

Evaluation of Pain and Jaw function impairments after Mini Screw Assisted Rapid palatal Expansion in young Adult Patients

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Abstract

Introduction: The aim was to evaluate pain intensity and jaw function impairments, after using MARPE (Miniscrew Assisted Rapid Palatal Expander) in young adult patients.

Methods: Sixteen subjects (5 males, 11 females) aged from (17-25± 2) years old with maxillary transverse skeletal deficiency. They received the MARPE with an activation protocol (2/3 turn per day) (0.4-0.6mm).

Self-reported Questions were used for evaluating Pain, pressure, Analgesic Consumption, and daily activities during the day before placement, the day after placement of MARPE and before activation, and the Fifth day of activation, the Seventh-day of activation and the Eleventh day of activation. Descriptive statistics, McNemar, Wilcoxon, and Pearson correlation were used.

Results: The results showed that the majority of the patients answered at T0 as "No pain", at T1, T2, T3 answered as "Moderate pain", at T4 answered as "Mild pain". There was pressure and pain in the upper first molars, pain in the anterior teeth and pressure on the maxilla. Speech ability and chewing hard food were affected, but the daily activities weren't.

Conclusion: Pain intensity after the use of MARPE was mild to moderate on (5, 7, 11)th day of activation which corresponded with mid palatal suture opening. Pain and pressure on the upper first molars peaked on the 5th day and decreased gradually. Pain from upper incisors was higher on the (5, 7)th day and decreased on the 11th day. Pressure on the maxilla was higher on the 7th day. The need for analgesic consumption was low. The MARPE Affected both speech and chewing hard food without any effect on the ability to work or study.

Keywords: pain, pressure, MARPE, WBFRS, Questionnaire.

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INTRODUCTION

Maxillary skeletal expansion through a fixed appliance is a well known practice in clinical orthodontics. Maxillary arch constriction with posterior crossbite can be treated in children and adolescents using RME (Rapid Maxillary Expansion) to open the mid palatal suture.¹

However, in adults it is based in part on anatomic studies of the maturing phase, which show the

midpalatal suture and adjacent circummaxillary articulations becoming more rigid and beginning to fuse by the mid twenties.²

Rapid Maxillary Expansion in adults was also associated with undesirable side effects such as pain, swelling, ulceration, flared posterior teeth, bite opening, gingival recession, alveolar dehiscence, fenestration, and root resorption.²⁻³

After the introduction of skeletal anchorage, the skeletally anchored RME appliances were introduced.⁴⁻⁵ Pain could be related to the rapid expansion activation protocol which is the main concern to the patient.⁶

A study of Isaacson in 1964 illustrated that the single activation of the expansion screw produced from about 3 to 10 pounds of force.⁷ Because of this huge amount of force, the inflammatory reaction during sutural opening with the compression of the periodontal ligament may contribute and increase the pain perception experienced during this kind of treatment.⁸ The fear of pain was the main cause that may dishearten a patient from undergoing orthodontic treatment.⁹

Pain is an individual response showing great diversity among individuals. It is dependent on many factors such as age, gender, individual pain threshold, the magnitude of the force applied, stress, and previous pain experiences.¹⁰

To my knowledge, there is no study done before on pain intensity, discomfort, and jaw functions after using MARPE (Mini screw Assisted Rapid Palatal Expander) in young adults.

This study aims to evaluate the pain intensity, and jaw function impairments during treatment with MARPE in young adult patients. The hypothesis was no pain, discomfort, or jaw dysfunction before and after using the MARPE.

MATERIALS AND METHODS

Subjects and study design: This is a prospective study which assesses the levels of pain, and jaw function impairments. It was conducted at the Department of orthodontics in Aleppo university of Syria between March 2019 to January 2021. The clinical procedure was conducted by the ethical principles of the World Medical Association Declaration of Helsinki No. 2435.

The patient's agreement was obtained by signing on papers and patients were informed that the data will be used and published in this study.

