

## Pain Perception during Initial Leveling and Alignment from Three Initial Wires of Different Sizes

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### ABSTRACT

**Objective:** The aim of this study was to determine pain perception during initial leveling and alignment from three initial archwires wires of different sizes.

**Methods:** A questionnaire-based study was conducted on 150 patients undergoing orthodontic treatment. The pain perception differences between groups were assessed using visual analogue scale. Chi-square and fishers exact test was used for the normality test.

**Results:** The perceptions of pain showed significant difference between three archwire groups.

**Conclusion:** Pain perception was more with 0.016 inch archwire after 0.014 and 0.012 archwire.

**KEYWORDS:** Leveling and Alignment; Pain Perception; VAS Scale

### INTRODUCTION

Pain is one of the most important reasons why patients are discouraged from seeking orthodontic treatment [1]. Although the reason for the pain encountered during orthodontic tooth movement is not fully understood, various concepts have been discussed. Bucci, Rosaria., *et al.* 2021 suggested that periodontal pain is caused by a process of pressure, ischemia, inflammation, and oedema [2]. Burstone (1964) identified an immediate and delayed pain response; the former being related to the initial compression of the periodontal ligament (PDL) immediately after placement of the archwire [3]. The latter response, which started a few hours later, was termed hyperalgesia of the PDL. Prostaglandins have been shown to cause hyperalgesia, which is an increased sensitivity to noxious agents such as histamine, bradykinin, serotonin, acetylcholine, and substance P. There are indications that perceptions of pain are due to changes in blood flow in the PDL [3-5] and are correlated with the presence of substances such as prostaglandins and substance P [3-6]. These reported that pain begins a few hours after application of an orthodontic force and lasts approximately 5 days [7-11]. Jones (1984), in a study examining the discomfort experienced by patients after placement of initial archwires, found statistically higher discomfort experienced by adults compared with adolescents [7]. Ngan., *et al.* (1989) suggested the use of non-steroid anti-inflammatory agents such as aspirin and ibuprofen to provide a level of relief [11].

### AIM OF THE STUDY

The aim of this study was to determine following parameters on application of three wires of different sizes:

1. The time at which pain starts.
2. The duration of the pain.
3. The areas it affects within the mouth.
4. The level of self-medication.
5. The effect of this pain on daily living and
6. Whether gender is important in the perception of pain.

Comparisons were made between each wire group and also by comparing the three wire groups with each other.

### SUBJECTS AND METHODS

The study group comprised 150 patients (80 boys, 70 girls) treated at the Department of Orthodontics, Dr. Rajesh Kambe Dental College and Hospital, Akola. The chronological mean age was 14.6 years for the boys [standard deviation (SD) = 1.38] and 15.7

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years for the girls (SD = 1.47). Dental crowding was not evaluated. Pre-angulated and pre-torqued 0.022 inch Edgewise appliances 'M.B.T System' were used in all patients. After bracket bonding 0.012, 0.014 and 0.016 inch NiTi (Ormco, CA, USA) wires were used initially. The patients were randomly selected for insertion of the 0.012, 0.014 or 0.016 inch wires. Following placement of the archwires they were ligated to all teeth. The 0.012 inch group, 0.014 inch group and 0.016 inch consisted of 50 subjects (29 boys, 27 girls) each. The wire was inserted in both arches. No extra-oral appliances, palatal arches or quad-helix appliances were used during the experimental period.

Following archwire insertion the patients were given previously prepared questionnaires (Table 1) and instructed on how they should be completed. The questionnaires were completed by all 150 patients and returned at the following appointment. Question 1 asked the time at which pain was first perceived after arch wire insertion. In the following questions, the patients were asked separately for each day, from 6 hours to day 7, whether they had pain, in which areas they perceived the pain, whether they took pain relief and whether the pain affected their daily living. The patients were allowed to take medication when they felt it necessary. The questions relating to daily living asked whether any of the activities carried out in their free time, such as sports and/or social activities, were affected. The questionnaire comprised 49 questions in total. The patients described the initial pain in the first question, they answered 24 questions as 'yes' or 'no' initially and in the other 24 questions the patients with 'yes' answers were provided with a visual analogue scale (VAS) divided into tens, in which 0 indicated no pain and 100 the greatest pain.

