Pain perception during Orthodontic Fixed Mechanotherapy

Sharath Kumar Shetty[1], Mahesh Kumar Y[2], Revanth Soonthodu[3], Beefathima.K[4]
[1]*Professor & HOD, Department of Orthodontics & Dentofacial Orthopaedics, K.V.G Dental College & Hospital, Sullia, Karnataka, India.*
[2]*Professor, Department of Orthodontics & Dentofacial Orthopaedics, K.V.G Dental College & Hospital, Sullia, Karnataka, India.*
[3]*Reader, Department of Orthodntics & Dentofacial Orthopaedics, K.V.G Dental College & Hospital, Sullia, Karnataka, India.*
[4]*Diploma Post Graduate Student, Department of Orthodontics & Dentofacial Orthopaedics, K.V.G Dental College & Hospital, Sullia, Karnataka, India.*

Abstract: **The purpose of the current study was to assess patient's level of pain perception undergoing fixed orthodontic treatment. Three common procedures—the insertion of separators, band or ring cementations, arch wire activations— were examined for their level of pain. In the first month after receiving fixed appliance orthodontic treatment, 100 patients aged 15 to 35 made up the sample for our study. A questionnaire designed to gauge the patient's experience of pain was filled out by them. The age and sex distribution of the study sample was used. We assessed the level of discomfort experienced during each of the three orthodontic treatments and discovered that, across all four age groups, elastic separator placement and wire activation was the most uncomfortable. The least painful method was band cementation procedure, with a greater value in the group 21- 25 years old. After procedures, the first three days were the most uncomfortable. The majority of patients didn't require analgesic medication, as they felt only pressure sensation and it was mild to moderate after undergoing the orthodontic procedures that were evaluated. Women experienced noticeably more discomfort than men did. The severity of felt pain varies across patients as they grow older.**

1. INTRODUCTION

The number of patients seeking orthodontic treatment, particularly with fixed appliances, has increased due to the high occurrence of dento-maxillary abnormalities and patient's desire to improve their facial appearance and aesthetics. According to recent research, people prefer to use clear aligners as a therapy to preserve their appearance, particularly adults and teenagers. Regretfully, only few of them can afford the price of this more aesthetically pleasing and comfortable form of treatment.

The most frequent adverse effects of orthodontic therapy include pain perception and discomfort during chewing. Before beginning treatment, the orthodontist should discuss these factors with the patient and assess their motivation and potential hazards in order to ensure effective patient compliance and positive results. Furthermore, educating the patient about possible treatment side effects is morally required and ought to be included in the patient's informed consent. The periodontium and dental pulp have particular inflammatory responses as a result of orthodontic tooth displacement, which trigger the release of different biochemical mediators and result in pain. In general, orthodontic appliances work by either favouring and selectively directing the action of natural forces or by causing new ones to be generated, which alters the balance of the preexisting dentofacial forces.

The characteristics of the appliance materials (such as the elasticity of the wire or rubber rings), their construction, and their interaction with the dento-maxillary system all affect orthodontic forces. De Nevarez's triad—the orthodontic force, the weight-bearing area, and the application area—are the three key coordinates in orthodontic biomechanics. The alveolar bone and the periodontal ligament receive force imparted to the tooth crown via the root. Alveolar bone resorption should happen in response to this stress in the case of tooth displacement; bone deposits should also form to preserve the integrity of the attachment mechanism in order for the tooth to stay firmly attached.

Pain is defined by the International Association for the Study of Pain (IASP) as an unpleasant emotional and sensory experience connected to actual or

possible tissue damage.

Psychogenic pain, on the other hand, is pain that is only caused by concurrent psychological elements that are specific to the individual or their surroundings. There is no physical basis for psychogenic pain, which is governed by the patient's psycho-emotional state. We cannot assess pain indirectly because it is a subjective feeling. When youngsters are unable to give definitive responses, the following criteria may be evaluated:

- Physiological measures include blood pressure, pulse, and sweating;
- Behaviour parameters include high-pitched sobbing, body actions such kicking and closed fists, and facial expressions like closed eyelids, open mouth, dilated nostrils, and hollow tongue. However, there are certain scales to gauge the level of discomfort.