The sample of the study included 16 patients

(5 males, 11 females) aged (17-25±2 years) with maxillary transverse skeletal deficiency.

The including criteria were: (1) Unilateral or bilateral crossbite unless 5mm, (2) Young adult patients, (3) No previous orthodontic treatment.

The excluding criteria were: (1) Clift lip and palate and bone anomalies, (2) Bad oral hygiene (3) uncooperative patient. The expander (9 mm) used in this study was bone born expander supported by four mini-screws from (IOS company, USA). The body of the expander consists of four quarter holes with four arms welded to the body. (Figure 1)



Fig. 1: The IOS expander

The four mini-screws (IOS company, USA) were (13mm in length, 1.5mm in diameter) of titanium alloy (self- drilled type).

The laboratory procedures

A 9mm MARPE was used. The anterior arms had removed to fit the narrow palatal vault then the posterior ones were bent to reach the bands following palatal curvature, leaving 2 mm at least between the arms and palate. Arms were welded to bands then finishing and polishing were done.¹¹

Clinical procedures

Following the cementation of the MARPE, four miniscrews were inserted perpendicular to the center of the third quarter holes, under local anesthesia.

The position of anterior mini screws corresponded to the place between second premolars and first molars. The position of the posterior ones corresponded to the posterior border of the first molars, as presented in figure 1. The activation protocol was (2/3 turn/ per day)¹¹ (0.4-0.6mm) considering that the full turn of the IOS expander

was (0.8mm).

The patients were given a questionnaire about pain intensity, pressure, and jaw function impairments. The self-reported Questions were Concerning Pain, pressure, Analgesic Consumption, and Daily Activities Assessment the day before placement, the Day after placement of MARPE and before activation, the Fifth day of activation, the Seventh-day of activation, and the Eleventh day of activation (appendix 1).¹² To assess pain intensity they were provided with the Wong Baker Faces pain Scale.¹³

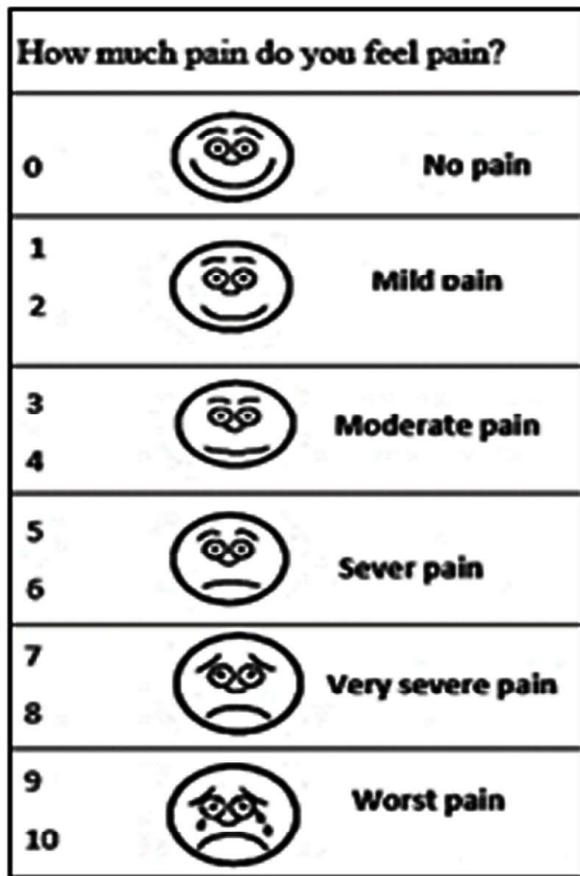


Fig. 2: The Wong-Baker faces rating scale (WBFRS)

PATIENTS WERE GIVEN TWO DIFFERENT FORMS

- By using the Wong-Baker Faces Rating Scale, the first form was for pain intensity assessment. This scale starts at (0) with the statement no pain, (1-2) mild pain, (3-4) moderate pain, (5-6) severe pain, (7-8) very severe pain, (9-10) worst pain.
- The second form was a questionnaire. The patients were asked to complete the questionnaire on their own in several times: T0= before placement of MARPE (baseline), T1= after placement of MARPE and before

activation, T2=the fifth day of activation, T3= the seventh day of activation, T4= the eleventh day of activation.

