PATIENT'S PERCEPTION OF PAIN AND DISCOMFORT DURING MAXILLARY ARCH EXPANSION USING TWO DIFFERENT APPLIANCES - A PILOT QUESTIONNAIRE SURVEY

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ABSTRACT:

Aim: To evaluate and compare perceived pain and discomfort levels experienced by subjects treated with tooth-borne (Hyrax) and bone-borne (MARPE) Maxillary expansion appliances.

Materials and Methods: Ten subjects (7 boys and 3 girls) with a mean age of 15.8(+/- 2.8) years were randomized into two groups. Group A received a MARPE appliance anchored using mini-implants in the anterior palate and group B received a conventional Hyrax appliance. A self-assessment questionnaire on pain intensity, discomfort and analgesic consumption was given to subjects on the review visit and responses were collected. Descriptive statistics and Mann-Whitney U test was done to compare the mean of pain and discomfort levels between the two groups.

Results: All 10 subjects answered the questionnaire. More pain was experienced in the posterior teeth region by subjects treated with MARPE ($p<0.05$). No significant intergroup difference in pain levels experienced in the anterior region, palatal vault and the head region and analgesic consumption was noted. ($p>0.05$)

Conclusions: Although both Hyrax and MARPE were generally well tolerated there was a significantly higher pain experience in posterior teeth region for subjects treated with MARPE.

Key Words: Maxillary expansion; Pain and discomfort; Mini-implants; Questionnaire

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INTRODUCTION

Maxillary expansion is a common orthodontic procedure used to correct maxillary arch constriction by opening the mid-palatal suture. This procedure is commonly used to correct posterior crossbites in the mixed or permanent dentition. This is possible with the help of various appliances like MARPE and Hyrax.

Pain and discomfort are the most common side effects of orthodontic treatment with fixed appliances,[1,2,3] but there are some studies [4,5,6] that have explored pain and discomfort during RME treatment. The conclusion of these studies is that most of the children who undergo treatment with RME report pain which is more severe in the initial few days and gradually decreases. Activation protocols with two turns per day result in greater pain levels than do protocols with only one turn per day [5,6,7]. The highest pain levels were reported during the first 10 activations and peaked on days 3 and 4. Earlier studies [8,9] have reported that adolescent patients have very good tolerance to the mini-implants anchored both in the interradicular area and in the palate. These studies also concluded that age was not a predictor of pain and discomfort. However, there were no studies that have explored pain intensity and discomfort during treatment with skeletally anchored RME appliances.

To increase skeletal expansion and reduce the side effects of tooth-borne RPE, various types of bone-borne RPE have been developed.[10,11,12] These appliances may produce different results based on their design and active protocol. A four-point microimplant-assisted rapid palatal expansion appliance (MARPE) has been used to treat skeletal maxillary transverse deficiency.[13]

The purpose of this study was to investigate the patients' perception of pain and discomfort during maxillary expansion using two different appliances - a four-point microimplant assisted rapid palatal expansion (MARPE) and Hyrax appliance.

MATERIALS AND METHODOLOGY:

The respondents for this questionnaire survey comprised of 10 patients with a mean age of 15.85 years treated for constricted maxillary arches with either MARPE or Hyrax appliance at the department of Orthodontics and Dentofacial Orthopedics in our college.

An informed consent was obtained from both patients and their parents/guardians. Group I was treated with a MARPE with four 1.8–mm miniscrew implants attaching the expander to the palate surface (n = 5) (Figure 1) and group II with a conventional banded hyrax expander (n = 5) (Figure 2). Both expanders were activated two quarter turns per day (0.5 mm) until the palatal cusps of the maxillary first molars contacted the buccal cusps of the mandibular first molars. The patients were advised to use non-prescription analgesics at their own discretion. All patients in both groups were treated by the same orthodontist. The questionnaires were analysed by one of the co-authors, who was blinded to the study and performed no orthodontic treatment on the patients.

Questionnaire:

The questionnaire included self-assessed questions concerning pain intensity, discomfort and analgesic consumption. The questionnaire was given to the patients on the tenth day after the insertion of the appliance. The patients were asked to complete the questionnaire (Figure 3) on their own. Questions concerning intensity of pain and discomfort experienced were graded using a visual analogue scale (VAS) with a score of 1-10 with 1 being no pain and 10 being the worst pain imaginable.

