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Midline diastema closure using lithium disilicate glass ceramic: step by step procedure.

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Abstract

Midline diastemas are of a major concern for one's appearance. The various treatment options mentioned in literature for magement of midline diastema are direct and indirect composite restorations, orthodontic treatment, surgical approach and partial or full veneer crowns. The prognosis of the treatment depends on understanding the etiology and application of proper treatment plan considering its indications and limitations. This case report focuses on a step-by-step procedure of maxillary midline diastema closure using lithium disilicate glass ceramic laminate veneer.

Keywords: Midline diastema closure, esthetics, lithium disilicate

Introduction

Dental diastema is defined as a space formed more than 0.5 mm between the proximal surfaces of adjacent teeth caused by multifactorial reasons.[1] Maxillary anterior midline diastema is a major concern of patients as it affects the appearance and self-confidence. The causes of midline diastema can be due to developmental disturbances, pathological migration, iatrogenic factors such as mesiodens, microdontia, hypodontia, or adverse oral habits, high frenum attachment, etc. Midline diastema has a prevalence ranging from 1.6% to 25.4% in adults. [2] Esthetic treatment of diastema closure is a challenging task for a clinician. Often such diastemas can be managed effectively with orthodontic treatment, direct and indirect composite restorations, and prosthetic restoration with full veneer crowns or laminate veneers. One of the preferred treatment option for esthetic treatment of diastema is laminate veneers due to its resolution, colour stability, mechanical properties, and biocompatibility.[2] Veneers were introduced into dentistry around 1938 by Charles Pincus and with the introduction of acid etch technique by Buonocore in 1955[4] and silica resin direct filling material by Bowen in 1958, laminate veneers was the treatment of choice.[3] Coupled with

silanization of veneers and the introduction in the early 1980s of bonded porcelain veneer by Horn, 1983, the results of laminate veneer have become more predictable.[5] This case report focuses on a step-by-step procedure of maxillary midline diastema closure by using lithium disilicate glass ceramic laminate veneer.

Case History

A 32-year-old female patient reported with a chief complaint of spacing in her upper front teeth and wanted it esthetically corrected. Clinical examination revealed a high frenum attachment and a maxillary midline diastema of 5 mm. There was spacing in lower anterior teeth of less than 0.5 mm. She had class III caries with upper right central incisor (Distal) and upper right lateral incisor (Distal). The missing teeth were upper right first and second premolar [Figure 1]. She had a previous dental history of root canal treatment followed by metal ceramic restoration with upper left second premolar past two years and history of extraction with upper right first and second premolar past six months, the reason of extraction being grossly decayed teeth. Her dentition was healthy with sound periodontal tissues. There were mild stains and calculus, overall the oral hygiene of patient was fair. The treatment plan proposed to her was oral prophylaxis followed by frenectomy, composite restoration with carious teeth, orthodontic correction of maxillary midline diastema and mandibular spacing then the prosthetic rehabilitation of missing teeth with dental implants. The patient was briefed with the significance of orthodontic approach and the advantages of dental implants over crown & bridge restorations. But the patient was reluctant for any surgical intervention and did not consent for frenectomy and dental implants procedure. Due to the time constraints patient was not willing for orthodontic treatment. Then the treatment plan of oral prophylaxis, composite restoration with carious teeth, all ceramic zirconia prosthesis for posterior teeth and lithium disilicate laminate veneers for anterior midline diastema closure was suggested to the patient. After discussion of its limitations involved due to proceeding without frenectomy and its possible risks involved, patient opted for the treatment plan and then the informed consent was obtained for the same.

Step by step procedure

- Diagnostic impressions were made using condensation silicone (Zetaplus C silicone, zhermack, Italy.) to obtain a study model. The model was poured using type III gypsum product (Kalabhai Karson Pvt LTd Mumbai, India.) [Figure 2]. Diagnostic wax up was done with maxillary central incisors to show the predictable outcome prior to the treatment.[Figure 3]. Before veneer preparation the shade selection was done digitally using vita easy shade guide [Figure 4] and Composite restoration were done with carious teeth
- Depth orientation grooves were made using the depth cut bur [Figure 5], followed by the pencil marking on the tooth surface so as to assess the depth for preparation guidance. Matrix band was placed while preparation of distal finish line to prevent damage to adjacent teeth. [Figure 6&7]. The tooth preparation was kept in enamel at a depth of 0.5 mm using round end tapered fissure diamond bur to obtain chamfer finish line at equigingival margin. [Figure 8]. The method of preparation chosen was a butt joint preparation which had the incisal overlap.
- For posterior missing teeth preparation for a four unit zirconia monolithic full veneer prosthesis was done. The gingiva was displaced apically and laterally using gingival retraction cord. (000 sure endo, Korea) [Figure9]. The image showing final preparation prior to impression making. [Figure 10].