The activation of MARPE was started 3 days after T1 (until the pain of inserting the mini-screws was over).

Times, which had selected for the patient's pain assessment and answering the questionnaire depending on diastema appearance, distributed on the following days: the fifth day, the seventh day, and the eleventh day of activation. The questionnaire (appendix 1) contains 9 questions. Question (1) concerning pain assessment using the Visual Analog Scale with WBFRS where patients could mark their pain level. Questions (2-3-4-5-6) had a binary (yes/no) response. The sixth question had a follow-up question with space to write the response. Questions (7-8-9) about jaw function impairments were assessed using triple responses (not at all slightly difficult very difficult).

STATISTICAL ANALYSIS

The distribution of the population was summarized as percentages for discrete variables for questions. With binary responses, Cochran's Q test, a non-parametric test, and McNemar test were used. Friedman test was used for ordinal variables. Wilcoxon signed rank test was used for the location of a set of samples or to compare the locations of two populations using a set of matched samples. The Spearman correlation was used to determine if there was a statistical correlation between the pain intensity and age of patients with a P-value of less than 5% ($p > 0.05$) and (95% Confidence Interval of the Difference)

RESULTS

16 Subjects were included in this study. (5 males, 11 females) randomly selected with accordance of inclusion criteria.

A: Pain Assessment

The overall pain intensity was studied at different times. Patients assessed pain intensity according to the Wong-Baker Faces Rating Scale, as presented in Figure 3. The majority of patients answered at T0 as "No pain", at T1, T2, and T3 answered as "Moderate pain", at T4 answered as "Mild pain" and there were significant differences in pain levels between T0 and T1 before starting the activation, and between T0 and T2, T3, T4 during activation phase as presented in Table 1.

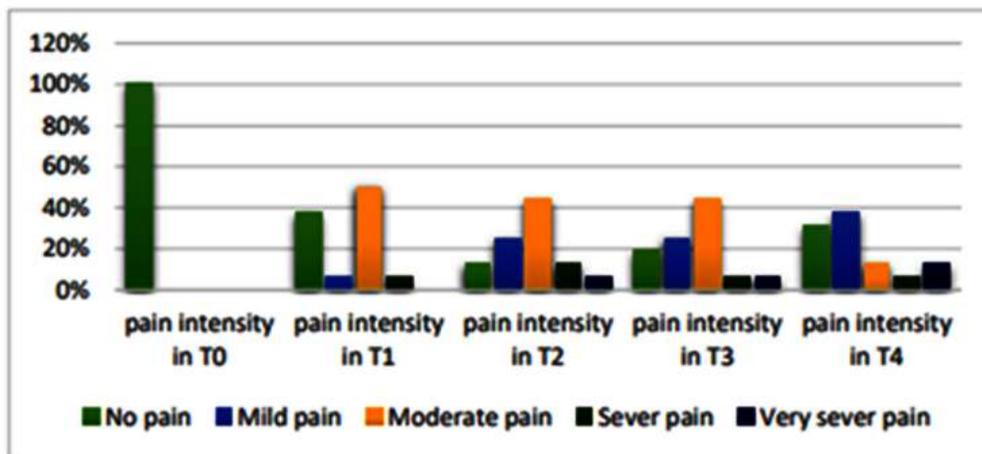


Fig. 3: Percentages of pain intensity before and after using MARPE during the eleven days of treatment.

