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Effect of gender, age and treatment modality on pain experience during initial alignment with three types of aligning archwires

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Abstract
Objective: The aim of this study was to determine the effect of gender, Age and treatment modality on the pain intensity after the placement of three different initial orthodontic aligning archwires.
Materials and Methods: 30 males and 30 females in age group of 17-22yrs who underwent orthodontic treatment across various private clinics of Bangalore, karnataka were selected. The selected sample was allocated to three different archwire groups (0.014 inch Copper NiTi group, 0.014 inch NiTinol group, 0.014 inch Orthonol group) and two different treatment modalities. Degree of crowding was similar for all cases (3-5mm on Little's irregularity index). Assessments of pain/discomfort were made on a daily basis over the first 7-day period after bonding by means of VAS (visual analog scale). The maximum pain score was recorded. The possible associations between age, gender, degree of crowding, teeth irregularity and the pain intensity were also examined.
Results: Among the three groups copper NiTi caused less pain and discomfort followed by Orthonol and NiTinol group in both males and females. No significant differences in pain perception were found in terms of gender, age, treatment modality (extraction or non-extraction).
Conclusions: copper NiTi caused less pain and discomfort followed by Orthonol and NiTinol group in males and females. Sex, age, the degree of crowding and treatment modality have no significant effect on pain caused by placement of initial arch wire in the three groups.

Keywords: NiTi archwires; VAS scale

Introduction
There is a vast literature available on pain related to Orthodontics and there appears to be a variable response among individuals undergoing orthodontic treatment, with some feeling high levels of pain and others just mild discomfort, despite similar sex, race and age [1-3]. It is still unclear that there are differences of sex to Orthodontic pain [4]. A lot of clinicians have not agreed on sex differences in the degree of pain felt by the orthodontic patient [5-7].
Considering a vast choice of biomaterial in Orthodontics for the initial aligning, pain is still considered inevitable after the placement of first arch wire. Many aforementioned studies have mentioned that Pain during orthodontic treatment usually appears at two hours after application of orthodontic force, reaches a peak level at 24 hours, and lasts approximately five days [8-11].
There are a lot of factors associated with pain and it depends upon variables such as patient's subjective previous pain experiences, age, type of appliance, present emotional state and stress, cultural differences, and sex [12].
Keeping the above literature in mind the present study was carried out to determine the effect of gender, Age and treatment modality on the pain intensity after the placement of three different initial orthodontic aligning archwires. The three different arch wires used for this study were 0.014 inch copper niti, 0.014 inch NiTinol, 0.014 inch Orthonol.

Material and Methods
A sample of 30 males and 30 females in age group of 17-22yrs who underwent Orthodontic treatment across various private clinics of Bangalore, karnataka were selected through random sampling method. The selected sample was allocated to three different archwire groups (0.014 inch Copper NiTi group, 0.014 inch NiTinol group, 0.014 inch Orthonol group) and two

different treatment modalities-Extraction (All first premolar's) and non-extraction. To maintain uniformity in the subject selection the degree of crowding was similar for all cases (3-5mm on Little's irregularity index). Assessments of pain/discomfort were made on a daily basis over the first 7-day period after bonding by means of visual analog scale and consumption of analgesics. The maximum pain score was recorded. The possible associations between age, gender, degree of crowding, and teeth irregularity and the pain intensity were also examined. Inclusion criteria included: Patients willing for Orthodontic treatment falling in age group of 17-22 yrs, Little, s index of 3-5mm. Exclusion criteria included: Patients with any missing teeth, Patient with any neurologic/psychiatric condition All the patients were given hard copy of questionaires based on likert scale and VAS scale to record the pain score and were told to return them in the next appointment. The data was collected and sent for statistical analysis.

Patient Feedback form

Name: **Age:** **Sex:**

1. Date of receiving the appliance?
2. How many hours after receiving the appliance did you have pain?
3. When did you have most serious pain?

	1	2	3	4	5	6	7
Day							

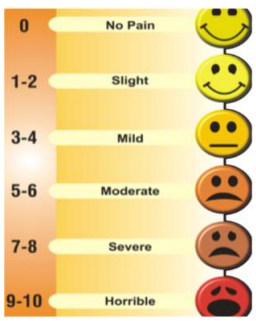
4. Mark with an tick on the scale corresponding to the pain you have experienced (from 1 to 10) during the next 7 days based on the visual analog pain scale (before taking medication).