1. Verbal measures: That categorize pain into three, five, or seven grades—absent, weak, mild, moderate, intense, severe, or extreme pain—are utilized at the time of presentation or during therapy.
2. Visual analog scales: Are made up of a 10-cm line that is oriented both horizontally and vertically. The expressions "no pain" and "the greatest possible pain" represent the extremes of these scales.
3. Numerical scales: In these situations, the patient is asked to rate their level of pain using a range of numbers from 0 to 10 or 0 to 100, where 0 denotes no pain and 10/100 denotes severe pain. These scales are commonly used in place of verbal/visual scales because they are simpler to comprehend and offer a more accurate depiction of pain intensity.
4. Behaviourally anchored scales: These measures how much pain affects behaviour and what effect it has on day-to-day activities.

The purpose of the study was to assess how much discomfort individuals receiving fixed orthodontic treatment felt. We examined the degree of discomfort associated with three standard procedures: arch ligation, band cementation, elastic traction, and the insertion of separating elastics. In order to help patients mentally prepare for the appearance of pain and to inform them of the appropriate medication, we wanted to find out which of these fixed orthodontic procedures causes pain, how much pain it hurts, and how long it lasts after the procedure. Another goal of the study was to identify the most popular method for releiving pain.

2. MATERIALS AND METHODS

The present investigation was carried out at the “Department of Orthodontics and Dentofacial Orthopaedics” KVG Dental college, Sullia, Karnataka.

During the first few months of orthodontic treatment with fixed appliances, a sample of 100 patients—children and adults in good health, aged 15 to 35—were assessed.

To gauge their feeling of pain, they were asked to fill out a questionnaire. As a result, the patients provided the response that best reflected how they felt pain; they were able to precisely gauge the degree of pain intensity using the numerical evaluation scale of our multiple-choice questionnaire. Every adult participant in the study gave their informed consent. Every studied parameter was used on both adults and children.

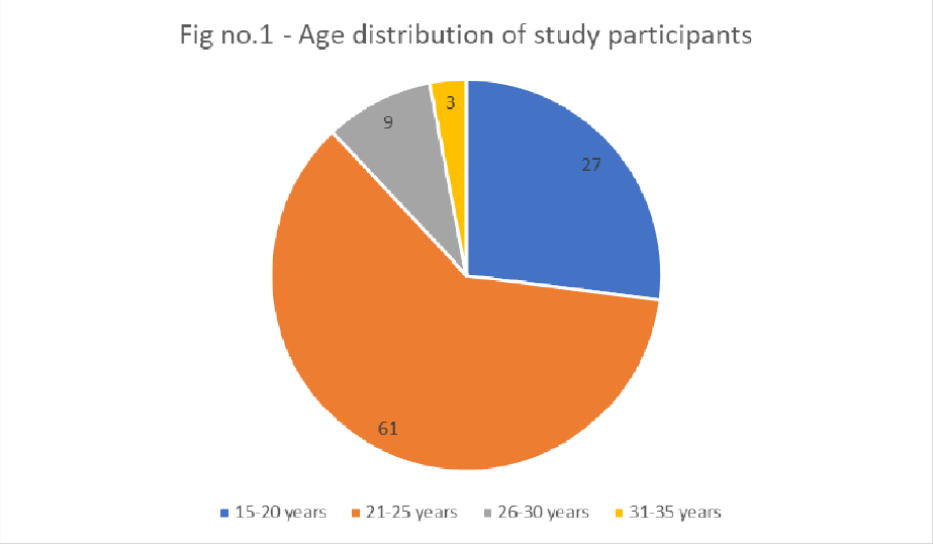
All statistical analysis was performed using SPSS 23.0 software.