Table 1: P-value for pain intensity in different times of treatment

	P-value			
	T0-T1	T0-T2	T0-T3	T0-T4
Pain intensity	0.003	0.001	0.001	0.003

Pain intensity in first molars and anterior teeth and pressure on first molars and maxilla are presented in figure 4. There were significant differences in

pain intensity in first molars and anterior teeth and in pressure on first molars and maxilla between T0 and T2, T3, and T4. Table 2

Table 2: The p-value for pain intensity in first molars and anterior teeth and pressure for first molars and maxilla

	p-value			
	T0-T1	T0-T2	T0-T3	T0-T4
Pain in first molars	1.000	0.000	0.001	0.004
Pain in anterior teeth	1.000	0.002	0.001	0.005
Pressure on first molars	1.000	0.001	0.000	0.002
Pressure on maxilla	1.000	0.000	0.000	0.002

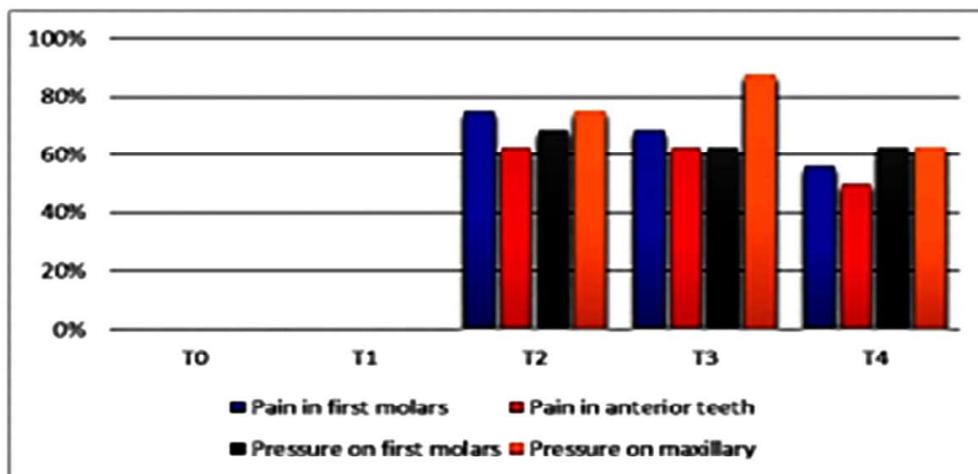


Fig. 4: Pain intensity in first molars and anterior teeth, pressure on first molars and maxillary

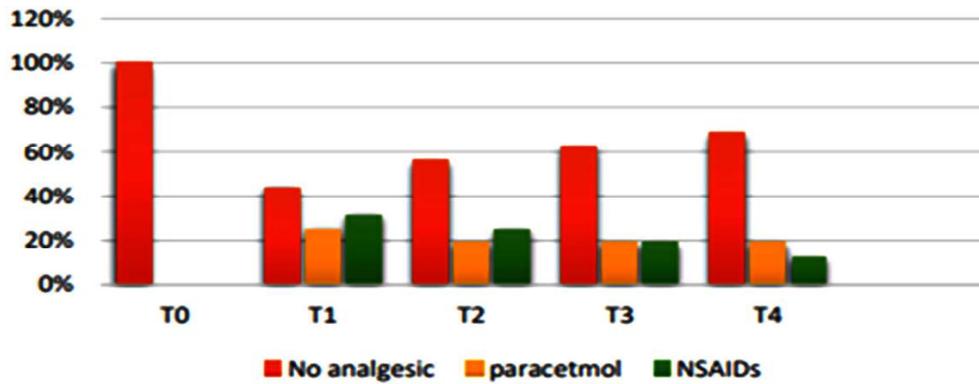


Fig. 5: Analgesic consumption at different times of treatment

B: ANALGESIC CONSUMPTION

Analgesic consumption was low and didn't differ

significantly during treatment where ($p < 0.05$). Paracetamol and Ibuprofen were the most commonly used analgesics Table 3.

