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Perception of Pain after Insertion of Mini-Screws in Orthodontic Patients

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ABSTRACT

Objective: To measure the pain perceived by the patient after the insertion of an orthodontic mini screw.

Materials and Methods: It was a descriptive cross-sectional study conducted in the Out-Patient Department of Orthodontics, Margalla Institute of Health Sciences, Rawalpindi for 8 months. The sample size used was 35. Self-drilling mini-screws (8mm x 1.6mm) were manually inserted. Patients were asked to report pain scores at 1 hour, 12 hours, 24 hours and 1 week on a Visual Analogue Scale. Data was analysed using Statistical Package for Social Sciences (SPSS) 21. Analysis of variance was used to compare the pain score at different time durations. The level of statistical significance was $P \leq 0.05$.

Results: There were 11 (31.4%) males and 24 (68.6%) females with a mean age of 18.66±3.404 years. The mean pain scores up to 1 hour was 0.83±1.014, from 1-12 hours was 1.06±1.083, from 12-24 hours was 0.14±0.355 and from 24 hours-1 week was 0±0. Out of the total, five (14.3%) patients had to take analgesia in the first hour, while during 1-12 hours, 12-24 hours and 24 hours per week, nine (25.7%), seven (2.9%) and zero took the analgesics respectively.

Conclusion: The pain experienced with mini-screw insertion is low. The greatest pain was recorded in 1-12 hours following insertion, after which it started to decrease.

Keywords: Mini-Implants, Orthodontic Anchorage Procedures, Orthodontics, Pain Perception, Screws

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INTRODUCTION

Anchorage is one of the most important factors considered for a successful orthodontic treatment.[1] It is defined as 'the resistance to unwanted tooth movement.[2] There are multiple ways to reinforce anchorage, including Nance holding arch, headgear, class II elastics etc., but all of these methods have certain disadvantages like design complexity, patient compliance, the need for elaborate wire bending and chances of potential iatrogenic injuries. In recent years, due to its versatility, minimal invasiveness, useful dimensions, low cost, and no requirement for lab work or patient compliance, the mini-screw has gained enormous popularity in the orthodontic community. It has provided an excellent

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alternative to conventional anchorage reinforcing methods.[3,4]

An orthodontic mini-implant has been defined as a device specially designed to be placed within, through, or upon the bones of the craniofacial complex to supply orthodontic anchorage.[5] Mini-implants, also called Temporary anchorage devices (TADs) have different parts, a head, neck, core (body) and thread. The core is the part that is inserted into the bone and provides maximum stability.[6] Over the years, various designs have been introduced to improve the biomechanical features and clinical efficacy, but the more recently introduced lightweight, self-drilling mini-screws are very versatile and user-friendly.[7] The pointed screw tip and guiding threads enable them to be inserted without drilling.[8] They can be placed anywhere in the jaw considering that there is sufficient bone, and no anatomic structure is damaged while placing the implant. They can help move teeth in all three planes of space, providing the option of both direct and indirect anchorage.[9]

Orthodontic pain and orthodontic tooth movement are two interrelated and dependent biological events.[1] Pain has been defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.[10] The fear of pain is one of the causes of patients deferring orthodontic treatment, decreasing compliance or discontinuing the treatment.[11,12] The popularity of mini-screw among contemporary orthodontists has added another potentially painful element to orthodontic therapy.[13,14]

Orthodontists usually underestimate the degree of pain caused by treatment.[9] Our knowledge of treatment perception can help to provide patients with realistic expectations of the likely pain that will be encountered during orthodontic treatment.[11] Baxmann M. et al[15] concluded that micro-implant placement seems to be a well-accepted treatment option in orthodontic patients with significantly lower pain levels than tooth extractions. Lee et al showed in a cohort study that patients expect the buccal placement of the mini-screw to be more painful than it is.[11] In Pakistan, one pilot study has suggested that there is no significant difference between the pain expected and actually perceived by the patient.[16] To the best of our knowledge, limited studies on pain perception after orthodontic mini-screw insertion were conducted in our population. The purpose of this study was to determine the pain perceived by the patient after the insertion of orthodontic mini-screws, in order to educate the patients.

