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Non-Orthodontic Closure of Diastemas: An Interdisciplinary Approach- A Case Report

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Abstract : Diastemas in the anterior region are the most common aesthetic problem encountered in permanent dentitions which can occur as a result of developmental, pathological or iatrogenic reasons. Various therapies including restorative procedures, surgical correction of frenum and orthodontics are utilized in management of diastema to improve esthetics. Although literature recommend orthodontic treatment post frenectomy, we have opted for restorative approach following frenectomy technique without any orthodontic intervention. Presented here are case reports of a 22- and 19-year-old female patients with a high frenal attachment and orthodontic limitations that had caused spacing of the maxillary central incisors. Non-surgical periodontal therapy and a maxillary labial frenectomy were performed followed by restorative approach using laminate veneers. On follow-up of the case for 1 year it was observed that the space remained closed and there was no necessity for a re-orthodontic treatment to correct the diastema. These clinical cases demonstrate the efficacy of frenectomy and restorative therapy as a self-sufficient interdisciplinary approach for the correction of maxillary diastemas without orthodontic intervention.

Keywords - *Dental Esthetics, Digital Dentistry, Dental Veneers, Laser Surgery, Labial Frenectomy*

I. INTRODUCTION

Maxillary diastema is a frequently encountered malocclusion and the most common aesthetic complaint reported by the patients for which they seek the treatment. Anterior midline spacing greater than 0.5 mm between adjacent teeth have been described as midline diastema by Keene [1]. Prevalence of midline diastema has been reported to be higher in the maxilla than in the mandible. Various conditions might result in development of diastema which includes developmental factors such as microdontia, missing lateral, mesiodens, macroglossia, macro-hypertrophic fibro frenum, and oral habits [2]. A hypertrophic labial frenum is considered to be a major etiological factor for midline diastema. The fibro-elastic band crosses the alveolus and inserts into the incisive papilla preventing closure of maxillary central incisors leading to diastema [3]. Relapse after an orthodontic treatment might also result in midline diastema which is considered to be 50% of the unwanted outcome of orthodontic therapy [4]. Diastema is considered to be unaesthetic, all the more when it can lead to altered phonetics, and improper oral hygiene maintenance [5].

Various treatment options for the management of midline diastema, include multidisciplinary approaches using orthodontic therapy along with frenectomy or via restorative dentistry using direct composite restorations or ceramic veneers [6]. Though orthodontics is considered to be an ideal treatment modality, it comes with psychological, physical, financial, and time factors limitations [7]. Patients who want instant aesthetic results may not accept treatment with such a long duration until a final result. Hence alternative approach including frenectomy and restorative approaches using direct composite veneers, indirect composite veneers, porcelain laminate veneers, all ceramic crowns, metal-ceramic crowns, and composite crowns can be considered which would reduce the treatment duration, improve aesthetics and thereby improve patient compliance [8].

The following case reports presents the closure of midline diastema by frenectomy followed by laminate veneers using the indirect technique for rehabilitation of multiple diastemas.

II. CASE PRESENTATION

2.1 Case report 1

A systemically healthy 22-years old female patient reported to the Department of Conservative Dentistry and Endodontics, Yenepoya Dental College and Hospital, Mangalore, with a chief complaint of spacing in the upper front tooth region. On intraoral examination, papillary penetrating upper labial frenal attachment, midline diastema of 3mm and multiple diastemas were present in the maxillary region between canines and laterals (Fig. 1). Past dental history revealed that the patient has undergone fixed orthodontic treatment 2 years back. It was diagnosed that the causative factor for the diastema was the aberrant frenal attachment. Frenectomy followed by indirect lithium disilicate (LiDS) laminate veneers were considered as the treatment option. Patient was referred to Department of Periodontology for oral prophylaxis and frenal correction.