Table 3: P-value for analgesic consumption at different times of treatment

P-Value	P-value			
	T0-T1	T0-T2	T0-T3	T0-T4
	.006	.015	.024	.038

C. JAW FUNCTION IMPAIRMENTS

After the placement of MARPE speech became slightly difficult in most patients (figure 6) and the ability to chew hard food also differed from

slightly to very difficult (figure 7) with statistically significant differences during treatment times ($p > 0.05$) table 4. The ability to work or study wasn't affected (figure 8) with no significant difference ($p < 0.05$).

Table 4: Presented P-value for speech, chewing hard food, and ability to study or work

	P-value (* p-value > 0.05)			
	T0-T1	T0-T2	T0-T3	T0-T4
Does the MARPE affect the speech?	0.000*	0.003*	0.005*	0.007*
Does the MARPE affect the ability to chew hard food?	0.000*	0.000*	0.000*	0.000*
Does the MARPE affect the ability to study or work?	0.112	0.112	0.112	0.112

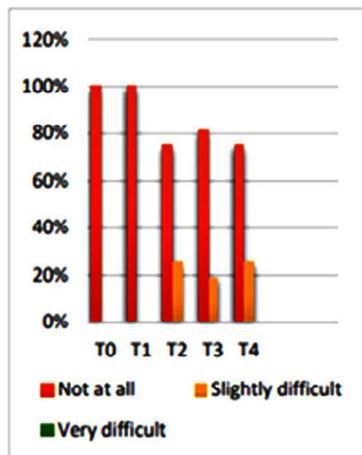


Fig. 6: Percentage of Speech

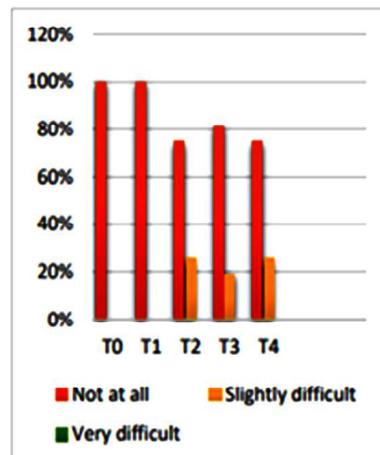


Fig. 7: Percentage of Chewing hard food

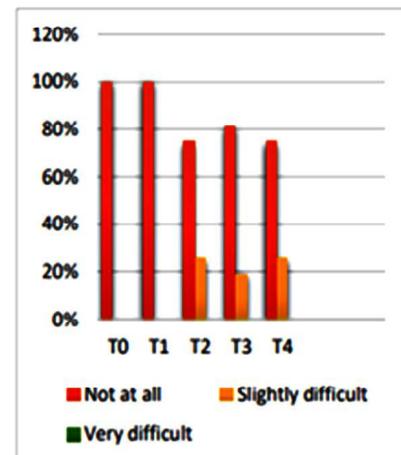


Fig. 8: Percentage of ability to work or study

D: RELATIONSHIP BETWEEN PAIN INTENSITY AND PATIENT'S AGE

The spearman correlation coefficient measured a reversal relation between pain and age (in some days) during 11 days of activation. The spearman test showed a statistically significant correlation at T1 and T2 (correlation coefficient -0.559, $p=0.033$ at T1) and (correlation coefficient -0.670, $p=0.004$ at T2). the level of pain is higher in younger patients.

DISCUSSION

In this study, the hypothesis wasn't confirmed by the results. There were statistically significant differences in most of the variables except for the ability to study or work.

Pain is a complex feeling that varies from person to person, so the qualitative assessment of pain is difficult. Verbal scaling systems have been used in the measurement of pain intensity, but verbal reporting may be distorted, both purposefully and unwittingly. The VAS (Visual Analogue Scale) is one of the most commonly used tools to assess pain intensity and is a valid and reliable method of measuring discrete pain as well as being an accurate, simple, replicable, and internationally accepted method of assessing pain.¹⁴⁻¹⁶ Thus, the VAS was employed in the assessment of pain in this study.