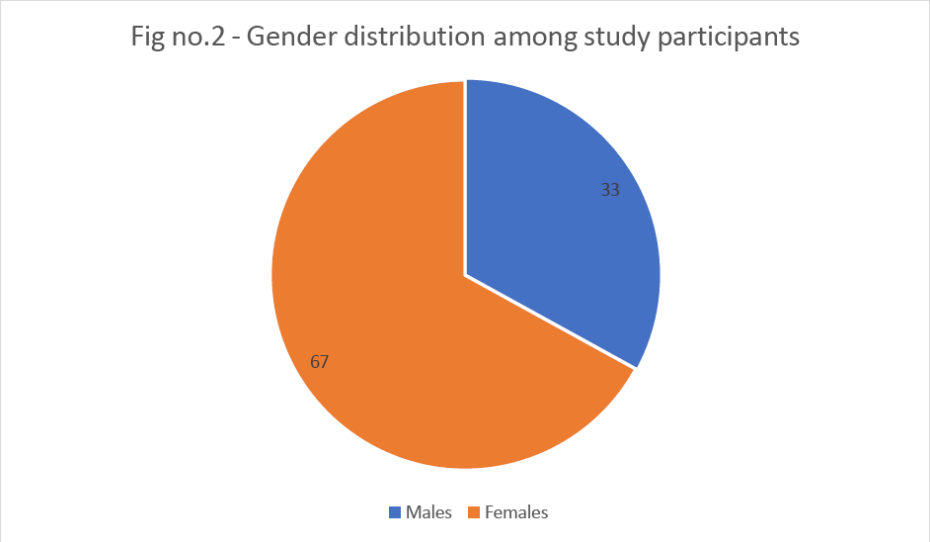
- Frequency and percentage was calculated for each parameter and variable.
- Mean and standard deviation was calculated for pain perception scores among gender categories and age group categories...
- The analysis of the responses in the questionnaire was carried out using chi square test.
- The analysis of pain perception among gender categories in the study was carried out using unpaired t tests, while analysis of age categories and Orthodontic treatment categories with respect to pain perception was assessed using ANOVA test.
- $P<0.05$ was considered to be statistically significant.

3. RESULTS

The 100 patients in our sample were split into four age groups: those aged 15–20 (27%), 21–25 (61%), 26–30(9%), and 31-35(3%). Pain intensity distribution according to patient count: The Numerical Pain Rating Scale had a range of 0 to 10, where 10 represented great pain and 0 represented no discomfort. Figure 1 displays the patient distribution based on the selected age ranges. Of the

100 participants in the study, 7% felt no pain values of 0, 32% felt mild pain values of 1 to 3 and 51% felt moderate pain values of 4 to 6, only 1% felt severe pain values of 7 to 9 and only 9% felt very severe pain values of 10.





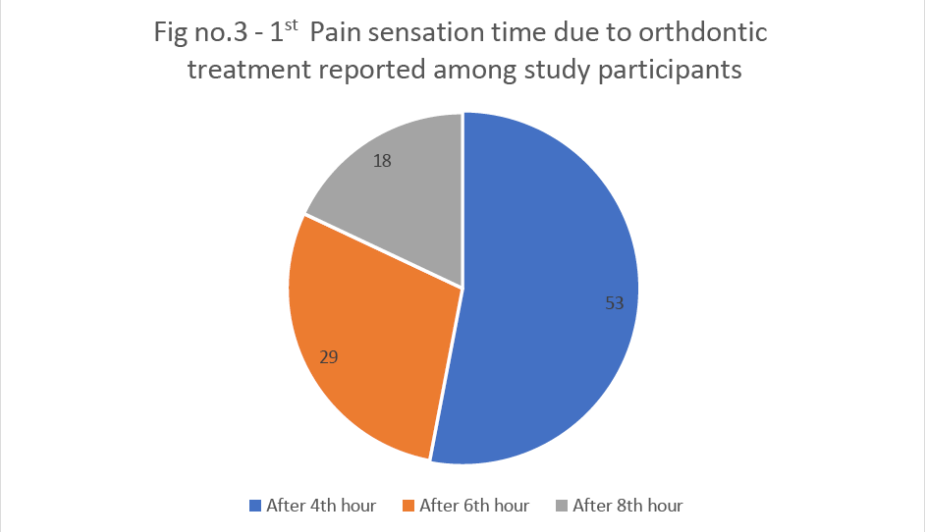


Fig no.4 - Type of Pain reported due to orthodontic treatment among study participants

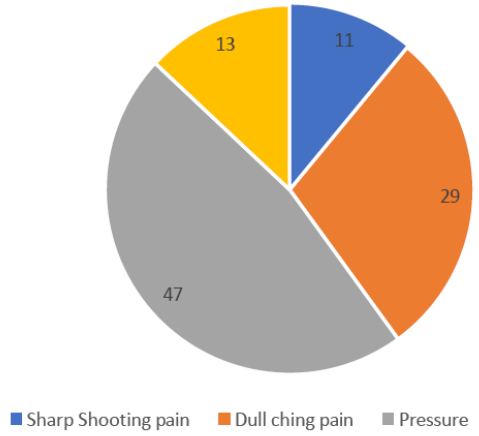


Fig no.5 - Intensity of pain due to orthodontic treatment reported among study participants