	0	1	2	3	4	5	6	7	8	9	10
1st day											
2nd day											
3rd day											
4th day											
5th day											
6th day											
7th day											

5. When did your pain disappear after taking medication?

	0	1	2	3	4	5	6	7	8	9	10
1st day											
2nd day											
3rd day											
4th day											
5th day											
6th day											
7th day											

6. Visual analog pain scale.



Statistical Analysis

The Statistical software namely SPSS 22.0, and ver.3.2.2 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc**.** Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis was used.

Results

Table 1 shows the distribution of patients in male in male and female subjects in age group of 17-22 years.

Table 2 shows equal gender distribution in three groups. Total of 30 males and 30 females were selected and distributed equally in three groups.

Table 3 shows the distribution of patients in extraction and non-extraction groups in both male and female subjects.

Table 4 shows the assessment of pain in 24hrs after the placement of initial arch wire in male and female patients in three groups.

In males less pain score was seen in copper Niti group followed by Orthonol and NiTinol group. Same trend was seen in females

Table 5 shows the assessment of pain on 3rd day after placement of initial arch wire in male and female patients in three groups.

In both males and females the pain scores followed same trend with less scores in copper NiTi followed by Orthonol and NiTinol group.

Table 6 shows the assessment of pain after 1 week after the placement of initial arch wire in male and female patients in three groups.

Pain score was lesser in all the three groups in both males and females and followed the same trend copper NiTi followed by Orthonol and NiTinol group.

Table 1: Age distribution of patients in three groups

Age in years	Orthonol Group	Copper Niti Group	NiTinol GROUP
Male			
• 17	0(0%)	0(0%)	0(0%)
• 18	4(40%)	1(10%)	1(10%)
• 19	0(0%)	0(0%)	1(10%)
• 20	4(40%)	5(50%)	5(50%)
• 21	1(10%)	2(20%)	2(20%)
• 22	1(10%)	2(20%)	1(10%)
• Total	10(100%)	10(100%)	10(100%)
Female			
• 18	4(40%)	3(30%)	1(10%)
• 19	2(20%)	3(30%)	2(20%)
• 20	1(10%)	1(10%)	3(30%)
• 21	2(20%)	2(20%)	3(30%)
• 22	1(10%)	1(10%)	1(10%)
• Total	10(100%)	10(100%)	10(100%)
P value	0.539	0.174	0.909

Table 2: Gender distribution of patients in three groups

Gender	Orthonol Group	Copper Niti Group	Nitinol Group	Total
Male	10(50%)	10(50%)	10(50%)	30(50%)
Female	10(50%)	10(50%)	10(50%)	30(50%)

Table 3: Treatment Modality in Male and Female patients

Treatment Modality	Orthonol Group	Copper Niti Group	Nitinol Group	Total
Male				
• Extraction	5(50%)	5(50%)	5(50%)	15(50%)
• Non extraction	5(50%)	5(50%)	5(50%)	15(50%)
• Total	10(100%)	10(100%)	10(100%)	30(100%)
Female				
• Extraction	5(50%)	5(50%)	5(50%)	15(50%)
• Non extraction	5(50%)	5(50%)	5(50%)	15(50%)
• Total	10(100%)	10(100%)	10(100%)	30(100%)
P value	1.000	1.000	1.000	-

Table 4: Assessment of Pain after 24hrs from initial wire placement

Pain	Orthonol Group	Copper Niti Group	Nitinol Group
24hrs			
Likert scale Male			
• 0	0(0%)	0(0%)	0(0%)
• 1-2	0(0%)	4(40%)	0(0%)
• 3-4	0(0%)	2(20%)	1(10%)
• 5-6	2(20%)	2(20%)	2(20%)
• 7-8	6(60%)	2(20%)	4(40%)
• 9-10	2(20%)	0(0%)	2(20%)
• Total	10(100%)	10(100%)	10(100%)
Female			
• 0	0(0%)	2(20%)	1(10%)
• 1-2	0(0%)	4(40%)	1(10%)
• 3-4	0(0%)	1(10%)	1(10%)
• 5-6	4(40%)	1(10%)	2(20%)
• 7-8	3(30%)	1(10%)	3(30%)
• 9-10	3(30%)	1(10%)	2(20%)
• Total	10(100%)	10(100%)	10(100%)

