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# Treating an Orthodontic Case of Midline Diastema with High Frenal Attachment in Association with Laser Assisted Periodontics and Restorative Procedure

Dr. Mayank Trivedi, MDS<sup>1</sup>, Dr. Priya Chaurasia, MDS<sup>2</sup>, Pranitha Prabhakaran, MDS<sup>3</sup>

<sup>1</sup> Senior Lecturer & Consultant Orthodontist, Department of Orthodontics & Dentofacial Orthopedics, Rajarajeshwari Dental College and Hospital, Bangalore – 560074. E-Mail: 1987.mayank@gmail.com. Phone no: +91995312417

<sup>2</sup> Consultant Periodontist, Private Practice, Navi Mumbai, Maharashtra. E-Mail: drpriya.chaurasia@gmail.com. Phone no: +919620569474

<sup>3</sup> Consultant Endodontist, Private Practice, Palakkad, Kerala. E-Mail: pranitha.prabhakaran@gmail.com. Phone no: +919731157546

Corresponding Author: Dr. Mayank Trivedi, MDS. Senior Lecturer & Consultant Orthodontist, Department of Orthodontics & Dentofacial Orthopedics, Rajarajeshwari Dental College and Hospital, Bangalore – 560074. E-Mail: 1987.mayank@gmail.com. Phone no: +91995312417

## Abstract

Maxillary midline diastema presents with the compromised aesthetic appearance of an individual which includes spacing in between the maxillary central incisors. Such appearances may worsen with the presence of high attachment of the frenum and small or peg-shaped lateral incisors. In order to address such conditions, multiple approaches may be required. It is important to close the space first and eliminate the cause of abnormal frenum followed by compensating the tooth size discrepancy with suitable restorative material. To achieve such objectives fixed orthodontics or bracket assisted closure of space, laser-assisted frenectomy for the removal of abnormal frenal attachment and composite resin crown build up to attain desirable shape of the tooth has to be employed. With such multidisciplinary practice, an aesthetically sound and pleasing profile was achieved for the patient.

**Keywords:** Orthodontics, Laser Frenectomy, Composite Resin Restoration

## Introduction

Maxillary midline diastema is a condition characterized by the presence of spacing between the two erupted permanent central incisors giving the patient an altered appearance. Some of the major causes for the prevalence of midline diastema is high frenum attachment, problems with the shape of adjacent lateral incisors such as small shaped or peg-shaped lateral incisors not filling the required space in the dentition or absence of lateral incisors and presence of small clefts in the bone.<sup>1</sup> High frenal attachment is characterized into four types namely gingival, musosal, papillary and papilla penetrating. Severe one being papilla penetrating where there is an attachment of the upper border lip tubercle to the palatine papilla. Papilla penetration is a severe attachment problem of the frenum, and subsequently, the cause for midline diastema causing spacing in between the teeth.<sup>2</sup> Midline diastema is characterized as upright, convergent and divergent, and its prevalence is observed mostly in

females. Etiology of midline diastema is of prime importance because it is necessary to get to the root of the problem for better treatment planning.<sup>3</sup>

Fixed orthodontic appliance for correcting midline diastema is better than correction done with removable appliance as there is better control over the crown and root movements and maintaining permanent retention is also possible by orthodontic intervention.<sup>4</sup> Available treatment modalities for correcting a midline diastema associated with a high frenal attachment are frenectomy and frenotomy, the former is the complete removal of the frena and latter involves relocation of the frenal attachment. The process of frenectomy is further divided into modifications such as V-Y plasty, Z plasty and Miller's technique that is performed with surgical scalpel.<sup>5</sup>

Lasers find various applications in the field of dentistry these days and orthodontic treatment facilitated by the use of laser procedures have been gaining momentum over the years.<sup>6</sup> Lasers used in frenectomy procedures are basically semiconductors and their property of approximating the wavelength to the absorption coefficient of the soft tissues such as collagen, haemoglobin, and melanin makes them unique for their usage in the treatment procedures.<sup>7</sup> Laser devices provide increased comfort, better visualization of the area of application and greater precision in areas of its application in dentistry and in periodontics.<sup>8</sup>

Orthodontic intervention and laser periodontal approach to resolve the diastema and high frenal attachment may not be enough. A recent technique for applying composite resins to the tooth surface for its build-up has acquired importance as it resembles the natural tooth structure in terms of shades selection and mechanical and physical properties.<sup>9</sup> Hence, in order to achieve an ideal tooth proportion, restoring the crown part to its natural anatomical measurements is necessary for which composite build-up technique can be employed.

