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## The Effect of Hyrax-Type Rapid Maxillary Expansion with or without Laser Biostimulation on Mid Palatal Suture in Children with Posterior Crossbite

Amina Elalkamy

*Associate Researcher, Orthodontics and Pediatric Dentistry Department, .Oral and Dental Research Division, National Research Centre, Egypt., aminaelalkamy@gmail.com*

Fatma Abdelaziz

*Professor of Orthodontics, Faculty of Oral and Dental Medicine for Girls, Al Azhar University, Head of Orthodontics Department, Faculty of Dentistry, Nahda University, Egypt., fatmaaziz2oo4@gmail.com*

Ossama Alshal


*Professor of Oral Medicine and Periodontology, Faculty of Oral and Dental Medicine for Girls, Al Azhar University, Cairo, Egypt., oelshall@hotmail.com*

Hend Hafez

*Associate Professor, Orthodontics and Pediatric Dentistry Department, .Oral and Dental Research Division, National Research Centre, Egypt., hafez.hs@dentistry.cu.edu.eg*

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Mosatafa Gheith

 *Professor of Laser Applications in Dentistry National Institute of Laser Enhanced Sciences – Cairo University, Cairo, Egypt., mostafa1969gheith@gmail.com*

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## The Effect of Hyrax-Type Rapid Maxillary Expansion with or without Laser Biostimulation on Mid Palatal Suture in Children with Posterior Crossbite

Amina Elalkamy<sup>1\*</sup>, Fatma Abdelaziz<sup>2</sup>, Ossama Alshal<sup>3</sup>, Hend Hafez<sup>4</sup>, Mosatafa Gheith<sup>5</sup>

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azhardentj@azhar.edu.eg

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### ABSTRACT

**Purpose:** The aim of the following study was to evaluate the use of low-level laser application on the width of the Mid palatal suture (MPS) after rapid maxillary expansion. **Materials and methods:** patients age range  $10 \pm 2.5$  years were prospectively selected from outpatient clinic of the Orthodontic Department, Faculty of Dental Medicine for Girls, Al-Azhar University (Girls' Branch). Each patient was examined, full diagnostic records and cone beam computed tomography (CBCT) were taken before appliance cementation (T0), after six months and at the end of retention phase (T1). The hyrax appliance was used for rapid maxillary expansion (RME). The activation protocol of the expansion screw was 2 full turns daily. The laser type used was the e Epic™ X diode laser system, 940 nm wavelength, 40 mW power, and 10 J/cm<sup>2</sup> density. **Results:** No significant differences were found in the two areas between the control and the laser group. **Conclusions:** The mid palatal suture width showed no statistical significant differences between the control and laser group in anterior and posterior region.

### INTRODUCTION

Posterior crossbite is one of the most common malocclusions among children. This type of malocclusion persists into permanent dentition in most of the cases, with little chance of self-correction. <sup>(1)</sup> So, treatment in these cases was considered to be obligatory, to allow normal growth

### KEYWORDS

Low level laser, Expansion,  
Cone beam computed  
tomography; Crossbite

1. Associate Researcher, Orthodontics and Pediatric Dentistry Department, .Oral and Dental Research Division, National Research Centre, Egypt.
2. Professor of Orthodontics, Faculty of Oral and Dental Medicine for Girls, Al Azhar University, Head of Orthodontics Department, Faculty of Dentistry, Nahda University, Egypt.
3. Professor of Oral Medicine and Periodontology, Faculty of Oral and Dental Medicine for Girls, Al Azhar University, Cairo, Egypt.
4. Associate Professor, Orthodontics and Pediatric Dentistry Department, .Oral and Dental Research Division, National Research Centre, Egypt
5. Professor of Laser Applications in Dentistry National Institute of Laser Enhanced Sciences – Cairo University, Cairo, Egypt.

