Case Report

Laser-Assisted Multidisciplinary Approach for Closure and Prevention of Relapse of Midline Diastema

Abstract
Midline diastema, which occurs as spacing between the upper central incisors, is a common occurrence seen in the pediatric population. In the ugly duckling stage of development; no treatment is generally advocated as the diastema is a transient one. When diastemas occur due to other pathologies, they pose several problems in relation to esthetics and speech in a growing child. With the advent of time, patient’s demand for esthetics has greatly increased. Along with this, a less time-consuming treatment option is a favorite. Proper diagnosis of the diastema, unfolding its etiology, helps in devising an adequate treatment plan. This eventually will lead to stability of the final result. The present case report presents a different and unique approach for the esthetic closure of midline diastema following frenectomy procedure. The approach proves to be a quick and simple option for closure of midline diastemas in cases with concomitant incisal edge irregularities.

Keywords: Anterior spacing, frenectomy, midline diastema

Introduction
Diastema, a space present between the upper central incisors, is a common problem affecting the esthetics in a child during mixed and early permanent dentition phases. Its occurrence varies according to age. For example, it is seen in approximately 98% of 6 year olds, 49% of 11 year olds and 7% of 12-18 year olds.[1] In most children, diastemas occur as a normal developmental growth characteristic as the permanent maxillary lateral incisors push the roots of the permanent central incisors away, with the canines acting in a similar manner in the mixed dentition phase. However, due to the medial eruption of the laterals and canines, the central incisor roots are pushed back together. Following the eruption of the canines, there is a normal closure of this space. In some individuals, however, the diastema closure does not occur spontaneously leading to a necessary intervention. Reasons for midline diastemas are genetic and racial predisposition, superior labial frenum attachment, oral musculature imbalances, presence of supernumerary teeth, presence of pernicious habits, and other iatrogenic factors.[2] It is complicated by the insertion of the labial frenum into the notch in the alveolar bone so that a band of heavy fibrous tissue lies between the central incisors.[3] One school of thought states that an abnormal frenum is a cause of midline diastema,[4] whereas according to the other one, a frenum is an effect and not a cause for the diastema.[5] It poses several problems related to esthetics and speech. Various treatment options available for management of midline diastemas are orthodontic corrections, use of interceptive appliances, extraction of supernumeraries, surgical correction of impeding factors, use of direct composite resin, and use of habit breaking appliances. However, all these methods when used separately have inherent limitations. As pediatric dentists come across children at the earliest, early recognition and interception of developing malocclusion could avoid long-term laborious orthodontic treatment.[6] Here, a unique approach for the esthetic closure of midline diastema is presented following frenectomy and orthodontic procedures.

Case Report
A 13-year-old healthy Asian boy reported to the department with the chief complaint of spacing between his upper front teeth and wanted immediate management for the same. Intraoral clinical examination revealed the presence of...
midline diastema (1 mm) with high, fibrous labial frenal attachment [Figure 1a]. A simple blanch test was performed and positive blanching of the papilla was noted [Figure 1a]. Upper right central incisor (tooth #11), upper right lateral incisor (tooth #12), upper left central incisor (tooth #21), and upper left lateral incisor (tooth #22) showed minor incisal edge irregularities [Figure 1a]. Various treatment options and their possible limitations were explained to the patient. It was decided to perform surgical (labial frenectomy), orthodontic (orthodontic separators), and restorative (composite build-up) procedures for long-term success of management strategies. The risks, complications, and possible outcome of procedures were explained, and written informed consent was taken.

**Surgical procedure**

A local anesthetic solution (2% lidocaine with 1:100,000 epinephrine, LOX 2% Neon Laboratory, India) was infiltrated in the soft tissue surrounding the frenum. With the appropriate parameters and settings, the Er, Cr: YSGG laser was used for labial frenectomy with the tip in slight contact with tissue. Tissue forceps was used to secure the labial frenum and to detach it carefully. Bleeding was minimal and arrested completely after applying pressure with gauze for 10 min [Figure 1b]. There was no need for sutures and only a periodontal pack was given for 7 days after which complete healing was observed [Figure 1c].

Laser parameters for Er, Cr: YSGG laser (Waterlase MD: Biolase Technology, Irvin, CA, USA): - 2.25 W of power supply, 30% water flow and 30% air flow, 600 µm diameter of optical fiber tip (G6) at 20 Hz intermittently.

**Orthodontic procedure**

For the closure of diastema, a novel and easy technique was carried out using orthodontic separators, which were introduced interdentally on either side of both upper lateral incisors [Figure 1d]. The patient was recalled after 24 h when complete closure of the midline diastema was observed [Figure 2a].

**Restorative procedure**

During this visit, restoration of the irregular incisal edges of upper central and lateral incisors was planned. The separators were then removed and replaced by plastic wedges to prevent the closure of space during the restorative procedure [Figure 2b]. The incisal irregularities were restored using composite resin (3M ESPE Universal Restorative-A2 shade) [Figure 2c]. Proper interdental contacts were also restored with the same material to prevent the opening up of spaces between the incisors. Finishing and polishing were adequately performed with the help of finishing burs and discs [Figure 2d].