In this study, no pain presented at T0 in all subjects and this is considered to be the baseline. However, at T1 after the insertion of mini-screws the majority reported moderate pain and this agreed with a study said that the insertion of mini-screw caused moderate pain.¹⁷

Three days waited after the insertion of mini-screws until patients reported that no pain remained to eliminate the confounding factors that could interfere with the pain assessment during treatment such as compression of the periodontal ligament, bending of the alveolar bone, and tipping of the anchoring teeth.¹⁸

When activation was started, during the activation period, the pain levels peaked on the days 5, 7 and 11. These levels differed between mild to moderate and thereafter remained relatively constant. This made the MARPE well accepted by young adult patients and this matched with a study that considered the skeletal RME was well accepted at a young age.¹²

There was pain of anterior teeth on the fifth and seventh day and decreased on the eleventh day.

This is because of the high tensile stresses resulting from opening the mid palatal suture which extends to the distal and anterior parts of the hard palate pretending to the appearance of diastema, and may be due to the stretching of the transeptal fibers that connect central incisors after opening the mid palatal suture.¹⁹

Pressure on the maxilla during activation was higher on the seventh day of activation. The single activation of RME produced a force of about 3-10 pounds (1361-4535 grams) and the force values indicate to the resistance of the facial skeleton sutures to expansion where with increasing age, interdigitation of the mid palatal suture increases. This means that somewhat higher forces are required to induce expansion. This might give rise to higher pain and tension.

For pain and pressure on the first molars, the higher responses were at T2 (the fifth day) and decreased gradually. This pain and pressure on the first molars were logical because the MARPE was welded to first molar bands, so that, they received the expansion force initially resulting in the scores in older patients.^{7,12} This explains why pressure on the maxilla was higher at the beginning of activation and decreased after the opening of the mid palatal suture.

Analgesic consumption was low and didn't differ during treatment. The pain resulting from rapid maxillary expansion was well tolerated by patients.¹²

After the placement of MARPE, speech became slightly difficult in most of the patients and the ability to chew hard food also differed from slightly difficult to very difficult in some patients with statistically significant differences during treatment times. These were obvious side effects because of the volume of the expander and its position in the palate which interfered with the position of the tongue and therefore affected both the speech and the ability to chew hard food.

Despite of, previous side effects, the ability to work, study, or any other daily activities weren't affected. There was an adverse relation between age and pain levels. We found that pain levels were higher in younger patients.

The subjects of this study weren't homogeneous in sex or age because we selected our sample regarding to the inclusion criteria that accord with the indication utilization of MARPE.

CONCLUSION AND RECOMMENDATION

- Pain intensity after the use of MARPE was mild to moderate on the days 5,7,11 of activation which corresponded with the period of midpalatal suture opening according to the patient.
- Pain and pressure on upper first molars peaked on day 5 and decreased gradually.
- Pain of anterior teeth was higher on day 5,7 and decreased in day 11.
- Pressure on maxilla was higher on day 7.
- The need for analgesic consumption was low.
- The MARPE Affected the ability to speak and to chew hard food without any effect on the ability to work or study.
- A larger sample size and homogeneous distribution for sex will be more beneficial and reinforce our results.

APPENDIX-1: QUESTIONNAIRE

Self-reported Questions Concerning Pain and pressure, Analgesic Consumption, and Daily Activities Assessment the First day before placement, the Day after placement of MARPE and before activation, the Fifth day of activation, the Seventh day of activation, the Eleventh day of activation:

(modified from Feldmann and Bazargani 2017)

Pain Intensity:

1. Do you have pain?
2. Do you feel any pain from the molars?
3. Do you feel any pain from the incisors?

Discomfort:

4. Do you feel any pressure in your molars?
5. Do you feel any pressure in your upper jaw?

Analgesic Consumption:

6. Have you used analgesics for pain from your jaws, teeth, or face?

If yes, what kind of analgesic and dosage did you use?

jaw function impairments:

If you now have pain or discomfort in your teeth and jaws, how much does that affect?

7. Your speech?

8. Your ability to chew hard food?
9. Your ability to study or work?

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