Statistical Analysis:

The statistical analyses were performed using SPSS software version 23.0. The descriptive analysis including the mean and standard deviation of the study groups was done. The significance of difference between groups was assessed with a nonparametric Mann-Whitney U test for pain and discomfort.

RESULTS:

All the 10 patients completed the questionnaire. Group I consisted of 5 patients (i.e., 3 boys and 2 girls) with a mean age of 15.7 years (SD 1.39 years), and group II consisted of 5 patients (i.e., 4 boys and 1 girl) with a mean age of 15.8 years (SD 1.16 years).

Pain Intensity and Discomfort

The differences between groups were tested using the nonparametric Mann-Whitney U test for pain and discomfort. There was a statistically significant difference in the pain experienced in the posterior region between the Group I (6.2+/-0.8) and the Group II (3.4+/-1.1) with a p value of 0.008 ($p<0.05$) with the Mann Whitney z value of -2.538 (Table 1). The mean pain score in the anterior region was 4.2+/-0.8 in group I and 3.2+/-0.8 in group II. There was no significant difference in the pain experienced between the two groups in the Palate and the head region. Overall, the pain experienced by subjects in group I was comparatively higher than the subjects in group II. The mean pain scores between the two groups are shown in Figure 4.

There was also no significant difference between the two groups in the difficulty experienced during swallowing, speech or excess salivation (Table 2).

Table. 1 . Inter group comparison of pain intensity assessed using Mann-Whitney U test.

PAIN	MARPE (n=5)	HYRAX (n=5)	.	..
	Mean & SD	Mean & SD	p value	Z value
Pain in Anterior Region	4.2 +/- 0.8	3.2 +/-0.8	0.151	-1.643
Pain in Posterior Region	6.2 +/- 0.8	3.4 +/- 1.1	0.008	-2.538

Pain in Palate	4.6 +/- 1.1	3.8 +/- 0.8	0.421	- 1.193
Pain in Head	2.6 +/- 1.1	2 +/- 0.7	0.31	- 0.986

Table.2 Inter group comparison for discomfort assessed using Mann-Whitney U test.

DISCOMFORT	MARPE (n=5)	HYRAX (n=5)	.
	Mean & SD	Mean & SD	p value
Difficulty in Swallowing	4 +/- 0.7	2.6 +/- 0.5	0.757
Hyper salivation	3.8 +/- 0.8	3 +/- 0.7	0.464
Difficulty in Speech	4.4 +/- 1.1	2.4 +/- 1.1	1

Table. 3. Inter group comparison for analgesic consumption assessed using Mann-Whitney U test.

.	MARPE (n=5)	HYRAX (n=5)	..
	Mean & SD	Mean & SD	p value
ANALGESIC CONSUMPTION	4 +/- 0.7	1.6 +/- 0.5	0.757

Analgesic Consumption:

All the patients who were included in the study consumed analgesics. The subjects in group I consumed analgesics for a mean period of 4 days while those in group II consumed analgesics for an average of 1.6 days. There was statistically no significant difference between the groups (Table 3).

DISCUSSION:

Previous studies have reported on pain associated with various types of orthodontic procedures such as separator placement, arch wire placement,[14–16,17,18] but literature on pain associated with rapid palatal expansion is limited. The purpose of this study was to investigate and compare the pain and discomfort experienced by patients subjected to arch expansion with two different appliances in order to aid clinicians in preparing their patients for this procedure. Pain experience during any orthodontic procedure is dependent on many variables like the subject age, gender, amount of force delivered, type of mechanics employed and most importantly individual subject pain tolerance .[19,20]

In the present study a total of ten subjects with an average age of 15.85 years were divided into two groups for arch expansion. Subjects in Group I received MARPE (Miniscrew Assisted Rapid Palatal Expansion) appliance and Group II receiving the Hyrax appliance for arch expansion. Pain and discomfort experienced by subjects was assessed using a questionnaire and the data was tabulated and descriptive analysis including the mean and standard deviation of the study groups was done. Pain experience was higher in subjects treated with MARPE appliances around the posterior teeth and there was a statistically significant difference in the intensity of pain between groups ($p<0.05$). There was no significant difference between the two groups in the discomfort experienced during swallowing, speech or excess salivation. All patients who were included in this study consumed analgesics and there was statistically no significant difference between the groups for frequency of analgesic consumption.($p>0.05$)

According to Zimring et al.,[21] the pressure after a single activation of a jack screw is followed by an immediate pain response which then begins to dissipate soon thereafter. Human and animal studies have shown that when sutural tissues are expanded rapidly, highly vascular disorganized connective tissue of an inflammatory nature is created, which results in the perception of pain.[[22, 23] Cleall et al. report that the midpalatal suture widened very soon after the application of pressure in Rhesus monkeys.