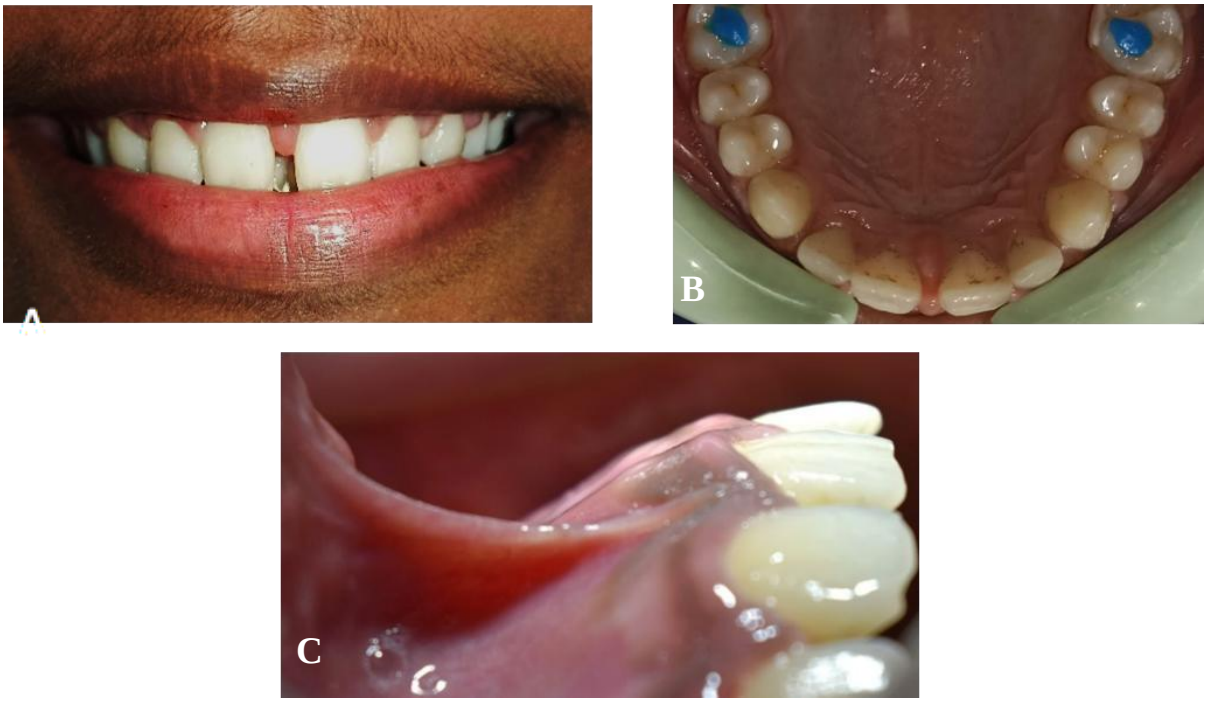


Figure 1: Baseline pictures showing a) midline diastema b) multiple diastema c) papillary penetrating frenal attachment

After obtaining informed consent, labial frenectomy was performed using the classical technique introduced by Archer (1961) and Kruger (1964) with scalpel [9] (Fig. 2a). Healing was satisfactory post one week after suture

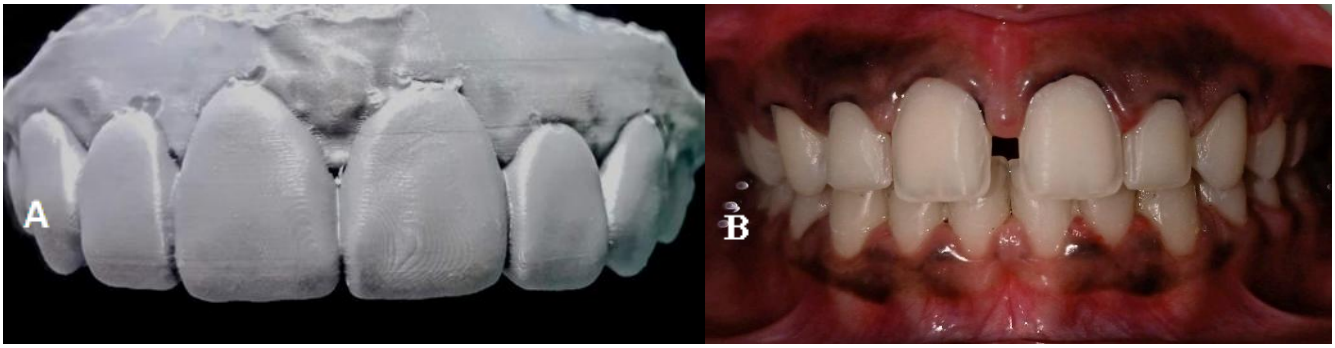
removal (Fig. 2b). At the end of one month patient was referred to the Department of Conservative Dentistry and Endodontics for the further management of midline diastema.

