Case Report

Labial frenectomy before debonding of orthodontic braces using diode laser: A case report

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ABSTRACT

Midline diastema is a common adult esthetic concern often linked to high labial frenal attachment. Traditional frenectomy using scalpels may cause pain, bleeding, and delayed healing. Diode lasers offer a minimally invasive alternative with improved precision and patient comfort. This case report presents the orthodontic and laser-assisted management of a 24-year-old male with generalized spacing and a 4 mm maxillary midline diastema due to a papilla-penetrating frenum. Fixed orthodontic treatment using McLaughlin, Bennett, and Trevisi (MBT) appliances achieved space closure, followed by a diode laser frenectomy using a 980 nm laser. The procedure was bloodless and suture free and healing was uneventful. Stability was maintained with a bonded lingual retainer and a Hawley retainer. Laser-assisted frenectomy proved to be a safe, effective adjunct to orthodontics, aiding in long-term stability and patient satisfaction.

Key words: Fixed appliance, Frenectomy, Laser, Midline diastema, Spacing

Achieving the ideal smile through dental treatment has become more and more important due to esthetic concerns. Adults' persistent diastema between their maxillary central incisors has frequently been viewed as an esthetic issue [1]. One of the biggest challenges in dentistry has been space closure in the anterior section of the jaws [1]. Space between adjacent teeth is called a "diastema." Approximately 98% of 6-year-old, 49% of 11-year-old, and 7% of 12–18-year-old have midline diastema (or diastemas) [2]. Generalized spacing or diastema between anterior teeth can be caused by several physiological or dental alveolar factors, such as missing teeth, peg-shaped lateral teeth, midline supernumerary teeth, the position of the teeth in their bony crypts, incorrect cupid eruption pathway, proclamation of the upper labial segment, prominent frenum, or self-inflicted pathology by tongue piercing. The treatment options involve observation and follow-up, active orthodontic tooth movement, combined orthodontic and surgical approach, restorative treatment, and Mulligan's technique of overcorrection [3]. Space closure is simple for younger patients and can be achieved with just orthodontic treatment. Keene defined anterior midline spacing as more than 0.5 mm between the proximal surfaces of neighboring teeth. He also stated that the occurrences of mandibular and maxillary midline diastema are 1.6% and 14.8%, respectively [4].

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Midline diastema was more common in the maxilla than in the mandible. Other studies confirmed Angle's conclusion that an aberrant frenum is the source of midline diastema [5]. Since one of the etiological factors for maintaining a midline diastema is the presence of an abnormal frenum, attention to the frenum has become crucial [1]. A frenum is a mucous membrane fold which contains muscle and connective tissue fibers that attach the lip and the cheek to the alveolar mucosa, the gingiva, and the underlying periosteum [6]. Knox and Young histologically studied the frenulum, and they reported both elastic and muscle fibers (orbicularis oris - horizontal bands and oblique fibers). However, Henry, Levin, and Tsaknis have found considerably dense collagenous tissue and elastic fibers but no muscle fibers in the frenulum [7]. Almost every area of dentistry uses lasers, including periodontal treatments, operations, restorations, and even esthetic dentistry. Laser-assisted frenectomy is one particular topic that needs more attention and significance [8].

Previously, frenectomy was carried out using scalpels and blades. However, many disadvantages have been observed with the use of scalpels, such as delayed healing, excessive blood loss, and post-operative pain and swelling. Conventional technique and use of sutures. Second, among almost all studies and research, it has been observed that patients treated with the scalpel technique faced problems such as scarring, post-operative swelling, delayed wound healing, and even intraoperative pain [9]. Conventional

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treatment involves a surgical procedure, which naturally makes use of anesthesia. Dental phobia among children is a difficult situation to deal with. Hence, lasers without anesthetic needles have made such procedures both dentist and patient-friendly.

CASE REPORT

A 24-year-old male reported to the Department of Orthodontics and Dentofacial Orthopedics, MAHE Institute of Dental Sciences and Hospital, with a chief complaint of spacing in the upper and lower front tooth region.

On extraoral examination, the patient had a mesoprosopic facial form with a slightly straight facial profile. There was neither gross asymmetry nor any facial disproportion (Fig. 1). On intraoral examination, there was severe spacing in the upper and lower arch along with a 4mm midline diastema in the upper arch. There was an Angles class I molar and class I canine relationship bilaterally with slightly decreased overjet and papillary frenal attachment (Fig. 2).