The sole purpose was to employ a multidisciplinary approach to midline diastema by correcting it with orthodontics, laser-assisted frenectomy, and composite resin build-up to attain a sound aesthetic appearance that would not relapse in the future.

### Case report

An 18-year-old patient came to a private dental clinical set up in Bangalore, India and desired to get her teeth corrected. At extraoral examination, she presented with competent lips and straight profile with a display of maxillary midline diastema on a smile. On intraoral examination, the patient presented with a midline diastema measuring 3-4 mm with high frenal attachment. The patient also showed the presence of peg-shaped lateral incisors which was a major cause for persisting midline diastema. Fixed orthodontic treatment was started, and midline diastema was closed, and adequate space was made available for composite resin crown build-up, brackets were removed prior to composite resin build up. After the restorative procedure was completed, fixed bonded retainers were given to the patient palatally. Laser-assisted frenectomy was performed. The patient was satisfied with the treatment outcome and overall treatment results (figure 1).

### Treatment Progress

**Orthodontics:** Treatment was started using MBT 0.22" prescription and initial 0.16" Nickel Titanium wires were placed for levelling and aligning of the teeth followed by 17x25" rigid stainless steel wires for the closure of the persisting diastematous space along with an elastomeric chain for incisor space closure. Posterior occlusal settling was done using red elastics prior to starting restorative procedure (figure 2).

**Restorative:** After creating sufficient amount of spacing between 11 and 12 and between 21 and 22, a treatment plan was the closure of space using direct composite resins on the mesial surfaces of 12 and 22 and distal surfaces of 11 and 21. Minimal tooth preparation was done on the mesial surfaces of 12 and 22 and on distal surfaces of 11 and 21. Cheek retractor was placed, and isolation was done. Polytetrafluoroethylene (Teflon) tape was used to isolate the adjacent teeth. Acid etching was done using EazEtch 37% phosphoric acid. Enamel etched surface was rinsed and dried. Tetric N Bond Universal bonding agent (Ivoclar) was applied and light cured. The restoration was done using A2 shade composite resin by Ivoclar (Tetric N cream bulk fill). Finishing and polishing were performed using (Shofu composite) finishing kit (figure 3).

**Periodontics using Laser:** Patient was prepared by applying topical anaesthetic gel with small cotton pellets over the frenum. As the patient was still complaining of pain during the procedure, a small amount of local anaesthetic was infiltrated in the vicinity of the frenum. For the laser technique, a diode laser (Sunny, MSI, Bengaluru) with an 808 nm wavelength was used. A 300 µm fibre with an initiated tip at 3W in a continuous mode was used. The tip of the laser was activated outside the oral cavity. For laser-assisted labial frenectomy, the upper lip was pulled upward by the chairside assistant, causing the frenum to tighten. The incision was started with the frenum from the attached gingiva and interdental papilla on the labial surface in a contact mode with a paintbrush stroke between the central incisors extending upward from inner side of upper lip to the depth of vestibule ending in a rhomboidal raw area, separating the fibres from the periosteum (figure 4). Sutures were not placed post the laser treatment.

### Treatment Results

Applying orthodontic force corrected the maxillary midline diastema within a shorter period of time, the patient presented with competent lips and improvement in the profile during a smile. Bonded fixed retainers after the closure of space provided for any kind of space opening. The restorative procedure gave an adequate crown shape and size along with matching midlines and matching tooth colour which satisfied the patient. Keeping both the procedures in mind and frenectomy by laser intervention being done, stability was assured towards space opening, attachment of the frenum and overall stability in terms of aesthetics and functional occlusion (figure 1).