When did you perceive the initial pain	1hr	2hr	3hr	4hr	5hr	6hr		
	6 hr	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day
Have you got pain?								
Yes No								
In which part do you feel the pain?								
Anterior teeth VAS index value								
Posterior teeth VAS index value								
Have you consumed any pain relief?								
Yes								
No								
Has your daily life been affected?								
Yes								
No								

**Table 1: Questionnaire table.**

For statistical analysis the Statistical Package for Social Sciences 10.0 (SPSS Inc., Chicago, IL, USA) was used.

Gender was taken into consideration and chi-squared and Fisher's exact tests were applied. The Kolmogorov-Smirnov test of normality was used for the VAS scores. A Mann-Whitney U-test was applied because of non-normal distribution. For assessment of the relationship between VAS scores and consumption of pain relief, the Spearman rank correlation analysis was utilized. The level of statistical significance was set at  $P < 0.05$ .

## RESULTS

Because gender differences were not found to be statistically significant in the perception of pain, the Findings were evaluated without sex discrimination.

### INITIAL PAIN

Initiation of pain was perceived 2 hours after wire insertion in all groups. There were no statistically significant differences between the groups. In the 0.012 inch group 44% (n = 22) patients out of 50, 56% in 0.014 inch group 28 of 50 perceived pain. In the 0.016 inch group, 64% (32 patients) perceived pain. No pain was reported by remaining patients (Table 2).

Archwire size	N = no. of patients [Total = 50]	Percentage
0.012 Niti	22	44%
0.014 Niti	28	56%
0.016 Niti	32	64%

**Table 2: Initial pain perception.**

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### PERIODS OF PAIN

Six hours after appliance insertion, pain was reported by 86% (43 patients) in 0.012 group, 94% (47 patients) in the 0.014 inch group and by 98% (49 patients) in the 0.016 inch group. At the end of day 1, 86% (43 patients) in 0.012 group, 96% (48 patients) in the 0.014 inch group and by 98% (49 patients) in the 0.016 inch group perceived pain. From day 2 to day 7 there was a daily decrease in pain. On day 7, pain was reported by 40% (20 patients) in the 0.012 inch group, 48% (24 patients) in the 0.014 group and by 52% (26 patients) in the 0.016 inch group. These findings were not statistically significant. The peak for pain intensity was recorded on day 1 in both archwires groups and started to decline after day 3 (Table 3).

Archwire size	N = no. of patients [Total = 50]	Percentage
0.012 Niti		
-6 Hour	43	86%
-At day 1 end	47	94%
-At day 7	49	98%
0.014 Niti		
-6 Hour	43	86%
-At day 1 end	48	96%
-At day 7	49	98%
0.016 Niti		
-6 Hour	20	40%
-At day 1 end	24	48%
-At day 7	26	52%

**Table 3: Periods of pain.**

### PAIN REGIONS

Although not statistically significant, in both archwire groups pain was perceived at the anterior and posterior teeth during the first few hours, but this decreased over the following hours. Again, while not statistically significant, the pain perceived at the anterior teeth was greater than at the posterior teeth.

### CONSUMPTION OF PAIN RELIEF

The highest consumption of pain relief for both groups, although not statistically significant, was recorded at the end of the first 6 hours. On the following days, the consumption of pain relief decreased day by day. At the end of day 1 there was no statistically significant difference ( $P < 0.05$ ) in the consumption of pain relief between the three groups. There was no consumption of pain relief in the 0.012 inch, 0.014 inch group on day 7 and in the 0.016 inch group on days 5, 6 and 7.