Figure 2: a) Classical frenectomy done using scalpel. b) One month after suture removal showing satisfactory healing.

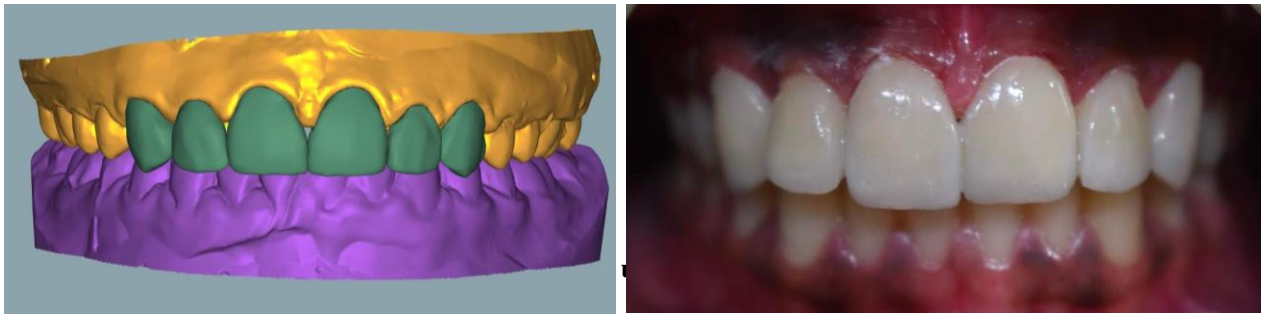
After thorough examination, 3D diagnostic model was fabricated with the help of Exocad software, from the digital scan done of the maxillary addition silicone impression (Fig. 3a). The models were studied to decide the shape and size of the restorations. At the onset of the treatment, thorough scaling and polishing was done. Before proceeding for tooth preparation, shade was selected using Vita Classical shade guide (Vita Zahnfabrik, Germany). The impression of the digital wax-up was transferred onto the maxillary anteriors using Protemp temporization material.

The maxillary teeth were then prepared from right side canine to left side canine keeping the temporary provisionals as guide to receive LiDS veneers. The tooth preparation was kept in enamel at a depth of 0.5 mm using a depth cutting diamond and a tapered diamond 1 mm in diameter. 0.25 mm chamfer was maintained in the cervical region (Fig. 3b). The chamfer finish lines were kept equigingivally. The incisal length was reduced by 1mm with an incisal butt margin. The proximal preparation was extended beyond the contact area to avoid visibility of the tooth restoration junction.

After finishing the sharp line angles and point angles, gingival retraction was performed. Impression of the maxillary arch was made in addition silicone (Hydrorise, Zhermack) by single step double mix technique. In this technique a prefabricated perforated tray was used. Putty consistency addition silicone was loaded on the tray. At the same time light body material was syringed around the prepared teeth to record the fine details and the previously loaded tray was inserted in the mouth to make the impression. Provisional restorations were made with bis-acryl composite (Cool temp, Coltene).



Initially a 6-unit mock laminates were fabricated. The laminates were tried in for shade, fit, marginal adaptation, shape, size, symmetry, and contacts. The porcelain veneers were fabricated with CAD/CAM (Amann Girbach, Austria). Try-in was done using glycerin as a holding medium to appreciate the esthetic enhancement. Patient's approval was obtained at the time of try-in (Fig.4).