### Discussion

Maxillary midline diastema necessitates the removal of high frenal attachment either before or after the treatment by fixed orthodontic mechanics and the treatment of which is followed by permanent retention plan in order to prevent the opening up of the spaces that are closed. Such a multidisciplinary approach provides good stability and better treatment outcome.<sup>10</sup>

Tissue changes take place when the infrared laser radiant energy in the range of 980 nm is converted to heat energy causing incision, coagulation to vaporization and mainly has an affinity towards haemoglobin and dark pigments which contributes to their thermal outcome. Homeostasis is seen when an infrared laser light diode at a particular wavelength induces thermal injury to the target tissue with a laser tip that moves gradually over the tissues providing a cut and the depth of which depends upon the power and duration of time for which the contact is made. Use of lasers has gained popularity as other treatment protocols have become less important when it comes to conditions of tissue ablation, sterilization, and homeostasis. The laser with its coagulating effects blocks the small sensory nerve endings and provides with the much needed homeostatic and anaesthetic effects. The term coagulation is important in laser surgery as it produces the desired homeostasis by approximating the edges of the wound and vessel wall contraction. With such properties of laser frenectomies being done, the need for placing sutures have also been minimized. Advantages of lasers for frenectomy includes no bleeding, good acceptance by the patient, minimal discomfort post surgically. Reduced inflammatory reaction and edema grounds less pain and irritation and less use of drugs postsurgically.<sup>11</sup>

Addressing the tooth size and shape problems are also important as full-fledged treatment by orthodontics may not address all the problems efficiently and is also an option that is unappealing to most of the patients. Composite resin restorations in combination with orthodontics offer a more conservative and economical method to solve problems of midline diastema.<sup>12</sup>

**Laser frenectomy:** In a case report by Kamble A et al., a successful treatment for the correction of high labial frenum was performed using Er, Cr: YSGG (Waterlase MD biolase technology, Ervin, CA, USA): 2.25 W of power supply, 30% water flow and 30% air flow, 600 µm diameter of optical fibre tip (G6) at 20 Hz) laser and the treatment outcome was effective as it was a lesser amount of expense and time consumption and was convenient to the patient and overall proved to be a minimally invasive and highly effective method of correcting midline diastema.<sup>13</sup> According to another case report by Sukumar Singh N et al, a diode laser having a wavelength of 810-900 nm of CO<sub>2</sub>, Nd: YAG, Argon, Er:YAG and diode laser with a power supply of 1W has a

significant effect on the frenal tissue removal and proved to be a useful method when compared to the conventional tissue removal method using a blade.<sup>14</sup>

**Orthodontic treatment:** In a case report by Nubesh Khan S et al, in two different patients who were treated by orthodontics and laser frenectomy by using diode laser with a wavelength of 980 nm, 3W power and 400 µm optical fibre with the idea that minimum power exposure and accurate wavelength together can be utilized for performing effective frenectomy in orthodontic patients despite the involvement of metal brackets.<sup>15</sup> In another article by Eduardo F S et al., high-intensity laser therapy was provided for frenectomy procedures having a laser setting of 1.6 W and was expected not to be used in close proximity to the bone as there might be chances of heat-related damage to the vital structures.<sup>16</sup>

**Composite resin restoration for a case of midline diastema and laser frenectomy:** In a case report by Utpal kumar Das et al., frenectomy was performed in a patient with a diode laser having a wavelength of 980 nm, 3W power, and 32 micron quartz optical fibre. A combination of laser-based frenectomy and composite restoration solved the problem of midline diastema.<sup>17</sup> In a report by Sucheta S, laser frenectomy was performed using a 400 µm fibre of diode laser 980 nm and 2.5 W and later restored the spaces using a combination of zirconia crown and composite resin buildup.<sup>18</sup>

Hence, according to the above findings, we can conclude that laser frenectomy is a reliable technique for correcting cases of midline diastema combined with orthodontics and composite resin build up.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or other, exists.

#### FIGURES



FIGURE 1: PRE AND POST TREATMENT PHOTOGRAPHS SHOWING PRESENCE OF MIDLINE DIASTEMA AND AFTER CORRECTION OF DIASTEMA





FIGURE 2: BEFORE AND AFTER THE CLOSURE OF MIDLINE DIASTEMA AND SETTLING ELASTICS



FIGURE 3: BEFORE AND AFTER THE CLOSURE OF MIDLINE DIASTEMA WITH COMPOSITE RESIN RESTORATION



FIGURE 4: LASER FRENECTOMY PROCEDURE AS PERFORMED IN STEPWISE MANNER FROM SETTING THE PARAMETERS TO INITIAL AND FINAL INCISION

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