MATERIALS AND METHODS

It was a descriptive cross-sectional study, carried out in the outpatient department of orthodontics, Margalla Institute of Health Sciences, Rawalpindi. The study duration was 8 months (24-07-2019 to 24-03-2020). A total of 35 patients were included in the study using non- probability consecutive sampling.

Only patients undergoing fixed orthodontic treatment with ages ≥ 11 years to ≤ 25 years and having mini-screws as part of their treatment plan were included in the study. Patients with any syndrome/ mental illness/ systemic disease, taking medications for chronic pain, with severe bone loss or having mixed dentition were excluded.

After the approval from the hospital's Ethics Review Committee, informed consent was taken from the patients fulfilling the selection criteria. All the mini-screws were inserted by the author in the maxillary bone. Pre-surgical periapical radiograph of the implant insertion site was taken. After the application of topical anaesthesia with 20% Benzocaine gel (Benzo-jel, Henry Schein), buccal infiltration of less than 1/4th of the cartridge Lignocaine HCl 2% was given (lidocaine hydrochloride 20 mg/mL, adrenaline 10 mcg/mL, Septodont, France). The patient was asked to rinse with 0.2% Chlorhexidine mouthwash (Clinica Mouthwash, platinum pharmacy) for 60 seconds before mini-screw placement. Self-drilling mini-screw (8mm x 1.6mm, sterile bone screw S16- JB-008H, Jeil Medical Corporation, Korea) were manually inserted with an implant driver. A periapical radiograph was taken after complete insertion to evaluate the position of the mini-screw.

Patients were requested to notify the operator if any pain or discomfort was experienced during the procedure. Patients were asked to document their level of pain using VAS from 1-10, with 0 being no pain and 10 being the maximum pain felt at 1 hour, 12 hours, 24 hours and 1 week after mini-screw insertion and to answer questions concerning analgesics with a 'yes' or 'no' response. The patients were advised to take Paracetamol 500mg if they needed to. The patient was

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Table 1: Responses of orthodontic patients regarding pain after insertion of mini-screws

Duration	Pain experienced n (%)					Mean ±SD
	0	1	2	3	4	
Up to 1 hour	16(45.7)	13(37.1)	3(8.6)	2(5.7)	1(2.9)	0.83±1.014
1 hr 1 min – 12 hrs	13(37.1)	12(34.3)	6(17.1)	3(8.6)	1(2.9)	1.06±1.083
12 hr 1 min– 24 hrs	30(85.7)	5(14.3)				0.14±.355
24 hr 1 min – 1 week	35(100)					0±0