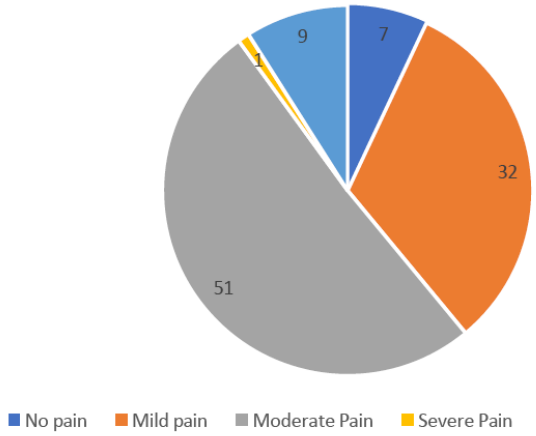


Fig no.6 - Treatment most painful reported among study participants

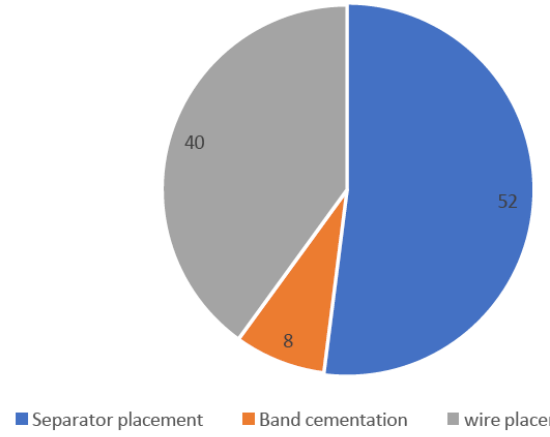


Fig no.9 - Best pain relief method during orthodontic treatment reported among study participants

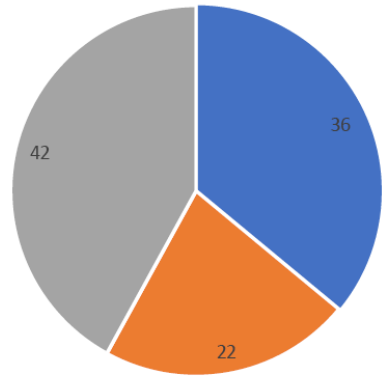


Fig no.11 - Comparison of mean pain perception scores in relation to Gender among study partipants

