.00	7.00
Day1	60	9.00	.50	9.00	10.00	61	9.00	.50	9.00	10.00
D3	60	9.00	.57	8.00	10.00	61	9.00	.56	8.00	10.00
D7	60	.50	.50	.00	1.00	61	.00	.50	.00	1.00
D15	60	.00	.50	.00	1.00	61	.00	.50	.00	1.00
D30	60	.00	.50	.00	1.00	61	.00	.50	.00	1.00

**Table 4.** VAS values with regard to the genders at different time points.

According to this highest values at girls were present at 1. and 3. day and lowest values

were observed in the beginning at 1. hour and at 7,15, and 30th days. However highest values at boys were present at 1. and 3. day and lowest values were observed in the beginning at 1. hour and at 7,15, and 30th days. Statistically significant difference were found in VAS at pain levels with respect to time period with respect to gender.(  $p < 0.05$ ) Highest and lowest values in FPS scale according time period by considering the gender difference were indicated in table 5. According to this highest values at girls were present at 1. and 3. day and lowest values were observed in the beginning at 1. hour and at 7,15, and 30th days. However highest values at boys were present at 1. and 3. day and lowest values were observed in the beginning at 1. hour and at 7,15, and 30th days. Pain levels were not considered as different in time periods at FPS test with respect to gender. ( $p > 0.05$ ) According Spearman's Rho correlation analysis; correlation between FPS and VAS was determined as following: in the beginning( $r = 0.27$ ,  $p = 0.02$ ), at first hour ( $r = 0.23$ ,  $p = 0.09$ ), at sixth hour ( $r = 0.27$ ,  $p = 0.02$ ), at twelfth hour ( $r = 0.34$ ,  $p = 0.001$ ), at first day ( $r = 0.05$ ,  $p = 0.53$ ), at third day ( $r = 0.03$ ,  $p = 0.97$ ), at seventh day ( $r = 0.22$ ,  $p = 0.01$ ), at fifteenth day ( $r = 0.21$ ,  $p = 0.02$ ), at thirtieth day ( $r = 0.27$ ,  $p = 0.02$ )

FPS	Girl			Boy		
	n	Min.	Max.	n	Min.	Max.
Initial	60	0	2	61	0	1
Hour 1	60	0	1	61	0	1
H6	60	2	4	61	2	4
H12	60	3	4	61	3	4
Day1	60	4	5	61	4	5
D3	60	0	5	61	4	5
D7	60	0	1	61	0	1
D15	60	0	1	61	0	1
D30	60	0	1	61	0	1

**Table 5.** FPS values with regard to the genders at different time points.

## Discussion

In this study evaluation of pain which occurs after initial arc wire application by using VAS and FPS scales and comparison of results which were obtained from both scales were aimed. It was observed after statistical analysis that similar and parallel results were obtained from both scales. Accordingly with this it was

found that there is no pain after 1 hour from application of arc wire, that pain has started at 6th hour, it increased at 12th hour and reached to peak value in 24 hours. Although pain has reduced at 3rd day of treatment it is still felt obviously and there was significant decrease in pain at 7th day of treatment. It was determined from pain scales that pain reduced to acceptable level and at the end of 1 month there was no pain.