### EFFECT OF PAIN ON DAILY LIFE

Although not statistically significant, the most highly affected daily living activity (sports and/or social) was observed at 6 hours, with a rate of 60% (30 patients) in the 0.012 group, 66% (33 patients) in the 0.014 inch group and 70% (35 patients) in the 0.016 inch group. In the following days there was a decrease in the number of patients reporting such an effect.

### DISCUSSION

This study was performed on 150 patients, who were asked to complete a questionnaire concerning pain perceived after insertion of fixed orthodontic appliances. The form was given to the patients at the first appointment after insertion of the archwires and returned at the next appointment. An informed concern was taken from all patients. The system of measuring discomfort by VAS was found to be appropriate.

Feinmann., *et al.* (1987) reported that pain is related to gender and social class [12].

In this study, no significant difference was found between pain and gender, which is in agreement with the findings of Jones and Chan (1992) [10]. Gender discrimination was therefore excluded and boys and girls were evaluated together. Clinically and statistically, it was expected that there would be a difference between the pain perceived by those in whom different sized wires were inserted. However, no statistically significant difference was found between the initial pain reported by the 0.014 and 0.016 inch groups. Jones (1984), in a study of pain perceived following insertion of initial archwires, reported that some patients had great discomfort for the first few days, with adults affected more than adolescents [7].

In this study, although not statistically significant, pain peaked at 24 hours in both groups following archwire ligation. Again, while not statistically significant, pain started to decrease after day 3 and the mean pain intensity score was between 0 and 60, indicating that the pain perceived was moderate. Although not statistically significant, the data show higher pain scores for the anterior than

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for the posterior teeth, in agreement with the results of other investigators [11,13]. This may be explained by the fact that during the levelling phase the anterior teeth are often more involved and incisors have smaller root surfaces than molars. In addition to this, biting while eating might be the reason for the higher pain perceived in the anterior teeth. Self-medication was statistically significantly higher in the 0.016 inch group compared with the 0.014 and 0.012 inch group. A correlation between pain intensity scores and the consumption of pain relief was observed in the present study, which is in agreement with the findings of Scheurer, *et al.* (1996) [13].

In the present study, although not statistically significant, it was observed that the daily lives of 60 to 70 percent of the patients were influenced by the orthodontic wire at 6 hours and on days 1 and 2. However, there was a significant decrease in the number of patients whose daily lives were affected starting from day 3 until day 7.

Sergl, *et al.* (1998) reported that patients who are aware of the severity of their orthodontic irregularities and can control their emotions perceive a less intense feeling of discomfort [14]. Before commencing orthodontic treatment, patients should be motivated by informing them of the nature and extent of the malocclusion. Because psychological factors during orthodontic treatment influence patient adaptation to discomfort and pain [15], the possibility of physiological adaptation by patient distraction techniques is also feasible [15].

### CONCLUSION

No gender discrimination was found for perception of pain in the three different archwire groups same as concluded by Ertan Erdnic, *et al.* 2004 [16]. No significant correlation was found for the time at which initial pain was perceived after insertion of the three initial archwires of different sizes.

In all groups, initial pain was perceived at 2 hours. Although not statistically significant, pain reached a peak in both groups on day 1, started to decrease on day 3 and was perceived as being greater at the anterior than the posterior teeth.

The consumption of pain relief was highest at 6 hours after archwire insertion and gradually decreased on the following days. Although not significant pain was more with 0.016 and 0.014 inch group than 0.012 inch group. This conclusion has been correlated with the study conducted by Maria, *et al.* 2023 in which, mean VAS values of the 0.012 SS group were lower than those of the 0.014 Ni-Ti group [17]. The results of this study show that pain was perceived after insertion of the three wires of different sizes used for initial alignment. Either of these can therefore be chosen as the initial archwire depending on the mechanics used by the orthodontist.

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