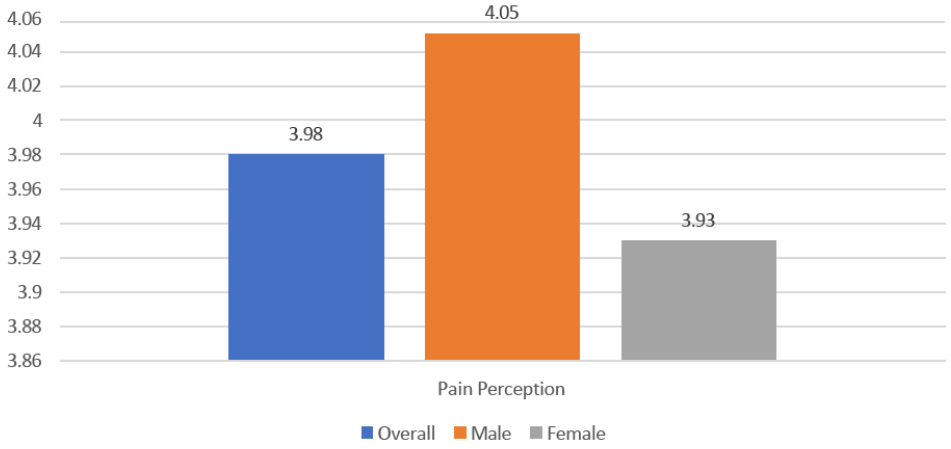
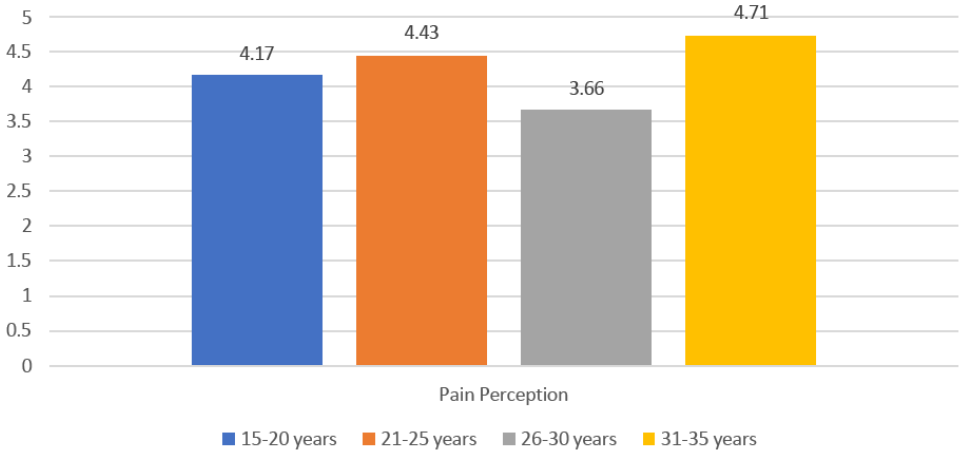
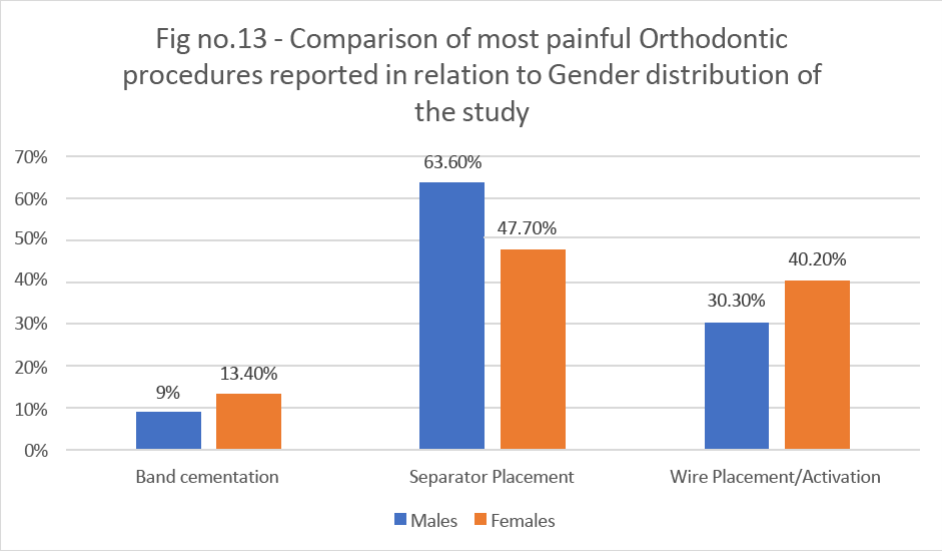
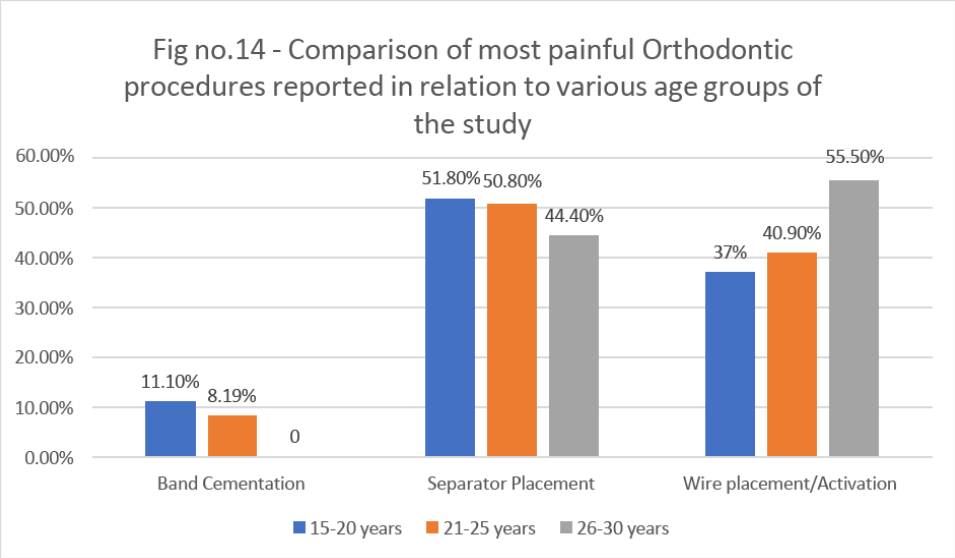


Fig no.12 - Comparison of mean pain perception scores in relation to Age groups among study partipants







4. DISCUSSION

When it comes to orthodontic treatments, pain assessment is important. In order to relax the patient and assist them in managing their pain, pain management entails employing particular verbal and nonverbal strategies. Over the past few years, significant advancements have been achieved in the study of pain and its mechanisms. The visual analogue scale, or VAS, measures the degree of sensory pain and shows that a non-invasive assessment technique is user-friendly. Its drawback is its one-dimensional analysis of pain, which is extremely intricate and has many more specificities, even when it comes to routine social activities like going to school, playing sports, or meeting friends. One of the most researched topics in psychology is interpersonal relations. The study of social psychology focuses on how people relate to one another.