A double mix double impression technique was used for impression making with addition silicone material. (zetaplus hydroise, zhermack, Italy) [Figure 11 & 12]. Polymethylmethacrylate CAD CAM Provisional restoration were fabricated [Figure 13] and were cemented using non eugenol temporary cement. (Ora Temp C & B, Prevest DenPro, Jammu, India.)[Figure 14 & 15].

- The lithium disilicate veneers were tried in for shade, marginal fit, shape, symmetry and contacts and patient's approval was taken. The definitive anterior lithium disilicate glass ceramic prosthesis along with the posterior zirconia monolithic restoration were then obtained.
- The inner surface of veneers were etched with 9.6 % hydrofluoric acid for 10 seconds (porcelain etch gel, pulpdent, USA) , rinsed and dried, applied silane agent for 60 seconds (silane bond enhancer, pulpdent, USA). The prepared teeth were etched with 37 % phosphoric acid for 20 seconds (N etch, Ivoclar vivadent, Schaan, Liechtenstein), rinsed and dried and then the bond enhancer was applied to the tooth surface thoroughly, gently air dried and then cured (Bluephase N M, Ivoclar vivadent, Schaan, Liechtenstein) [Figure 16]. Calibra veneer translucent esthetic resin cememt was applied on the inner surface of veneers (Calibra veneer, Dentsply Sirona, USA), the veneers were then seated onto the prepared tooth surface and light cured.(Bluephase N M, Ivoclar vivadent, Schaan, Liechtenstein) and the excess cement was removed. Zirconia monolithic prosthesis were cemented resin modified Glass Ionomer Cement (3M Rely X, USA)
- The definitive Prosthesis showing lithium disilicate veneers and zirconia prosthesis. [Figure 17]. Postoperative image [Figure 18].

Discussion

Esthetics is indeed compromised by diastemas. A midline diastema presents a higher prevalence in the maxilla than the mandible and its etiology is multifactorial.[6] The diagnosis of a diastema is based on a medical history, dental history, clinical examination, and radiographic evaluation. Once the cause is known there are different treatments approaches to manage diastemas. The various options being orthodontic correction, direct and indirect composite restoration, surgical intervention and prosthetic restoration either with full veneer crowns or laminate veneers. Small diastemas can be closed in 3-6 months by a simple Hawley retainer.[7] But an orthodontic treatment is indicated generally in cases having multiple diastemas with malocclusion. Composite restorative material is economical and one of the predictable treatment option. But diastemas up to 1-1.5 mm can be managed using composite resin but it has limitations of being less wear-resistant and they do gather stain over a period of time.

In this case the cause of midline diastema was due to high frenum attachment. In such cases frenectomy should be done prior to diastema closure. Frenectomy not only improves the prognosis of the treatment but also attributes to the pink and white aesthetics. Since the patient did not consent for any surgical interventions frenectomy was not considered in the treatment plan. The suggested choice of orthodontic correction was not acceptable to the patient due the time constraints. Since there was a diastema of 5 mm composite resins had less predictable prognosis in this particular case, hence lithium disilicate veneer was the treatment of choice. For the posterior missing teeth a four unit zirconia monolithic prosthesis was planned as patient was not willing for dental implants.

Lithium disilicate structure has the ability to produce a flexural strength that is almost the same as that of enamel in the range of 360-400 MPa and also a biaxial flexural strength that is three times greater than that of feldspathic ceramics.[8] It has higher concentrations of ceramic crystals about 70% of the total substrate. It has a low refractive index and thus being highly translucent despite its high crystalline content.[9] It not only adheres to enamel and dentin but also improves over its bond strength after microetching with 9% hydrofluoric acid. Morimoto et al. conducted a systematic review that involved identifying 899 studies, out of which only 13 were analyzed. The findings of the review revealed an overall survival rate of 89% at nine years. Interestingly, the survival rate for glass-ceramic veneers (94%) was higher compared to that for feldspathic porcelain veneers (87%). [10]

Incisal preparation can be divided into 2 broad categories: overlap and nonoverlap. There are four different designs for veneer preparation in the literature 1) Window preparation(intraenamel) : in which the incisal edge of the tooth is preserved 2) Feather edge preparation: in which the incisal edge of the tooth is prepared Bucco-palatal, but the incisal length is not reduced 3) Bevel preparation(palatal chamfer): in which the incisal edge of the tooth is prepared Bucco-palatal, and the length of the incisal edge is reduced slightly 4) Incisal overlap preparation (the butt joint): in which the incisal edge of the tooth is prepared Bucco-palatal, and the length is reduced, so the veneer is extended to the palatal aspect of the tooth[11]. The window and the feathered-edge preparation designs belong to the nonoverlap category, and the palatal chamfer and the butt joint designs belong to the overlap category.[11]