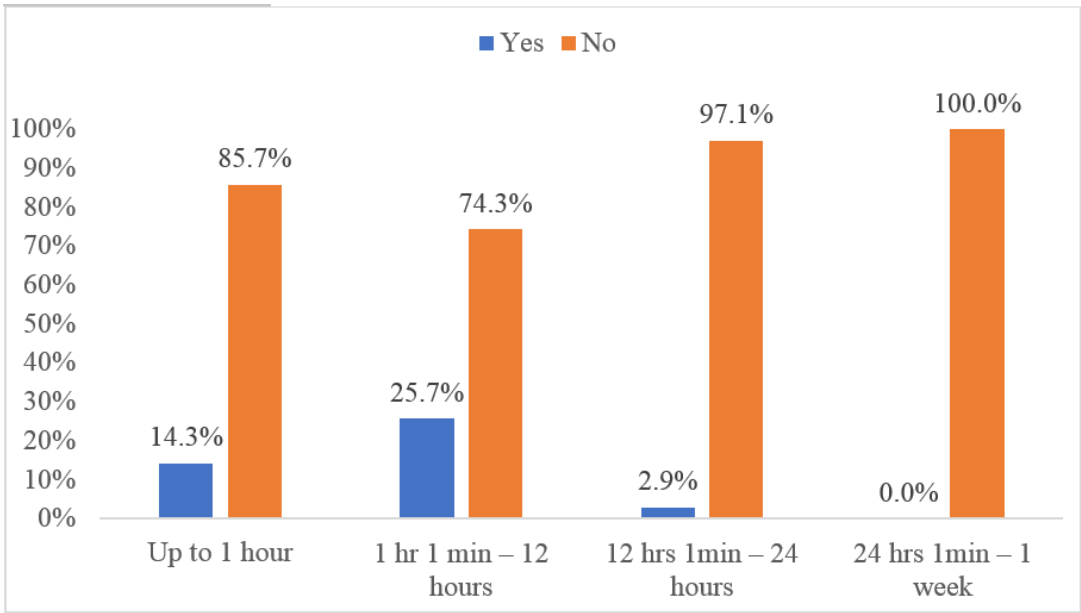

Figure 1: Orthodontic patients who have taken analgesics at different times

Table 2: Gender-wise difference in responses of orthodontic patients regarding pain experienced after insertion of mini- screws

Duration	Total number of analgesics		Mann Whitney U test	
	Male	Female	z-value	*p*-value
Up to 1 hour	0.27±0.647	0.17±0.482	-0.47	0.793
1 hr 1 min – 12 hrs	0.09±0.302	0.38±0.576	-1.52	0.252
12 hrs 1 min – 24 hrs	0.00±0.000	0.04±0.204	-0.68	0.847
24 hrs 1 min – 1 week	0.00±.000[a]	0.00±.000[a]	0	1

Table 3: Age-wise difference in responses of orthodontic patients regarding pain experienced after insertion of mini- screws

Duration	Pain experienced Age (years)			Kruskal Wallis Test	
	12 - 16	17 - 20	21 - 25	z-value	*p*-value
Up to 1 hour	1.22±0.97	0.67±1.11	0.73±0.90	0.92	0.409
1 hour – 12 hours	1.44±1.24	0.87±0.83	1.00±1.26	0.814	0.452
12 hours – 24 hours	0.11±0.33	0.13±0.35	0.18±0.40	0.102	0.903
24 hours – 1 week	0.00±0.00	0.00±0.00	0.00±0.00	0.92	0.409

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called after 1 week for routine examination and loading. The stability of the mini-screws and gingival health around the mini-screws were also evaluated.

The data was analysed using Statistical Package for Social Sciences (SPSS Version 21.0, IBM Corp., Armonk, NY). Quantitative variables like age and pain score were represented in the form of mean and standard deviation. Qualitative variables like gender were represented by frequency and percentage. Analysis of variance (ANOVA) was used to compare the pain scores at different time durations. The level of statistical significance was $p \leq 0.05$.

RESULTS

All the data was analysed using Statistical Package for Social Sciences (SPSS Version 21.0, IBM Corp., Armonk, NY). A total of 35 patients were included in this study. None of the inserted mini-screws were lost during the study period. All participants completed the questionnaire. There were 11 (31.4%) male patients and 24 (68.6%) female patients. The mean age of the patients was 18.66±3.404. Most of the patients were between 17-20 years, as 15 (42.9%) out of the total patients, belonged to this age group.

The responses of patients when asked about pain scores at different time intervals are shown in Table 1. The maximum pain score marked by the patient at any time was four. The Mean± SD pain score up to 1 hour was 0.83±1.014. Here, 16 (45.7%) patients experienced zero pain, 13 (37.1%) experienced pain with a score of 1, 3 (8.6%) experienced pain with a score of 2, 2 (5.7%) experienced pain with a score of 3 and only 1 (2.9%) patient experienced pain with score 4. The Mean± SD pain score from 1-12 hours was 1.06±1.083. This was the highest among all. The majority of the patients i.e., 13 (37.1%) experienced zero pain, whereas 12 (34.3%) experienced pain with a score of 1, 6 (17.1%) experienced pain with a score of 2, 3 (8.6%) experienced pain with score 3 and only 1 (2.9%) patient experienced pain with score 4. The Mean± SD pain score from 12-24 hours was 0.14±0.355. During this time duration, 30 (85.7%) patients experienced zero pain and only 5 (14.3%) patients experienced pain which was of pain score of 1. All 35 (100%) patients experienced zero pain between 24 hours and 1 week after the insertion of the mini-screw, therefore the Mean± SD pain score was 0±0.