For the best tooth displacement rate, orthodontic forces should be applied twenty-four hours a day. According to evidence- based findings, minimal displacement can only be achieved with an orthodontic force action of at least 6 hours every day. It is believed that a tooth displacement coefficient of 1 mm/month is ideal. The following variables could influence this movement:

- The displacement coefficient can be affected by the patient's age; therefore, in adults, the tooth displacement rate is lower than in children due to the increased alveolar bone density and the decreased cell response effectiveness.
- The force applied—both small and large forces cause tooth displacement, but in the case of

smaller intensity forces that reduce and avoid periodontal ligament hyalinization, the displacement coefficient is bigger.

We decided to set the age limit at 15, when the oral cavity has permanent teeth and it is much simpler to fix crowding and spacing. After 15 years, facial development aids with tooth displacement, and if the child is cooperative, full orthodontic treatment can be completed in a fair amount of time—between 18 and 24 months. It is the age at which self-neglect or, conversely, a marked rise in interest in one's appearance can lead to behavioural issues, necessitating orthodontic treatment to repair dento-maxillary abnormalities, mostly for cosmetic reasons.

In reference to the most painful time, research indicates that, generally speaking, pain intensity rises from 4 to 24 hours following orthodontic procedures but falls back to normal after the first week. According to other research, pain is felt for approximately five days after applying orthodontic forces (with the arch ligated to the brackets) and begins several hours later. The majority of the patients had moderate pain, with a range of 4 to 6.

Patients were advised to choose their own medications if they felt that they were required after the orthodontic appliances were placed. Based on their prior experiences with pain relief, the patients chose their drug. According to other study, patients take analgesics to relieve pain from the dental equipment used to move their teeth in the first few days following each orthodontic appointment.

The Student-test revealed that the p-value = 0.02642366, which is less than the cutoff $\alpha = 0.05$, indicates that the mean pain value varies by age groups; hence, p is statistically significant, and we can conclude that pain perception varies with age.

Regardless of age groupings, our findings showed that the mean pain value differed between the sexes. Research indicates that it is challenging to compare how age affects how pain is perceived during orthodontic treatment.

According to the majority of authors, adults experience more pain than children.
The increased degree of pain perception in the 21-25 age group may be explained by the fact that this age group is typically linked to a higher degree of emotional problems.
According to some research, men can handle pain more readily than women, who are thought to be more delicate and sensitive to the pain that fixed orthodontic appliances generate. However, other research finds no statistically significant difference between the two sexes.

Nandi et al. and other writers shown that postoperative pain is more common in women. This has been explained in a number of ways, one of which is based on the biological distinctions between the sexes. These relate to variations in the reproductive organs, including hormonal alterations linked to variations in serotonin and noradrenaline levels as well as a rise in the frequency of menstrual cycle discomfort. In certain situations, ethical considerations impede the feeling of pain.
However, one study reveals that the mean pain values were typically higher during the day than at night, peaking only on the first night, which led to sleeplessness in some patients.

5. CONCLUSIONS

After the orthodontic procedures under study, the majority of patients had moderate pain.

1. Patients receiving fixed orthodontic equipment said that the first three to four days following implantation were the most painful.
2. During the fixed orthodontic treatment, the majority of patients needed orthowax to relieve ulcer caused pain(42%),Salt water gargling(36%), Applying an oral gel (22%) and analgesic medicine was the most common one paracetamol.
3. In all four age groups, the average pain sensation was considerably higher for the female sex (67%) than for the male sex(33%). As they age, patients experience perceived pain intensity in different ways.
4. Arch wire activation was the most unpleasant across all age categories, with the 21–25 age group experiencing the most discomfort.

Appendix A Questionnaire

Evaluation of the perception of the pain sensation during the initial stages of orthodontic treatment with fixed appliances. Personal data will be used strictly for academic purposes, while respecting

confidentiality!