The preparation in the presented study was incisal overlap (the butt joint), the advantages of incisal overlap include masking of the otherwise noticeable incisal finish line, thicker ceramic and reinforcement of incisal edge, and positive seating of ceramic veneers. Calamia cited the incisal overlap design (butt joint) as the primary reason for the low fracture rates.[12] An in vitro study by Castelnuovo and colleagues showed that the feathered-edge and the butt joint groups had the greatest fracture resistance, comparable with the control teeth. The authors further elaborated that the butt joint preparation design was favourable compared with the palatal chamfer preparation design for a number of reasons which included its simpler preparation, faciopalatal path of insertion, increased fracture strength, low risk of developing a fracture of thin unsupported palatal ceramic ledges, improved esthetics at incisal one-third of veneers, favourable bonding to exposed enamel prisms, easier impression, and easier identification of the finish line on the model.[13] A photoelastic analysis comparing the butt joint incisal preparation design with the feathered edge incisal preparation design demonstrated that the butt joint preparation design exhibited more favourable stress distribution for the 4 loading conditions compared with the feathered-edge design.[14] Guess and colleagues showed a slightly better survival rate for veneers with butt joint incisal preparation design compared with the palatal chamfer design in a prospective clinical study.[15]

The preparation for the veneer was 0.5 mm overall with a chamfer finish line. The mechanical gingival retraction was done using gingival retraction chod (000) considering the gingival biotype of the patient. Gingival retraction is one of the key aspect prior to impression making. It helps to demarcate the finish line, the junction between the prepared and unprepared tooth. The impressions were made using elastomeric impression material, addition silicone. The method of impression making was double mix double impression technique. In achieving the best outcome, the bonding process is

highly dependent on the preparation of the teeth, the conditioning of the ceramic veneers and the structure of the teeth, as well as the materials used for bonding the veneers.[16]

Conclusion

Self-confidence directly reflects on one's personality and a confident smile makes the picture perfect. Midline diastema closure using lithium glass ceramic veneer provides good esthetics due to its thin film and translucency. It's a minimally invasive procedure with predictable outcomes. However, laminates have their own limitations, they should not be used when remaining enamel is inadequate to provide adequate retention. The prognosis of midline diastema cases depends on understanding the etiology of diastema and proper selection of choice of the treatment. The Success of ceramic laminate veneer depends on the method of veneer preparation and the choice of veneer material.

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Legend Figures

Figure 1: Preoperative image showing maxillary midline diastema.

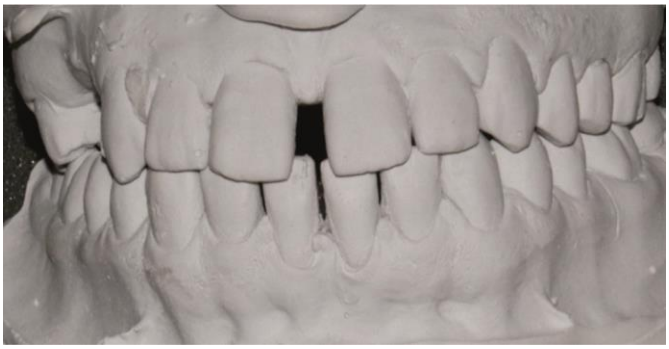

Figure 2: Study model poured for wax mock up

Figure 3: Wax mockup done with maxillary central incisors

Figure 4: Digital shade selection using vita easyshade

Figure 5: Depth orientation grooves made with depth cut bur

Figure 6: Matrix band placed to the adjacent tooth prior to preparation on tooth.

Figure 7: Matrix band placed to the adjacent tooth prior to preparation of tooth

Figure 8: Tooth preparation done for laminate veneer

Figure 9: Gingival retraction using 000 retraction cord

Figure 10: Posterior preparation done for zirconia monolithic prosthesis and anterior for lithium disilicate laminate veneer

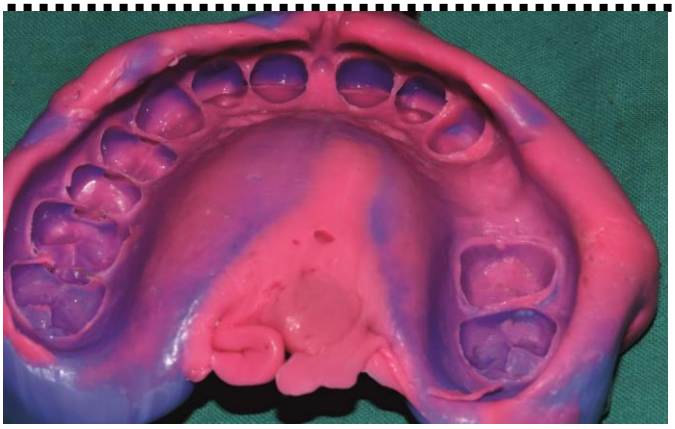

Figure 11: Impression showing maxillary prepared teeth

Figure 12: Impression of mandibular arch

Figure 13: PMMA CAD CAM provisional prosthesis

Figure 14: Placement of provisional prosthesis

Figure 15: Provisional prosthesis cemented

Figure 16: Bonding apparatus for lithium disilicate laminate veneer

Figure 17: Definitive prosthesis bonded to the prepared teeth

Figure 18: Postoperative image