On smile analysis, the amount of incisor exposure was 80 %, with no gingival exposure. On average, the smile line was high with a consonant smile arch. His upper and lower lips lengths were normal, with a 0 mm interglacial gap. The patient presents with a permanent dentition, with all teeth present in both the upper and lower arches except for the third molars in the third and fourth quadrants. The shape, size, and enamel texture of the teeth are normal. The dental arches are U-shaped in both the maxilla and mandible. In terms of vertical relationship, there is no open bite, and the overbite measures 2 mm. Anteroposteriorly, the overjet is 3 mm. Transversely, there is no evidence of crossbite or scissor bite. The lower dental midline is shifted 2 mm toward the right side (Fig. 3).

Tests were done for the frenal attachment: The Blanch test was done to confirm the diagnosis, wherein the upper lip was stretched upward and outward, showing an apparent zone of attached gingival along the midline/the interdentally papilla shift, indicating papilla penetrating frenal attachment (Fig. 4).

On the basis of these tests, a diagnosis of skeletal class I Jaw base relationship with prognathic maxilla and orthognathic mandible was made, which showed an average growth pattern and Angle's class I molar relationship bilaterally, along with spacing in the upper and lower arches, 3 mm of midline diastema, and high frenum attachment.

Bonding in upper and lower teeth was done till the 2nd premolars. Leveling and alignment using 0.014NiTi, 0.016 NiTi, 0.016 SS, 0.018 SS, 0.017 × 0.025 NiTi, 0.017 × 0.025 SS, 0.019 × 0.025 NiTi, 0.019 × 0.025 SS. Both the arches were prepared for retraction with posted 0.019 × 0.025 stainless steel (Fig. 5). In upper and lower arches, en masse retraction was carried out by using continuous arch mechanics. After obtaining the result, a decision was made to remove the high frenum attachment by laser technique, and written consent was taken from the parents and patient for the frenectomy procedure. Incision with a fiberoptic tip was started with the frenum from the attached gingiva and interdental papilla on the labial surface between central incisors, extending upward from the inner side of the upper lip to the depth of the vestibule (Fig. 6). The tip of the fiberoptic was held in a perpendicular or oblique direction to the frenum in contact mode

Figure 1: Pre-treatment extraoral photographs

Figure 2: Pre-treatment intraoral photographs

between the laser tip and tissue surface. After the end of the laser exposure, the surgical site was wiped off with a normal saline cotton roll. Post-operative antibiotics and analgesics were given to the patient. The patient was then recalled for post-operative evaluation after 7 days (Fig. 7a).

After 10 days of the surgical procedure, again a bonded lingual retainer along with Hawley retainer in the upper and lower arches was delivered. Moreover, this whole treatment procedure was finished within 11 months. At the end of treatment, an optimum overjet and overbite was obtained along with closure of midline diastema and midline shift. A consonant smile was established by maintaining a proper class l molar and canine relation (Fig. 7b).

DISCUSSION

Photothermal interaction with tissue is the basic concept of surgical lasers. In this process, radiant light is absorbed by the tissue and transformed into heat energy, changing tissue structure. Laser light within was converted to thermal energy on contact with the tissue, causing laser tissue interaction, which when appropriately applied, can produce reactions ranging from incision, vaporization, to coagulation. Diode laser provides better patient perception in terms of operation time, pain, and bleeding than that encountered with the scalpel.

Figure 3: Smile photograph

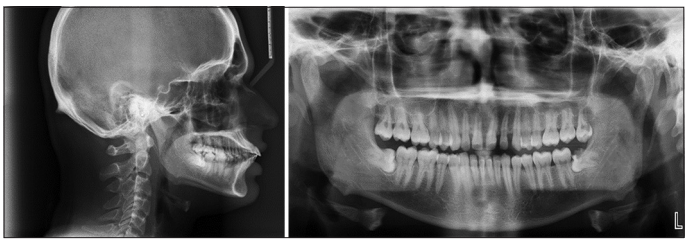

Figure 4: Pre-treatment - Lateral cephalogram and Orthopantomogram

Intraoperative bleeding during frenectomy is a key consideration. Studies show that bleeding is significantly higher when using a scalpel compared to a laser. Many cases with laser frenectomy report bloodless surgeries [9-11], although some still experience minimal to moderate bleeding [5]. Potential causes for bleeding include improper surgical technique, insufficient understanding of the laser, anatomical variations, patient behavior, and lack of experience.