1. Name:
2. Age:

(a) 15 to 20 years
(b) 21to 25 years
(c) 26 to 30 years
(d) 31 to 35 years

3. Sex:

(a) male
(b) female
(c) other

4. When did you experience the 1st pain after wearing braces?

a) 4th hour
b) 6th hour
c) 8th hour

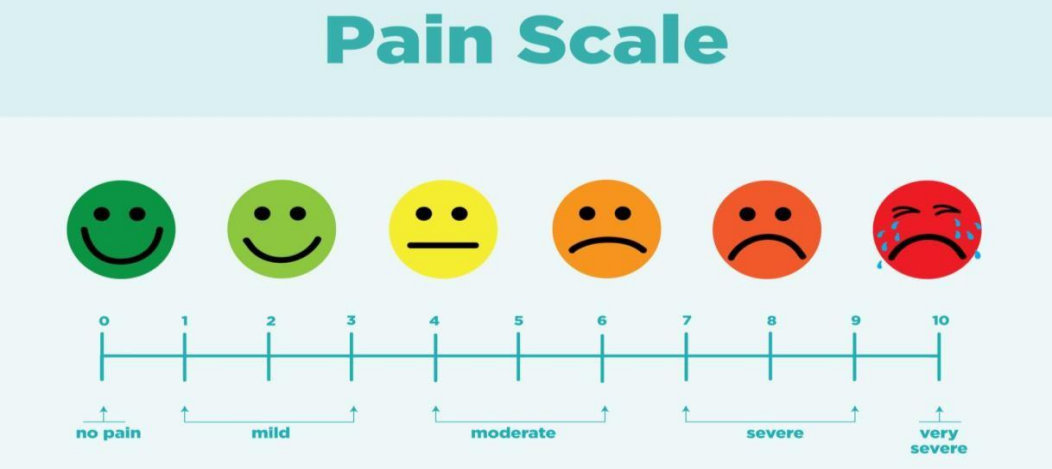
5. What type of sensation did you feel during the wear of braces?

a) Sharp shooting pain
b) Dull aching pain
c) Pressure sensation
d) No pain

6. Whether the pain was tolerable or not?

a) Yes
b) No

7. On the scale 0-10 how do you rate your pain during the wear of braces?



a) 0 -No pain
b) 1-3-mild pain
c) 4-6-moderate pain
d) 7-9-severe pain
e) 10-very severe

8. Which was the below procedure most painful?

a) Separator placement
b) Band cementation
c) Wire placement/activation

9. At which area of the mouth do you feel the pain the most during the wear of braces?

a) Upper front tooth area
b) Upper back tooth area
c) Lower front tooth area
d) Lower back tooth area

10. Has daily routine been affected due to pain experienced due to braces?

a) Yes
b) No

11. Have you experienced any ulcer formation in your mouth during the wear of braces?

a) Yes
b) No

12. What did you feel the best of the below to relieve the pain during the wear of braces?

a) Salt wter gargle
b) Applying oral gel
c) Using orthodontic wax

13. Have you taken any medication for pain relief during braces wear?

a) Yes
b) No

14. How many days did the pain last during the wear of braces?

a) 1 day
b) 3 days
c) 5 days
d) 7 days

REFERENCES

[1] Alansari, R.A. Youth Perception of Different Orthodontic Appliances. Patient Prefer. Adher. 2020, 14, 1011–1019. [CrossRef] [PubMed]

[2] Fujiyama, K.; Honjo, T.; Suzuki, M.; Matsuoka, S.; Deguchi, T. Analysis of pain level in cases treated with Invisalign aligner: Comparison with fixed edgewise appliance therapy. Prog. Orthod. 2014, 15, 64. [CrossRef] [PubMed]

[3] Bucur, S.M.; Chibelean, M.; Pacurar, M.; Sita, D.D.; Zetu, I.N. Ethical considerations in Orthodontics and Dentofacial Orthopaedics. Rev. Rom. Bioet. 2014, 12, 80–84.

[4] Yamaguchi, M.; Fukasawa, S. Is Inflammation a Friend or Foe for Orthodontic Treatment?: Inflammation in Orthodontically Induced Inflammatory Root Resorption and Accelerating Tooth Movement. Int. J. Mol. Sci. 2021, 22, 2388. [CrossRef]

[5] D'Apuzzo, F.; Nucci, L.; Delfino, I.; Portaccio, M.; Minervini, G.; Isola, G.; Serino, I.; Camerlingo, C.; Lepore, M. Application of Vibrational Spectroscopies in the Qualitative Analysis of Gingival Crevicular Fluid and Periodontal Ligament during Orthodontic Tooth Movement. J. Clin. Med. 2021, 10, 1405. [CrossRef]