Evolving pain levels as response to arc wire placement during orthodontic treatment has become subject of many studies. In their study Ngan<sup>16</sup> et al where they had used VAS scale reported that pain feeling has started after 4 hours from placement of arc brace and increased at 24 th hour. In their study Bondemark<sup>17</sup> et al where they had realized by using several survey questions and VAS scale together; they mentioned that most severe pain after implementation of arc wire was observed in 2nd day and it had decreased approximately within 5 days. Consent was obtained in many studies where evaluation is performed by VAS measurement that pain reaches the peak level during orthodontic leveling movement within 24 hours and it has reduced within 7 days.<sup>18-20</sup> Contrary with this some researchers mentioned that pain has continued in 42% of patients even though after seven days have passed by using VAS scales.<sup>21-23</sup> There are some studies examining the pain which occurs following placement of first arc wire in different races and ethnical groups.<sup>24-26</sup> their studies Erdinç<sup>24</sup> et al pointed out that pain evolves in first two hours in turkish race; it reaches peak value in hours and starts to decrease beginning from 3rd day. Scheurer<sup>25</sup> et al has reached similar results in their studies they made over German race. 170 patients who were bracketed in studies were followed for 7 days.<sup>25</sup> 65% of patients mentioned that pain has started within 4 hours and 95% of them have mentioned that pain has started within 24 hours.<sup>25</sup> Even though pain reduces in majority of patients, 25% of patients reported that they still have pain at 7th day. 18% of patient were administered analgesic at first day and 16% of them felt pain which has caused them woke up.<sup>25</sup> Pain which was felt by patients after replacement of arc braces were evaluated by using VAS in the study of Fernandes<sup>22</sup> et al. In their study pain gradually increased in each hour after placement of Nitinol or Sentalloy arc wire, it remained at same level in 2nd day and later its tendency was

towards reducing and in 7th day it has reduced up to initial level. Above mentioned studies are compliant with our study indicating that pain increases within 24 hours and reduces significantly within 24 hours.<sup>17-25</sup>

Joneas and Richmond<sup>21</sup> examined the relationship between pain and crowding amount in the beginning of treatment and obtained the result that crowding level in the beginning does not affect the pain level after implementation of orthodontic apparatus. Once again significant difference could not be determined between pain levels caused by 0,014 inch superelastic NiTi and 0.015 inch Twistflex steel wire in a study where VAS scale was used.<sup>22,23</sup> Similarly in their study where they used VAS Fernandes et al<sup>22</sup> could not find significant difference between pain levels between superelastic NiTi and conventional NiTi. In a study which was realized in our country 0,104 inch NitTi was applied to 56 of 109 patients, and 0,016 inch NiTi arc wire was applied and it was reported that same pain levels are observed in arc wire application by using VAS scale and survey including 49 questions.<sup>24</sup> Only difference which has occurred in studies was that 0,016 inch NiTi group patients have received more analgesic in first 24 hours. However in our study patients of which crowding level is low and close to each other (2±4 mm) were used for preventing the effect of crowding over felt pain and 0,014 inch NiTi arc wire were administered to teeth for leveling.

Exact determination of property and severity of pain is impossible because of complex and subjective nature of pain felt by an individual. Methods which are used for determination of pain level are generally based on the idea of evaluation of own declarations of patients. Declaration of patient gives most valid information since pain is a subjective concept and it is considered as golden rule in pain measurement. Therefore pain measurement tools have become important part of pain searches and many pain scales were developed.<sup>8-14</sup> Pain measurement tools should be easily understandable, should be able to be used depending on subject and should be comparable with other methods for being valid and useful. Validity of every pain scale may not provide directly accurate results. There are some opinions recommending use of several methods together for improving reliability.<sup>7-12</sup> Although many pain measurement methods have been

developed only a few of them can be commonly used. VAS is very frequently used method for determination of severity of pain. Other methods are FPS, and CAS. Khatri<sup>26</sup> et al have compared FPS and VAS scales for evaluation of tooth ache in Eastern Delhi children and achieved the result that FPS scale is more precise with respect to VAS scale. In acute pain evaluation Fadaizadeh<sup>27</sup> et al evaluated the relationship between FPS and VAS and eventually they found that results are conforming in both scales like our study. It was determined in concerned study that FPS scale can be a good alternative for VAS scale although VAS is the most reliable method. Subhashini<sup>28</sup> et al have evaluated the pain and compared FPS and CAS scales in Indian children having age of 6-12 and achieved the result that both methods are consistent and reliable. Needleman<sup>15</sup> et al preferred using FPS and CAS scales together for children at 51-3 age group for evaluation of pain with respect to age, gender and expansion amount.