Tooth Preparation:

The procedure for cementation was performed on two teeth at a time starting at the midline. The prepared teeth were etched using 37% Phosphoric Acid (Meta Etchant- 37, Meta Biomed Co. Ltd, Korea) for 15 seconds. On air drying bonding agent (Tetric® N-Bond Universal, Ivoclar) was applied & light cured for 30 seconds. A light-cure resin-based veneer luting agent (Variolink, Ivoclar) was used for cementation. The laminates were spot cured for 2 seconds initially. Excess cement was removed with explorer and then complete curing was done for 20 seconds. On completion of the cementation procedure, the occlusion was checked in centric and eccentric positions for interferences. The high points were checked and polished. The patient was given the necessary instructions on the maintenance of the veneers.

The cementation:

Laminate Preparation: The laminates were arranged on a sheet denoting the position of the tooth in the arch to avoid incorrect placement and inadvertent breakage. The laminates were etched with 15% Hydrofluoric acid (Porcelain Etchant , Angelus, Brazil) for 1 minute carefully avoiding contact on the facial surface. After etching, they were washed thoroughly using liberal amount of water. On drying, a coat of Silane coupling agent (Porcelain Primer, Angelus, Brazil) was applied.

Patient was recalled after one year for follow-up. During this period, the outcomes remained consistently favourable, with no relapse or recurrence of the initially addressed issue (Fig. 5).

Figure 5: Results at the end of one year follow-up

2.2 Case report 2

A systemically healthy 18-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, Yenepoya Dental College and Hospital, Mangalore, with a chief complaint of spacing between the upper front tooth region. On intraoral examination, diastema was found in maxillary region involving the

midline diastema of 4mm was noted in relation to maxillary central incisors (Fig.6a) with class I canine relationship and reduced overbite and overjet of 1mm. Several treatment plans were developed and presented to the patient. Orthodontic treatment or full-ceramic crowns were rejected, to avoid preparation of the healthy tooth structure and for the long treatment durations. A direct mock-up with composite resin was performed to simulate the proposed laminates.There were no significant periodontal or radiographic findings. Pull test revealed a papillary type of maxillary labial frenum attachment (Fig. 6b). Frenectomy followed by indirect LiDS laminate veneers were considered as the conservative, aesthetic, and quicker option.

Figure 6: Baseline pictures showing A) Midline diastema B) Papillary penetrating frenal attachment

Labial frenectomy was performed using the classical technique with laser. Healing post one week was found to be satisfactory. After thorough examination, a 3D diagnostic cast model was fabricated with alginate impression. Scaling and polishing was done and shade selection using Vita Classical shade guide (Vita Zahnfabrik, Germany).The tooth preparation in the maxillary central incisors were kept in enamel at a depth of 0.5 mm using a depth cutting diamond and a tapered diamond 1 mm in diameter. 0.5 mm chamfer was maintained in the cervical region. The chamfer finish lines were kept subgingivally. The incisal length was reduced by 1mm with an incisal overlap margin. The proximal preparation was extended 1mm mesially, beyond the contact area to avoid visibility of the tooth restoration junction.

After finishing the sharp line angles and point angles, gingival retraction was performed. Impression of the maxillary arch was made in addition silicone (Hydrorise, Zhermack) by single step double mix technique, as explained in the first case report. Provisional restorations were made with bis-acryl composite (Cool temp, Coltene). The 2-unit laminates were tried in for their form, function, and aesthetical aspects. The porcelain veneers were fabricated with CAD/CAM (Amann Girbach, Austria). Patient's approval was obtained at the time of try-in. The protocol for cementation and tooth preparation were followed as mentioned previously. Patient was recalled after 1-year for follow-up, (Fig.7) the patient's aesthetic expectations were met, and she was happy with the aesthetic outcome.