Earlier studies [4,6] of pain during conventional RME treatment have stated that pain and discomfort levels peaked on days 3 and 4 and thereafter remained relatively constant. It could be speculated that the mini screw placement and further activation of the screw in patients undergoing expansion with MARPE can cause more pain than in patients treated with Hyrax. This could explain why patients in the Hyrax group experienced less pain and thus assigned lower scores. In his study, Alessandro et. al., compared pain experience of subjects treated with RME and subjects treated with leaf expander and concluded that the subjects on RME had more pain experience. He also reported the pain perceived by subjects treated with RME had a significantly higher amount of pain in the first four days of treatment. The findings of our study were consistent with that of another study by Feldmann et. al., where it was reported that the site with highest pain experience in patients treated with hyrax and bone anchored RPE was around the first maxillary molars.

According to Cleall et. al., as expansion continues less disruption of the midpalatal tissues occur with each progressive turn of the screw.[22] This observation may explain the gradual decrease in reported pain by the subjects after reaching a peak at the third and fourth days. This can also be explained by the fact that subjects may become more comfortable with the procedure, and thus the fear and anxiety of activating the appliance may be lessened with each turn.

Measurements of pain in children through self-reports must be interpreted cautiously. Pain can be difficult to measure due to limited language skills, developmental factors, different attitudes towards pain, and prior pain experiences. However, with proper utilization of a valid pain scale such as the VAS scale the factors associated with painful medical or dental treatments performed on children can be identified. To reduce the pain experience with MARPE the appliance can be activated 1 turn/day for the first few days when the pain is most intense and then at 2 turns/day for the remaining period

so that the patients get accustomed to the appliance. The findings of this study suggests that MARPE is associated with more pain experience than Hyrax in the posterior teeth hence clinicians can use approaches to minimize pain experience with MARPE. There are a few limitations of this survey which include sample size calculation not performed, age and gender difference were not evaluated and the influence of different activation protocols on pain experience were not assessed also pain is a subjective experience hence it can vary a lot between individuals

CONCLUSIONS:

All of the subjects reported at least some pain and discomfort during arch expansion with MARPE and Hyrax

Patients on MARPE had more pain in the posterior region than patients on Hyrax. All of the subjects took pain medication at least once during the expansion phase . There was no difference in the difficulty in swallowing or speech between the two groups.

DECLARATION OF CONFLICTING INTERESTS:

The Authors declare that there is no conflict of interest.

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1. Scheurer PA, Firestone AR, Bürgin WB. Perception of pain as a result of orthodontic treatment with fixed appliances. *The European Journal of Orthodontics*. 1996;18(1):349-357. doi:10.1093/ejo/18.1.349

2. Firestone A. Patients' anticipation of pain and pain-related side effects, and their perception of pain as a result of orthodontic treatment with fixed appliances. *The European Journal of Orthodontics*. 1999;21(4):387-396. doi:10.1093/ejo/21.4.387

3. Abdelrahman RS, Al-Nimri KS, Al Maaitah EF. Pain experience during initial alignment with three types of nickel-titanium archwires: A prospective clinical trial. *The Angle Orthodontist*. 2015;85(6):1021-1026. doi:10.2319/071614-498.1

4. Halicioğlu K, Kiki A, Yavuz I. Subjective symptoms of RME patients treated with three different screw activation protocols: a randomised clinical trial. *Aust Orthod J*. 2012;28(2):225-231.

5. Needleman HL, Hoang CD, Allred E, Hertzberg J, Berde C. Reports of pain by children undergoing rapid palatal expansion. *Pediatr Dent*. 2000;22(3):221-226.

