Digital Perfection: Transforming a Diastema using Veneers with Computer-aided design and manufacturing- A Case Report

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ABSTRACT

Midline diastema is a frequently encountered Esthetic condition resulting from diverse etiological factors such as developmental variations, habits, or pathological influences. Its management demands a conservative approach that restores harmony without compromising natural tooth structure. The evolution of ceramic veneer systems—especially lithium disilicate processed through CAD/CAM technology—has enabled highly esthetic outcomes with minimally invasive intervention.

This case report describes the Esthetic rehabilitation of a young adult with a 2 mm midline diastema using digitally designed lithium disilicate veneers. Following clinical evaluation and shade selection, a minimally invasive preparation protocol was executed, and digital scanning was performed. The veneers were fabricated using IPS E.max CAD lithium disilicate blocks and subsequently bonded adhesively. The digitally assisted workflow provided precise adaptation, controlled translucency, and favourable soft-tissue response. At recall visits, the restoration exhibited stable margins, intact lustre, and patient-reported satisfaction with smile enhancement. No postoperative sensitivity or discolouration was observed. The case demonstrates that CAD/CAM-fabricated lithium disilicate veneers can serve as an effective and conservative alternative for diastema closure while preserving enamel and ensuring long-term Esthetic integration. Meticulous planning, case selection, and adherence to adhesive protocols play a decisive role in achieving predictable Esthetic results.

Keywords: CAD/CAM veneers; Esthetic dentistry; Lithium disilicate; Midline diastema; Minimally invasive dentistry; Smile rehabilitation.

INTRODUCTION

Maxillary midline diastema, which Keene defined as a space more than 0.5 mm between the neighbouring maxillary central incisors, is an aesthetic problem to which many people have resorted to having teeth modifications done[1–3]. Ceramic laminate veneers were first mentioned by Pincus back in 1938, and they have since become a non-invasive and very elegant method to change the form, colour, and proportion of the teeth in such cases[4].

Development of ceramic science, in particular the lithium disilicate systems and CAD/CAM-fabricated IPS e.max CAD blocks, has resulted in materials that possess very high translucency, strength, and minimal-thickness preparation, which makes them perfect for diastema closure and anterior esthetic rehabilitation [2,5]. They possess enamel-like optical and mechanical properties that increase predictability and long-term success when compared to direct composites or feldspathic porcelain[3–5], and

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hence, this material and technique have been widely used for veneer fabrication.

This case report aims to present the application of a minimally invasive, digitally guided method that employs CAD/CAM lithium disilicate veneers for the esthetic closure of a maxillary midline diastema, with emphasis on treatment planning, execution, and short-term clinical outcomes

CASE DESCRIPTION

A woman in her 20s came to the Department of Conservative Dentistry and Endodontics, with primary concern being the spaced upper front teeth. An intraoral inspection unveiled that the maxillary central incisors were about 2 mm apart, and the patient's medical history disclosed no systemic diseases (Figure 1,2).

The patient was presented with a range of treatment choices, such as composite restorations, orthodontic treatment, and laminate veneers. Because orthodontic treatment is time-consuming, the patient decided to adopt a more cautious approach to improving the appearance of his smile.

As a more conservative, cost-effective, and aesthetically beautiful option, indirect aesthetic lithium disilicate veneers were considered as build-ups for both upper central incisors.

First, the teeth that will be fixed were selected using the Vita guide's A1 shade (Figure 3).

Veneers with a buccal profile of 0.5 to 1.0 mm and an incisal bulk of 1.0 mm were created using a bur marking depth cut (Figure 4) (0.4 mm thick) and a tapered round end bur, operated with a handpiece and irrigated using water spray.

Following pencil marking of the parallel horizontal grooves, the second bur was inserted into the first bur. A buccal depth of 0.6 mm and a mini-chamfer cervical finish line of 0.3 mm were used to produce the specimens. A thin 3.0 cable was used as a retraction cord and was gently placed into the sulcus. After cutting the incisal border to 2 mm in length, a thin preparation of the palatal chamfer was used as a stop (Figure 5).