Figure 1 demonstrates the response of patients when asked if they took any analgesics at different times. The majority of the patients i.e., 30 (85.7%) said that they did not take any analgesic for up to one hour and only 5 (14.3%) patients took analgesics during this time. In the duration from 1-12 hours, only 9 (25.7%) patients took the analgesic. This was the maximum number of patients recorded for taking analgesics. In the period from 12-24 hours, only one (2.9%) patient reported taking an analgesic. None of the total 35 (100%) patients took any analgesic in the period between 24 hours–1 week after the insertion of the mini-screw.

The last part of the questionnaire acquired the data regarding the total number of analgesics taken at different times. Up to 1 hour, out of the five patients who took the analgesics, 3 (8.6%) patients reported taking 1 tablet and 2 (5.7%) patients reported taking 2 tablets. The highest Mean±SD (0.29±.519) for the number of painkillers was recorded at times from 1-12 hours. During this time, out of the nine patients, eight (22.9% of the total) patients took one tablet, and one (2.9% of the total) patient took two tablets. From 12-24 hours, only one tablet of analgesic was taken by the patient. There was no statistically significant difference between males and females regarding the pain experienced with the mini-screws at any time as shown in Table 2.

There was no statistically significant difference in different age groups regarding pain experienced with mini-screw insertion. A significant difference was found in age groups when considering taking analgesics, at the time from 1-12 hours; more patients (55.5%) from the age group 12-16 years were found to have marked 'yes' in this section. In addition, significant results were found when a total number of analgesics were compared. From 1-12 hours, patients aged 12-16 took more analgesics (M±SD=0.67±0.71) as shown in Table 3.

DISCUSSION

Orthodontic treatment is considered a painful procedure.[11] It is known that it not only originates a sensation but negatively affects the patients' quality of life in terms of health and activity.[17] Therefore, this fear is one of the causes of patients deferring orthodontic treatment, decreasing compliance or discontinuing the treatment.[11,12] Orthodontic mini-screws have added another potentially painful element to orthodontic therapy, and the fear of pain in patients is likely to affect

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the process of treatment.[13,18]

Anchorage planning is the foundation of an orthodontic treatment plan. With the introduction and advancement of mini-screws, it has become a widely used option in the orthodontic practice.[3] A major advantage of mini-screw implants is the ease by which they can be placed by the orthodontist accurately at the desired site.[19] They can be placed anywhere in the jaw considering that there is sufficient bone and no anatomic structure is damaged while placing the implant. Their versatility in tooth movement has enabled orthodontists to successfully treat many complex and challenging malocclusions with a relatively easy approach.[20]

The literature provides numerous data regarding pain association with orthodontic treatment, but limited articles have focused on patients' experience of pain for orthodontic treatment with mini-screws. Therefore, the purpose of this study was to determine the perception of pain after the insertion of a mini-screw in orthodontic patients. Our knowledge of treatment perception can help to provide patients with realistic expectations of the likely pain that will be encountered during orthodontic treatment.

There are several pain assessment tools or pain scales that have been validated over the years for use by health professionals. This study used a Visual Analogue Scale from 0-10 to assess the pain scores, with 0 representing 'no pain' and 10 representing 'worst pain'. Lee et al. used a VAS with a score from 0-100 in their study.[11] The difference is only that 0-10 scores are represented on a centimetre scale and 0-100 on a millimetre scale. The benefits of the VAS are that it has been validated and shown to be sensitive to changes in a patient's pain experience. It is easy to understand and rapid to fill for most of the patients.[21]

In this study, the mini-screws were only placed in the maxilla. A previous study done by Lee et al. did not limit the mini-screw placement to one jaw and included both the maxilla and the mandible.[11] This decision to exclude the mandible from the study was based on the fact that the maxilla and mandible have different bone densities and stress loads.[22] Due to higher bone density of the mandible, higher insertion torque is needed which can also cause overheating of the mandible during mini-screw placement. The implant placement in the mandible also sometimes requires pre-drilling.[23] These factors could affect the pain scores experienced by the patients.