Diode lasers have found their way even in the field of orthodontics, where abnormal frenal attachments are a hindrance to tooth movement. Hence, diode lasers are a good method for frenectomy, providing a better post-operative response and minimizing the use of sutures, anesthesia, and, therefore, patient discomfort even during the treatment. Using a scalpel left behind a scar at the incision site, which interfered with periodontal health and esthetics; however, with a diode laser, the healing mechanism is clean and faster.

A common esthetic problem faced in adults is the spacing between teeth. Spaced dentition is characterized by interdentally spaces and a lack of contact points. Spacing can be both localized and generalized types due to the number of teeth involved. The characteristic feature of mixed dentition is the presence of spacing mainly in the anterior segment, which usually is corrected by the termination of mixed and the beginning of permanent dentition. The frenal attachment can be of different types, including mucosal, papillary, gingival, and papilla penetrating. It has been stated that when the remaining teeth erupt by 16 years of age, 83% of the maxillary gingival, and papillary and papilla has been stated that when the remaining teeth erupt by 16 years of age, 83% of the maxillary midline midline diastema disappear spontaneously, chances of relapse occurs after treatment of small initial diastema [12], measures must be taken to avoid relapse. Bonded lingual retainers are easily favored by patients and are non-dependent. In general, abnormal frenal attachment require removal either before orthodontic treatment or at the end of active orthodontic treatment. The advantage of excision before orthodontic treatment is the ease of surgical access. Performing surgery before the orthodontic procedure might impede the closure of diastema by forming scar tissue, but there is a major advantage of excision after orthodontic tooth movement, which helps to maintain closure of diastema.

Figure 5: Orthodontic treatment using MBT brackets and archwires

Figure 6: Laser frenectomy and immediate post-operative after complete removal of frenum attachment

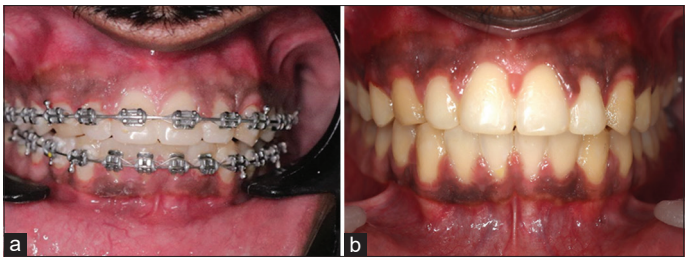

Figure 7: (a) Showing 1-week post-operative healing; (b) After 6 months of follow-up

A study by Suter *et al*. assessed the maxillary midline diastema closure after frenectomy by CO_2 laser. They advised an interdisciplinary approach to the maxillary midline diastema. Although the results were satisfactory, they expressed the lack of case series using other frenectomy methods in the literature [13]. A case report by Jawale *et al.* [12] presents the orthodontic management of a 32-year-old male patient with Class I malocclusion characterized by a maxillary midline diastema and generalized spacing in both the upper and lower arches. The midline diastema in the maxillary arch was attributed to a thick band of fibrous tissue between the upper central incisors.

The treatment approach involved conventional fixed orthodontic therapy to close the spaces, followed by a frenectomy performed just before the final closure of the midline diastema to minimize scar tissue formation. The results demonstrated successful space closure in both arches, highlighting the effectiveness of interdisciplinary collaboration between an orthodontist and a periodontist.

This case underscores the importance of comprehensive treatment planning, careful case selection, and patient cooperation in achieving significant clinical outcomes. In this case, the use of a 980 nm diode laser allowed increased surgical precision and accuracy, thereby reducing unnecessary damage to underlying tissue, and the procedure was performed with no bleeding in all cases. Resulting in improving visualisation of the surgical field, eliminating the need for post-operative sutures.

CONCLUSION

Laser-assisted frenectomy is a safe and effective adjunct to orthodontic treatment, offering improved healing, reduced discomfort, and enhanced patient compliance. When timed appropriately, it contributes to long-term stability by addressing high frenum attachments that may affect treatment outcomes. Integrating soft-tissue management into orthodontic planning is essential for achieving optimal functional and esthetic results.

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