\* Corresponding author email: [aminaelalkamy@gmail.com](mailto:aminaelalkamy@gmail.com)

of the maxilla, which also provides better results. If this type of malocclusion is left untreated, it may affect growth and development in childhood, leading to skeletal asymmetry that may require surgical intervention in adults.<sup>(2,3)</sup>

Orthodontic maxillary expansion through separation of the mid palatal suture is the most common intervention used since 1860, in treatment of crossbite cases for the correction of the maxillary deficiency and increasing the arch perimeter.<sup>(4)</sup> Rapid maxillary expansion (RME) using Hyrax-type appliance is a routine procedure used to widen maxilla, in order to correct posterior crossbite and maxillary crowding. The Haas and Hyrax expanders are the most common devices used for RME.<sup>(5,6)</sup> This technique requires 6 months retention period to decrease the relapse tendency.<sup>(4,7)</sup>

Low level laser is a low-intensity, non-thermal light therapy that stimulates osteoblastic activity, vascularization, and organization of collagen fibers.<sup>(8-11)</sup> Several studies used LLL during expansion to accelerate suture separation and shorten the retention period through bone deposition.<sup>(9-13)</sup> More randomized clinical trials were needed to elucidate the effect of laser on the expansion and the retention period.<sup>(14)</sup>

The aim of the following study was to evaluate the use of low level laser application on the width of the Mid palatal suture (MPS) after rapid maxillary expansion.

## MATERIALS AND METHODS

This study was conducted on 14 patients. They were recruited from the outpatient clinic of the Orthodontic Department, Faculty of Dental Medi-

cine, Al-Azhar University (Girls' Branch). All cases included in this study were growing patients that were clinically diagnosed with posterior crossbites and indicated for maxillary expansion. Subjects with poor oral hygiene and active periodontal disease, craniofacial abnormalities, previous orthodontic treatment, any medical condition or medication that may affect bone metabolism were excluded.

The study was approved by the ethical committee of the faculty of dental medicine, Al-Azhar University of Cairo (Girls' branch) with the code (REC-OR-20-01). Each parent signed an informed consent form after detailed explanation for the whole procedure, a detailed case history, an extra and intra-oral examination has been performed. All records were taken before and after the treatment procedure which takes 6 months. The patients were randomly allocated into 2 groups. First group; the patients who received rapid maxillary expansion with Laser application, second group: the patients who received the rapid maxillary expansion without Laser application.

The cone beam computed tomography (CBCT) scans were taken at the start of treatment and 6 months after active expansion was completed. CBCT images were obtained before and after treatment, then data was analyzed and extracted using blueskybio 4 Viewer software. Measurement of MPS width just anterior to the nasopalatine duct and at the premolar area was measured in millimeters.

Rapid maxillary expansion procedure has been performed for both groups using the hyrax appliance (Fig. 1,B) which was bonded to the upper primary or permanent posterior teeth using glassionomer



Figure (1) 'A' is representing pre-treatment photographs, 'B' is representing the hyrax appliance and 'C' is representing the post treatment photographs.

cement. The expansion screw was activated twice daily (0.25mm for each turn), till reaching the needed expansion.

The laser group received laser sessions on the maxillary MPS anterior to the appliance along the maxillary MPS. The laser type used was the e Epic™ X diode laser system, 940 nm wavelength, 40 mW power, and 10 J/cm2 density.

**RESULTS**

The statistical analysis of the preliminary data were collected, tabulated and analyzed. The data

were explored for normality by Kolmogorov-Smirnov and Shapiro-Wilk tests and presented as; mean, standard deviation (SD), median and range. For parametric data Student’s t-test were used and for non-parametric data, Mann-Whitney test was used. Significance level was set at  $P \leq 0.05$ . Statistical analysis was performed with IBM SPSS Statistics (IBM SPSS Statistics for Windows Version 23.0, Armonk, NY: IBM Corp.)

No significant differences were found between the two groups control and laser in the MPS at the canine level as shown in Table 1 and also at the premolar level as well in as presented in Table 2.

**Table (1)** Descriptive statistics and comparison of MPS (mm) at the canine level in the control group and laser group.