All the mini-screws in this study were placed under local anaesthesia. Most of the clinical studies placed the mini-screws under local anaesthesia,[4,24] but some studies suggested the use of topical anaesthesia only. They suggest that topical anaesthesia is simpler to use, comfortable for the patient, and lacks tissue ballooning thus leading to the easier placement of mini-screws. A most important factor of topical anaesthesia is that the patient can be notified if the mini-screw is placed close to the root. Lamberton et al, however, suggest that topical anaesthesia is less predictable and less comfortable to the patient when compared to local anaesthesia.[25]

The results of this study showed that the pain score experienced at any level was not more than four and the highest mean score recorded at any time was 1.06±1.083, deducing that the maximum pain experienced is of a low level. Baxmann M. et al,[15] also when compared the mini-screw with other variables like extraction, concluded that pain experienced with mini-screws is of significantly lower levels. In this study, the highest mean pain score (1.06±1.083) reported was at the interval from 1 hour to 12 hours. Similar results were found in the study carried out by Mirhashemi et al.[4] The results of our study also showed that after 12 hours there was a decrease in pain score, as only 14.3% of the patients experienced pain in the time interval from 12 hours to 24 hours, and none reported pain in the duration from 24 hours to 1 week. But Mirhashemi et al.[4] reported that few patients experienced pain even at 24 hours and 1 week time period.

The limitation of our study is that the sample size was small and it was exclusively conducted at a single study centre. More studies with a greater sample size and including individuals from various settings can provide more reliable results.

CONCLUSION

This study concluded that the pain experienced after mini-screw insertion is significantly low. The greatest pain and discomfort are experienced in the time from 1-12 hours following insertion, after which it starts to decrease, and no pain is felt for 1 week post- surgically. There is no difference in gender with regard to the pain experienced after mini-screw insertion.

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DISCLAIMER

None.

CONFLICT OF INTEREST

None to declare.

ETHICAL STATEMENT

The ethical approval was provided by the Ethics Review Committee, Margalla Institute of Health Sciences, Rawalpindi (ERC Ref No: RA/39/18).

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AUTHORS CONTRIBUTION

Conception and design of the study: R. Arshad

Acquisition of data: R. Arshad

Analysis and interpretation of data: A. Mahmood

Drafting of the manuscript: R. Arshad

Critical review of the manuscript: A. Mahmood

Approval of the final version of the manuscript to be published: R. Arshad, A. Mahmood