[6] Mansour, A.Y. A comparison of orthodontic elastic forces: Focus on reduced inventory. J. Orthod. Sci. 2017, 6, 136–140. [CrossRef]

[7] Nucera, R.; Gatto, E.; Borsellino, C.; Aceto, P.; Fabiano, F.; Matarese, G.; Perillo, L.; Cordasco, G. Influence of bracket-slot design on the forces released by superelastic nickel-titanium alignment wires in different deflection configurations. Angle Orthod. 2014, 84, 541–547. [CrossRef]

[8] McNamara, C.; Drage, K.J.; Sandy, J.R.; Ireland, A.J. An evaluation of clinicians' choices when selecting archwires. Eur. J. Orthod. 2010, 32, 54–59. [CrossRef]

[9] Foster, T.D. A Textbook of Orthodontics, 3rd ed.; Blackwell Scientific Publications: Boston, MA, USA, 1990; pp. 123–129.

[10] Proffit, W.R.; Fields, H.W., Jr. 1992 Contemporary Orthodontics, 2nd ed.; Mosby Year Book: Mount Joy, PA, USA, 1992; pp. 12–18.

[11] D'Apuzzo, F.; Cappabianca, S.; Ciavarella, D.; Monsurrò, A.; Silvestrini-Biavati, A.; Perillo, L. Biomarkers of Periodontal Tissue Remodeling during Orthodontic Tooth Movement in Mice and Men: Overview and Clinical Relevance. Sci. World J. 2013, 2013, 105873. [CrossRef]

[12] Miles, T.S.; Nauntofte, B.; Svensson, P. Clinical Oral Physiology; Quintessence Publishing Co., Ltd.: New Malden, UK, 2004; pp. 45–61.

[13] Jeon, H.H.; Teixeira, H.; Tsai, A. Mechanistic Insight into Orthodontic Tooth Movement Based on Animal Studies: A Critical Review. J. Clin. Med. 2021, 10, 1733. [CrossRef]

[14] Raja, S.N.; Carr, D.B.; Cohen, M.; Finnerup, N.B.; Flor, H.; Gibson, S.; Keefe, F.J.; Mogil, J.S.; Ringkamp, M.; Sluka, K.A.; et al. The revised International Association for the Study of Pain definition of pain: Concepts, challenges, and compromises. Pain 2020, 161,1976–1982. [CrossRef] [PubMed]

[15] Grassia, V.; Rotolo, R.P.; Nucci, L.; D'Apuzzo, F.; Perillo, L. Bullying and malocclusion in adolescence: A case report. South Eur. J. Orthod. Dentofac. Res. 2020, 7, 17–20. [CrossRef]

[16] Patel, V. Non-completion of Active Orthodontic Treatment. Br. J. Orthod. 1992, 19, 47–54. [CrossRef] [PubMed]

[17] Bergius, M.; Berggren, U.; Kiliaridis, S. Experience of pain during an orthodontic procedure. Eur. J. Oral Sci. 2002, 110, 92–98. [CrossRef]

[18] Available online: https://assessment-module.yale.edu/im-palliative/visual-analogue-scale (accessed on 3 April 2021).

[19] Asiry, M.A. Biological aspects of orthodontic tooth movement: A review of literature. Saudi J. Biol. Sci. 2018, 25, 1027–1032. [CrossRef] [PubMed]

[20] Anthonappa, R.P.; Ashley, P.; Bonetti, D.L.; Lombardo, G.; Riley, P. Non-pharmacological interventions for managing dental anxiety in children. Cochrane Database Syst. Rev. 2017, 2017, CD012676. [CrossRef]

[21] Scheurer, P.A.; Firestone, A.R.; Burgin, W.B. Perception of pain as a result of orthodontic treatment with fixed appliances. Eur. J. Orthod. 1996, 18, 349–357. [CrossRef]

[22] Fernandes, L.M.; Skoglund, L. Pain and discomfort experienced after placement of a conventional or a superelastic NiTi aligning archwire. A randomized clinical trial. J. Orofac. Orthop. 1998, 59, 331–339. [CrossRef]

[23] Aslihan, M.E.; Dincer, B. Perception of pain during orthodontic treatment with fixed appliances. Eur. J. Orthod. 2004, 26, 79–85.

[24] Rakhshan, H.; Rakhshan, V. Pain and discomfort perceived during the initial stage of active fixed orthodontic treatment. Saudi Dent. J. 2015, 27, 81–87. [CrossRef]