	Control group (n=8)		Laser group (n=6)		p-value
	Median (range)	Mean (±SD)	Median (range)	Mean (SD)	
<b>Before treatment (T0)</b>	0.61 (0.74)	0.66 (±0.23)	0.7(0.65)	0.73 (0.24)	0.56
<b>After treatment (T1)</b>		-0.64 (±0.45)		-0.34 (±0.15)	0.51

SD: standard deviation, \*:  $P \leq 0.05$  significant difference

**Table (2)** Descriptive statistics and comparison of MPS (mm) at the premolar level in the control and laser group

	Control group (n=8)		Laser group(n=6)		p-value
	Median (range)	Mean (SD)	Median (range)	Mean (SD)	
<b>Before treatment (T0)</b>	0.45(0.65)	0.63 (0.37)	0.69 (0.47)	0.67 (0.15)	0.11
<b>After treatment (T1)</b>		-0.77 (0.27)		-0.62 (0.35)	0.39

SD: standard deviation, \*:  $P \leq 0.05$  significant difference

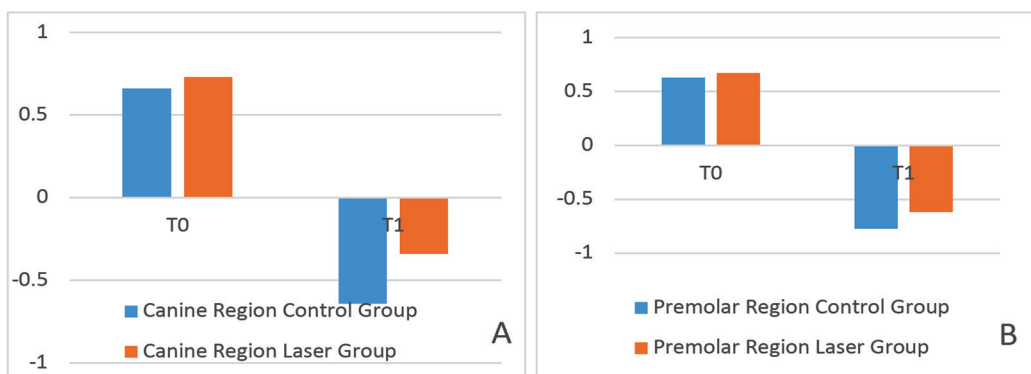


Figure (2) These graphs are representing the control and laser group before and after the retention period completion at the canine region (A) and the premolar region (B).

## DISCUSSION

For RME, both the Haas and the Hyrax type were the most commonly used appliances.<sup>(5, 6)</sup> In this study, using the Hyrax type rapid maxillary expansion for mid palatal suture separation in which posterior crossbite correction was provided. Choosing the hyrax type to allow easily laser application along the MPS, which came in agreement with previous study.<sup>(13)</sup> Also, to maintain better oral hygiene while decreasing the amount of acrylic plate in the patients' mouth, as well as maintaining the appliance for a period of time to decrease the tendency for relapse.<sup>(7,13)</sup> In the present study, the age group was coincident with more than one study.<sup>(13,15)</sup> Angelieri et al have introduced the assessment of the maturation of the mid palatal suture using CBCT diagnostic method which can be used to predict the expansion success and to estimate the prognosis of the expansion.<sup>(3,16,17, 18)</sup> And this came in agreement with this study as using CBCT became widely used in the normal dental practice for better results.

Retention period in this study came in agreement with different studies which ranged up to 6 months for MPS remodeling.<sup>(19-23)</sup> At least in our study, the width of the MPS increased successfully due to expansion procedure in control and laser groups insignificantly with slight increase at the anterior region in comparison with the posterior region. These findings were evaluated using CBCT before the treatment procedure (T0) and after treatment (T1). These results came compatible with other studies as Cantarella et al, however, their results were statistically significant.<sup>(15)</sup>

## CONCLUSION

After the rapid maxillary expansion treatment, the mid palatal suture width showed increase in anterior and posterior region without statistical significant differences between both groups either the control or laser group. However, the posterior crossbite is corrected.

## RECOMMENDATION

Prolonged follow up for the patients.

Further RCTs studies are needed.

## CONFLICT OF INTEREST:

All the authors denied any conflict of interest.

## FUNDING

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