Greatest advantage of VAS is that it can be used easily in all individuals of which motor functions are in place beginning from age 7 and that it is simple. Also it is independent from language since it does not include any word. Other important advantages are that it presents a regular distribution; it has sufficient preciseness in evaluation of effects of treatment and being able to realize recurrent measurements.<sup>6</sup> Only problem about use of VAS is that it can not be used in postoperative period after general anesthesia, in patients having motor coordination losses and visually impaired individuals since it requires visual and motor coordination during application.<sup>29,30</sup>

FPS have different applications such as face expressions presenting pain at 8 different severity, face expressions presenting pain at 20 severity levels, combination of 5 different face expressions with VAS which is called as Visual pain analogue, Mcgrath scale including 9 different face expression and Qucher scale including 6 face expression.<sup>7,10,31,32</sup> In this study combination of FPS with VAS is was selected since it will be used together with VAS scale. In past it was observed that FPS was used in combination with VAS in children having lack language and mental capacity where VAS can not be used.<sup>26,27</sup> Advantage of FPS is that face expressions can maintain grading without requiring explanations. It can be administered to

patients at all age, having any language and in any geography without need of any education level. In our study use of FPS and VAS scale which are frequently used in pain evaluation were selected as pain evaluation method in early stage of orthodontic treatment and comparison of pain information which were obtained by both scales were aimed.

Jones and Chan<sup>23</sup> pointed out that most severe pain following the placement of first arc brace occurs in first 24 hours at patients having premolar pulled out and their pain scores increase in the evening and night hours. Gianelly and Goldman<sup>32</sup> et al mentioned that following the placement of brace patients avoid chewing hard foods.

Whether pain levels change with respect to genders have conflicting results. It was determined in clinical studies that women are less durable against pain and they feel pain for longer periods.<sup>33-35</sup> However no difference was found between genders in some studies.<sup>33-36</sup> In our study significant difference was found between within VAS group and although it was determined that women patients are less endurable against pain; any significant difference could not be found between genders within FPS group.

Although relationship between age factor and pain can not be exactly determined since treatment which is made according to age is different even in individuals having same malocclusions general idea is that individuals at puberty period are more endurable against pain. In the study of Scheurer<sup>34</sup> et al which compares the pain levels of individuals at different age groups it was observed that least pain response is observed at age group younger than 13 and age group of 16 has followed this. Once again most pain sensitivity was observed at 13-16 age group in this study.<sup>34</sup> It was observed in a similar study implemented by Brown and Moerenhout<sup>36</sup> that adolescents at 14-17 age interval feel pain more with respect to little children and adults and ratio of giving up is highest in this group. In our study patient belonging to adult patient with certain age interval were included in our study for avoiding affection of pain level from age group.

It was proven with studies that pain is felt more in front areas with respect to rear areas where orthodontic treatment is applied.<sup>37-40</sup> It was determined that more pain evolves in mandible teeth with respect to maxilla teeth.<sup>37</sup>

Recently effects of personal attitudes over pain level which is felt at the beginning of orthodontic pain level was examined and it was determined that patients having dental anxiety feel pain more.<sup>41</sup> Similarly it was determined in other study that anxiety reduces the pain threshold and an operation which is indeed painless may be felt as painful.<sup>42</sup>

## Conclusion

Briefly first arc wire placement or activation causes pain, change diet habits of patients and effects the lives. When VAS is used most severe pain occurs in 1 and 3 days, it reduces 7. day and turns to normal in 15. day. When FPS is used similarly most severe pain occurs in 1 and 3. days, reduces in 7th day and turns to normal in 15. day. When both scales are compared it can be seen that VAS/FPS results are parallel and results of VAS scales seem to be more consistent because of scale distinction easiness. Also although results which were obtained from both scales are parallel with each other, use of VAS considered to be more correct since VAS scale is considered to more understandable and easy to use by patients during evaluations.

## Declaration of Interest

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