**Discussion**

Clinicians should understand the etiology, consequence, and the extent of the diastema as not all diastemas can be managed in the same manner with respect to timing or treatment modalities. Before going ahead with any treatment plan, the clinician should evaluate the various possible techniques as successful treatment depends on proper case selection, appropriate technique selection, adequate patient cooperation, and good oral hygiene maintenance. Effective treatment of midline diastema requires an accurate diagnosis and an intervention based on its exact etiology. Correct diagnosis includes medical and dental history along with radiological and clinical examinations [Flowchart 1]. Midline diastemas could be transient or created by developmental, pathological, or iatrogenic factors such as oral habits, soft tissue imbalance, physical impediment, dental anomalies, and/or skeletal disharmonies. At around 9–11 years of age, midline diastema is a normal occurrence as seen in the ugly duckling stage of development and eventually closes during further development. In such cases, no treatment is

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**Figure 1:** (a) Midline diastema (1 mm), high labial frenal attachment, and minor incisal edge irregularities in upper four incisors. (b) Er, Cr: YSGG laser-assisted frenectomy. (c) Complete healing seen after 7 days. (d) Orthodontic separators introduced interdentally on either side of both upper lateral incisors

**Figure 2:** (a) Complete closure of the midline diastema observed on recall of the patient after 24 h. (b) Separators were replaced by plastic wedges to prevent the closure of space. (c) Restoration of incisal irregularities using composite resin. (d) Proper interdental contacts restored to prevent the opening up of spaces between the incisors
needed as diastema closes after the eruption of permanent maxillary canines [Flowchart 2]. Interceptive treatment modalities in mixed dentition phase prevent the uptake of other invasive and long-term orthodontic modalities. Pathological causes such as supernumerary teeth, abnormal frenal attachments, and midline cysts can be treated surgically and then orthodontic closure of the space can be done [Flowchart 1].

An abnormally attached fibrous maxillary labial frenum between the central incisors is frequently associated with diastemas and complicates its correction. The maxillary labial frenal attachments have been classified by Placek et al. (1974) as: mucosal - when the frenal fibres are attached up to the mucogingival junction, gingival - when the fibres are inserted within the attached gingiva, papillary - when the fibres are extending into the interdental papilla, and papilla penetrating - when the frenal fibres cross the alveolar process and extend up to the palatine papilla. In cases with high frenal attachment, frenectomy proves to be useful for stability of the final result. If the frenum is removed surgically before tooth movement, then scar tissue formed during healing impedes the closure of diastema. In a laser frenectomy, wound healing does not involve any scarring and the need for suturing is also not there. Moreover, operating time and anxiety is reduced in laser-assisted surgery. Hence in the presented case, Er, Cr: YSGG laser was opted for frenectomy. Moreover, tooth movement should not be delayed after surgery as it may result in a space that is even more difficult to close.

In the presented case, the patient wanted an immediate result for the management of his diastema. On examination, the diastema was found to be <2 mm, and hence, it did not require any orthodontic intervention. The high frenal attachment, which was confirmed by a positive blanch test, was the major causative factor leading to midline spacing in the patient. Such frenal attachments are unsightly and their presence impedes the maintenance of good oral hygiene. Soon after the frenectomy, a less invasive, simple and quick approach using orthodontic separators was used to close the diastema. A 24 h recall showed successful closure of the diastema. To prevent the closing up of the space even during the treatment period, wedges were inserted soon after the removal of the elastic separators.

The patient showed minor incisal edge irregularities with teeth #11, 12, 21, and 22. These incisal irregularities along with the contacts were restored with composite resin, thereby avoiding excessive damage to 11 and 21 which is otherwise seen in conventional methods of diastema closure.

Several authors have reported satisfactory esthetic outcome using composite resins for the closure of diastemas. As part of a comprehensive esthetic treatment and of an overall dental treatment plan, the result of diastema closure should produce a beautiful smile and fulfill the goals of overall smile design. Composite resins have proved to be very helpful in managing these goals. It is cost-effective and time-saving with minimal damage to the tooth structure. Only orthodontic correction of diastema tends to relapse and it requires permanent retention. In this case, since the interdental contacts were properly established using composite restoration, it prevented the opening up of spaces and thereby chances of a relapse. Midline diastemas are a common finding in the dental office on a regular basis. Several patients are becoming more and more conscious of their appearance, thereby raising the importance and the need of esthetically pleasing results. Overcoming several limitations, such surgical, orthodontic, and restorative correction of a diastema can be successfully accomplished in patients requiring a rapid correction.

**Conclusion**

Treating diastemas as early as possible prevent its worsening. A simple procedure for closure of midline diastemas which is less time consuming, less expensive, and requires minimal patient compliance should be advocated. The present case thereby depicts a noninvasive

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**Flow Chart 1: Diagnostic tests for maxillary midline diastema**

- **Clinical tests:**
  - Comparative evaluation of tooth size with respect to jaw size
  - Blanching test – to rule out the cause of high frenal attachment
  - Periodontitis – to rule out the chances of pathological tooth migration.

- **Radiographic tests:**
  - Intraoral periapical and occlusal radiographs – to rule out presence of any supernumerary tooth (eg - mesiodens) or pathology (eg - globule-maxillary cyst)
  - U- and V-shaped interproximal bone between diastema.

**Flow Chart 2: Treatment modalities for maxillary midline diastema**

- **Physiological midline diastema –**
  - Ugly-Duckling Stage (9–11 years)

- **High frenal attachment**
  - Removal of frenum using –
    - Lasers
    - Electro surgery
  - Scalpel

- **Midline diastemas due to pathological / iatrogenic factors like –**
  - Mesiadens
  - Cystic lesions e.g.: radicular cyst, globule-maxillary cyst
  - Advanced periodontitis
  - Oral habits
  - Physical impediment

- **Persistence of diastema**
  - Removal of pathology

- **Removal of permanent canines**
  - (11–12 years)

- **Restorative approach**
  - Composite build-up
  - Veneers – composite or ceramic.
  - Ceramic crown

- **Orthodontic approach**
  - Removable orthodontic appliance
  - Fixed orthodontic appliance.

- **Combination services**
  - Restorative and Orthodontic approach
and highly effective treatment option for rapid closure of midline diastemas in cases with incisal irregularities.

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Conflicts of interest
There are no conflicts of interest.

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