REFERENCES

1. Pithon MM, Santos MJ, Ribeiro MC, Nascimento RC, Rodrigues RS, Ruellas AC, et al. Patients' Perception of Installation, Use and Results of Orthodontic Mini-Implants. Acta Odontol Latinoam. 2015;28(2):108-12.
2. Contemporary Orthodontics - 6th Edition [Internet]. [cited 2023 May 5]. Available from: https://www.elsevier.com/books/contemporary-orthodontics/proffit/978-0-323-54387-3
3. Liu Y, Yang Z jin, Zhou J, Xiong P, Wang Q, Yang Y, et al. Comparison of Anchorage Efficiency of Orthodontic Mini-implant and Conventional Anchorage Reinforcement in Patients Requiring Maximum Orthodontic Anchorage: A Systematic Review and Meta-analysis. J Evid Based Dent Pract. 2020;20(2):101401.
4. Mirhashemi A, Hosseini MH, Yadalloahi H, Jalali YF. Pain and discomfort experience after miniscrew insertion as an anchorage device in orthodontic patients. Dent Hypotheses. 2016;7(3) :112-16.
5. Elias CN, de Oliveira Ruellas AC, Fernandes DJ. Orthodontic Implants: Concepts for the Orthodontic Practitioner. Int J Dent. 2012;2012 (1):1-7.
6. Cousley R. The Orthodontic Mini-implant Clinical Handbook. John Wiley & Sons; 2020. 342p.
7. Marchi A, Camporesi M, Festa M, Salvatierra L, Izadi S, Farronato G. Drilling Capability of Orthodontic Miniscrews: In Vitro Study. Dent J. 2020;8(4):1-10.
8. Yi J, Ge M, Li M, Li C, Li Y, Li X, et al. Comparison of the success rate between self-drilling and self-tapping miniscrews: a systematic review and meta-analysis. Eur J Orthod. 2017;39(3):287-93.
9. Baumgaertel S. Temporary skeletal anchorage devices: The case for miniscrews. Am J Orthod Dentofacial Orthop. 2014;145(5):558–64.
10. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The Revised IASP definition of pain: concepts, challenges, and compromises. Pain. 2020;161(9):1976–82.
11. Lee TCK, McGrath CPJ, Wong RWK, Rabie ABM. Patients' Perceptions Regarding Microimplant as Anchorage in Orthodontics. Angle Orthod. 2008;78(2):228–33.
12. Rakhshan H, Rakhshan V. Pain and discomfort perceived during the initial stage of active fixed orthodontic treatment. Saudi Dent J. 2015;27 (2):81–7.
13. Ganzer N, Feldmann I, Bondemark L. Pain and discomfort following insertion of miniscrews and premolar extractions: A randomized controlled trial. Angle Orthod. 2016;86(6):891–9.
14. Sreenivasagan S, Subramanian AK, Nivethigaa B. Assessment of Insertion Torque of Mini-implant and Its Correlation with Primary Stability and Pain Levels in Orthodontic Patients. J Contemp Dent Pract. 2021;22(1):84–8.
15. Baxmann M, McDonald F, Bourauel C, Jäger A. Expectations, acceptance, and preferences regarding microimplant treatment in orthodontic patients: A randomized controlled trial. Am J Orthod Dentofacial Orthop. 2010;138(3):250.e1-250.e10.

DOI: 10.33897/fujd.v4i1.369

16. Anwar A, Raja UB, Naureen S. Success Rate and Pain Perception in Orthodontic Patients Receiving Bone Screws for Anchorage: A Pilot Study. Pak Oral Dent J. 2010;30(1):101-103
17. Long H, Wang Y, Jian F, Liao LN, Yang X, Lai WL. Current advances in orthodontic pain. Int J Oral Sci. 2016;8(2):67–75.
18. Büyükbayraktar ZÇ, Doruk C. Dental Anxiety and Fear Levels, Patient Satisfaction, and Quality of Life in Patients Undergoing Orthodontic Treatment: Is There a Relationship? Turk J Orthod. 2021;34(4):234–41.
19. Shirck JM, Firestone AR, Beck FM, Vig KWL, Huja SS. Temporary anchorage device utilization: comparison of usage in orthodontic programs and private practice. Orthod Art Pract Dentofac Enhanc. 2011;12(3):222–31.
20. Ohashi E, Pecho OE, Moron M, Lagravere MO. Implant vs screw loading protocols in orthodontics. Angle Orthod. 2006;76(4):721–27.
21. Frampton CL, Hughes-Webb P. The measurement of pain. Clin Oncol (R Coll Radiol). 2011;23(6) :381-6.
22. Chugh T, Jain AK, Jaiswal RK, Mehrotra P, Mehrotra R. Bone density and its importance in orthodontics. J Oral Biol Craniofacial Res. 2013;3(2):92–7.
23. Nucera R, Lo Giudice A, Bellocchio AM, Spinuzza P, Caprioglio A, Perillo L, et al. Bone and cortical bone thickness of mandibular buccal shelf for mini-screw insertion in adults. Angle Orthod. 2017;87(5):745–51.
24. Sreenivasagan S, Subramanian AK, Selvaraj A, Marya A. Pain Perception Associated with Mini-Implants and Interventions for Pain Management: A Cross-Sectional Questionnaire-Based Survey. BioMed Res Int. 2021;1(1):1-9.
25. Lamberton JA, Oesterle LJ, Shellhart WC, Newman SM, Harrell RE, Tilliss T, et al. Comparison of pain perception during miniscrew placement in orthodontic patients with a visual analog scale survey between compound topical and needle-injected anesthetics: A crossover, prospective, randomized clinical trial. Am J Orthod Dentofacial Orthop. 2016;149(1):15–23.