Table 5: Assessment of Pain on 3rd day from initial wire placement

Pain	Orthonol Group	Copper Niti Group	NiTinol GROUP
3rd Day			
Male			
• 0	0(0%)	5(50%)	0(0%)
• 1-2	1(10%)	1(10%)	0(0%)
• 3-4	0(0%)	1(10%)	1(10%)
• 5-6	4(40%)	3(30%)	3(30%)
• 7-8	4(40%)	0(0%)	5(50%)
• 9-10	1(10%)	0(0%)	1(10%)
• Total	10(100%)	10(100%)	10(100%)
Female			
• 0	0(0%)	2(20%)	0(0%)
• 1-2	1(10%)	3(30%)	0(0%)
• 3-4	2(20%)	1(10%)	1(10%)
• 5-6	3(30%)	4(40%)	3(30%)
• 7-8	4(40%)	0(0%)	5(50%)
• 9-10	0(0%)	0(0%)	1(10%)
• Total	10(100%)	10(100%)	10(100%)

Table 6: Assessment of Pain on 7th day from initial wire placement

Pain	Orthonol Group	Copper Niti Group Group	NiTinol GROUP
1week			
Male			
• 0	6(60%)	9(90%)	1(10%)
• 1-2	2(20%)	1(10%)	3(30%)
• 3-4	2(20%)	0(0%)	3(30%)
• 5-6	0(0%)	0(0%)	3(20%)
• 7-8	0(0%)	0(0%)	0(0%)
• 9-10	0(0%)	0(0%)	0(0%)
• Total	10(100%)	10(100%)	10(100%)
Female			
• 0	4(40%)	7(70%)	0(0%)
• 1-2	3(30%)	2(20%)	2(20%)
• 3-4	2(20%)	1(10%)	3(30%)
• 5-6	1(10%)	0(0%)	5(50%)
• 7-8	0(0%)	0(0%)	0(0%)
• 9-10	0(0%)	0(0%)	0(0%)
• Total	10(100%)	10(100%)	10(100%)

Discussion

The sample size in this study was uniformly distributed in all three groups of Orthonol, Copper NiTi, NiTinol group with equal male and female subjects which were further distributed in extraction and non-extraction group. The results of this study showed not much difference in pain perception of male and female patients in all the three groups which is in agreement with the results of the study conducted by Jones M *et al*, [13] Fernandes LM *et al*, [14] Erdinc E *et al*. [15] who also reported no statistically significant differences in pain scores between female and male patients with regard to VAS.

Similar to present study, Jones and Chan and Fernandes *et al*. [13] used a visual analog scale to evaluate the pain intensity. VAS is one of the most commonly used tools in the measurement of the perceived discomfort during orthodontic treatment [13-15] This scale is simple to use, reliable, reproducible, and readily understood by most patients [16, 17]. When compared to other pain/discomfort assessment methods like the verbal rating scales, VAS is more precise and demonstrates better sensitivity between small changes in pain intensity.

In the present study VAS score for Copper Niti group was lesser followed by Orthonol and NiTinol group in both male and female groups. The score was lower in all the three

groups on the seventh day as compared to 24hrs and 3rd day were pain was felt more and gradually reduced with time. Different *in vitro* and *in vivo* studies have a different view on pain caused by various aligning arch wires. Various *in vitro* studies [18-21] demonstrated that superelastic wires are able to deliver almost continuous light forces with large activations that may generate less pain, which is contrary to the present study where in copper Niti caused less pain. A clinical study [22] found no evidence of significant difference in the pain intensity with the three types of NiTi aligning archwires (martensitic stable, austenitic active, and martensitic active) A study [23] comparing conventional Nitinol wires to superelastic, Sentalloy wires over 1 week following archwire placement reported no significant difference in the overall pain. However, it was found that conventional Nitinol wires induced significantly higher pain levels than superelastic and Sentalloy wires at 4 hours.

This study included subjects with same little's irregularity index and the pain perception for both extraction and non extraction groups was same with no statistically significant results in both male and female groups indicating treatment modality has no significant effect on the pain during placement of initial aligning wire. The shortcoming of this study was a small sample size and further studies with a greater subject participation and establishment of a strong relation between age, gender and treatment modality can be a possibility.

Conclusions

1. Among the three groups copper NiTi caused less pain and discomfort followed by Orthonol and NiTinol group in males and females.
2. Sex, age, degree of crowding and treatment modality have no significant effect on pain caused by placement of initial arch wire.
3. 3.Pain decreased at 1 week in all the three groups and peaked at 24 hours followed by 3rd day.

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