6. Gecgelen M, Aksoy A, Kirdemir P, et al. Evaluation of stress and pain during rapid maxillary expansion treatments. *Journal of Oral Rehabilitation*. 2012;39(10):767-775. doi:10.1111/j.1365-2842.2012.02330.x

7. Baldini A, Nota A, Santariello C, Assi V, Ballanti F, Cozza P. Influence of activation protocol on perceived pain during rapid maxillary expansion. *Angle Orthod*. 2015;85(6):1015-1020.

8. Ganzer N, Feldmann I, Bondemark L. Pain and discomfort following insertion of miniscrews and premolar extractions: A randomized controlled trial. *The Angle Orthodontist*. 2016;86(6):891-899. doi:10.2319/123115-899.1

9. Feldmann I, List T, Feldmann H, Bondemark L. Pain Intensity and Discomfort Following Surgical Placement of Orthodontic Anchoring Units and Premolar Extraction. *The Angle Orthodontist*. 2007;77(4):578-585. doi:10.2319/062506-257.1

10. Lee K-J, Park Y-C, Park J-Y, Hwang W-S. Miniscrew-assisted nonsurgical palatal expansion before orthognathic surgery for a patient with severe mandibular prognathism. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2010;137(6):830-839. doi:10.1016/j.ajodo.2007.10.065

11. Wilmes B, Ludwig B, Katyal V, Nienkemper M, Rein A, Drescher D. The Hybrid Hyrax Distalizer, a new all-in-one appliance for rapid palatal expansion, early class III treatment and upper molar distalization. *Journal of Orthodontics*. 2014;41(sup1):s47-s53. doi:10.1179/1465313314y.0000000107

12. Lin L, Ahn H-W, Kim S-J, Moon S-C, Kim S-H, Nelson G. Tooth-borne vs bone-borne rapid maxillary expanders in late adolescence. *The Angle Orthodontist*. 2015;85(2):253-262. doi:10.2319/030514-156.1

13. Zong C, Tang B, Hua F, He H, Ngan P. Skeletal and dentoalveolar changes in the transverse dimension using microimplant-assisted rapid palatal expansion (MARPE) appliances. *Seminars in Orthodontics*. 2019;25(1):46-59. doi:10.1053/j.sodo.2019.02.006

14. Jones ML. An investigation into the initial discomfort caused by placement of an archwire. *Eur J Orthod*. 1984;6(1):48-54.

15. Graber TM. An investigation into the initial discomfort caused by placement of an archwire. *American Journal of Orthodontics*. 1984;85(6):533. doi:10.1016/0002-9416(84)90102-7

16. Ngan P, Kess B, Wilson S. Perception of discomfort by patients undergoing orthodontic treatment. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1989;96(1):47-53. doi:10.1016/0889-5406(89)90228-x

17. Brown DF, Moerenhout RG. The pain experience and psychological adjustment to orthodontic treatment of preadolescents, adolescents, and adults. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1991;100(4):349-356. doi:10.1016/0889-5406(91)70073-6

18. Ngan P, Wilson S, Shanfeld J, Amini H. The effect of ibuprofen on the level of discomfort inpatients undergoing orthodontic treatment. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1994;106(1):88-95. doi:10.1016/s0889-5406(94)70025-7

19. Krishnan V. Orthodontic pain: from causes to management--a review. *Eur J Orthod*. 2007;29(2):170-179.

20. Sergl HG, Klages U, Zentner A. Pain and discomfort during orthodontic treatment: causative factors and effects on compliance. *Am J Orthod Dentofacial Orthop*. 1998;114(6):684-691.

21. Zimring Jf, Isaacson Rj. Forces Produced By Rapid Maxillary Expansion. 3. Forces Present During Retention. *Angle Orthod*. 1965;35:178-186.

22. Murray JMCG, MC G. Murray J, Cleall JF. Early Tissue Response to Rapid Maxillary Expansion in the Midpalatal Suture of the Rhesus Monkey. *Journal of Dental Research*. 1971;50(6):1654-1660. doi:10.1177/00220345710500065101

23. The effects of splitting the midpalatal suture on the surrounding structures. *American Journal of Orthodontics*. 1964;50(12):923-924. doi:10.1016/s0002-9416(64)90146-0

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