III. Discussion

The causes of diastema may include hereditary factors such as congenitally missing teeth, tooth and jaw size differences, supernumerary teeth, and frenum attachments. Developmental issues like habits, periodontal disease, tooth loss, and posterior bite collapse can also contribute to diastema. The aberrant frenum, characterized by an abnormal attachment or position, can play a significant role in maintaining the diastema. Treatment options for diastema correction range from orthodontic closure, restorative therapy, surgical correction, to a multidisciplinary approach, depending on the underlying cause of diastema. Restorative closure of diastema can be accomplished using a variety of techniques, including direct composite veneers, indirect composite veneers, porcelain laminate veneers, all-ceramic crowns, metal-ceramic crowns, and composite crowns [10].

Veneers, a part of Minimally invasive dentistry (MID) focuses on preserving healthy tooth structure. With improved materials like ultra-thin porcelain or composite veneers, dentists can minimize the need for extensive reshaping of the teeth. This approach not only enhances aesthetics but also protects the natural tooth structure, leading to a more conservative and sustainable treatment. Recent studies emphasize that the fusion of MID and veneers results in less discomfort, faster recovery, and long-lasting, natural-looking outcomes for patients.

In the present case reports, we have excised the frenum by conventional scalpel technique as well as laser technique to relive the high frenal attachment. Classical frenectomy technique, originally introduced by Archer (1961) and Kruger (1964), was employed in the present case reports to correct aberrant frenum attachments [11]. By surgically removing these muscle fibres, the connection that was supposedly contributing to the diastema persistence could be eliminated, potentially facilitating the closure of the midline space.

In contrast to conventional surgery, the claimed benefits of lasers include increased coagulation yielding a dry surgical field and improved visualization, the ability to negotiate curvatures and folds within tissue contours, tissue surface disinfection and consequently, decrease in bacteraemia, reduced distension, oedema, and scarring, decreased pain, faster healing response and increased patient appreciation. Healing was uneventful and diastema was further managed by restorative approach [12]. Composite resin and porcelain are the most frequently used veneering material for diastema closure conservatively. It is easy to use, requires less appointments, and is economic but offers less wear resistance and surface staining, which makes it inferior to dental porcelain.

It has become increasingly apparent that conservation of tooth structure is a major factor in determining the long-term prognosis of any restorative procedure. One of the most important advantages of bonded porcelain veneers is that they are extremely conservative in terms of tooth reduction. In the current case, only 0.5 mm reduction on the labial surface was done. This minimal reduction rarely, if ever, leads to pulpal involvement which is a major advantage. The highly glazed surface of the porcelain laminates prevents plaque accumulation, considered important to attain a healthy periodontal response. Excellent esthetics could also be achieved due to lifelike appearance of porcelain and scattering effect of the luting cement.

The amount of unsupported porcelain should be carefully evaluated in cases with a large diastema. Even, if the laminates fail in the long run, the conserved tooth can still be treated with a full crown restoration. Porcelain laminate veneers offer a predictable and successful treatment modality that preserves a maximum of sound tooth structure. An increased risk of failure is present only when veneers are partially bonded to dentin. The estimated survival probability of porcelain laminate veneers over a period of 10 years is 91% [13].

At the end of the mentioned follow-up period, the surgical intervention has led to the maintenance of adequate papillary fill and proper marginal contour at the treated site. The sustained positive outcomes and the restoration of the normal anatomical features in the treated area demonstrate the effectiveness and long-lasting benefits of the restorative as well as surgical approach avoiding the lengthy duration typically associated with orthodontic treatment. This highlights the importance of addressing the underlying etiological factor, to achieve lasting solutions for the management of multiple diastemas.

IV. Conclusion

The interdisciplinary approach to the non-orthodontic closure of diastemas presents a viable and effective alternative to traditional orthodontic methods. This case report demonstrates that satisfying aesthetic and functional outcomes can be achieved and maintained for long term with the successful application of restorative techniques such as bonded porcelain veneers and frenectomy. Porcelain laminate veneers offer more extensive applications when they are used cautiously and the results achieved have been gratifying for the cosmetic dentist and the patient alike.

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