After that, the primed surfaces were softly refined with rubber tips. Visual evaluation of the amount of visible enamel was done using 4X magnification loops (Figures 6a, 6b,6c)

Full-arch impressions were made using polyvinyl siloxane (Aquasil soft putty/regular set- Dentsply, Germany) using technique of relining putty material (Figure 7).

Consistent pressure was applied to the mouth to make the impression. Impression was subsequently covered with Type IV gypsum product. The A1 shade was selected by using the VITA Toothguide 3D-MASTER (VITA, Yorba Linda, CA) in direct sunlight. Following tooth preparation and impression making, OraTemp C&B provisional restorative material (Prevest DenPro Limited, India) was used for temporization until the CAD/CAM-fabricated lithium disilicate veneers were definitively cemented.

A 3-dimensional model of the prepared teeth was completed in DentalCAD software (exocad, Darmstadt, Germany) by scanning the cast using a lab scanner (Figure 8) (inExo X5; Dentsply Sirona, Charlotte, NC).

The desired appearance of patient and the shape of the natural tooth were taken into consideration when designing the veneer (Figure 9).

The incisal edge was made using a cut-back technique, which improved its character and translucency.

After the design was finished (Figure 10) and the milling process started, the veneers were digitally positioned on the three-dimensional model.

A CAD-CAM milling machine (inLab MC X5; Dentsply Sirona) was used to mill the veneers using lithium disilicate ceramic material (CEREC TesseraTM; Dentsply Sirona) that was taken from A1 shade block. The patient had the placement of milled veneers in their mouth for a try in to evaluate fit, occlusion, with aesthetics. Each restoration's intaglio surface was prepared for bonding by etching it with 5 percent hydrofluoric acid for 20 seconds (IPS Ceramic, Ivoclar, Vivadent, Schaan, Lichtenstein) and then silanizing it with G Multi Primer (GC, Tokyo, Japan) for 60 seconds.

Following isolation of prepared tooth, followed by treatment using 37 percent phosphoric acid for a duration of 15 minutes, a dentine bonding agent was used as directed by manufacturer (Prime Dental, India). Cementation was done using RelyX™ Ultimate dual-cure resin cement (3M, USA). The intaglio surface of the veneers was coated with cement, and they were then carefully placed on top of the prepared teeth (Figure 11).

Extra cement was scraped off for a precise fit and finish (Figure 12).

In order to guarantee the longevity of the restorations, the patient was advised to attain proper oral hygiene (Figure 13).

Along with encouragement to practice proper dental care, the patient was given information about recalls that were scheduled at 1-week, 1-month, and 3-month intervals (Figure 14).

After a year's recall, no tooth fractures, discoloration, or sensitivities were discovered.

Figure 1: *Pre-operative clinical image.*

Figure 2: *Pre-operative clinical image in contrast.*

Figure 3: *Shade selection.*

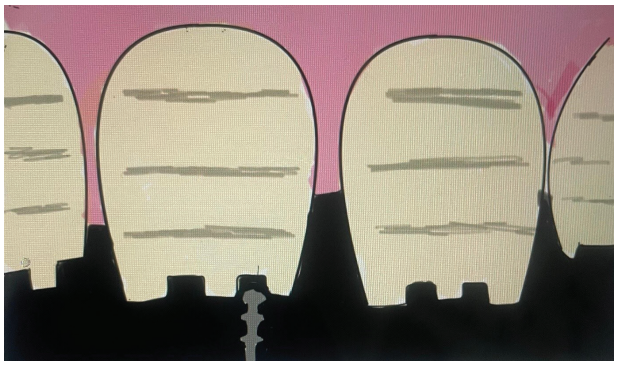

Figure 4: *Diagrammatic representation of incisal and labial bulk reduction (self-designed).*

Figure 5: *Tooth preparation for veneers.*

Figure 6a. 6b. 6c: *Tooth preparation for veneers visualised in contrast and from the right and left sides, respectively.*

Figure 7: *Polyvinyl siloxane impression.*

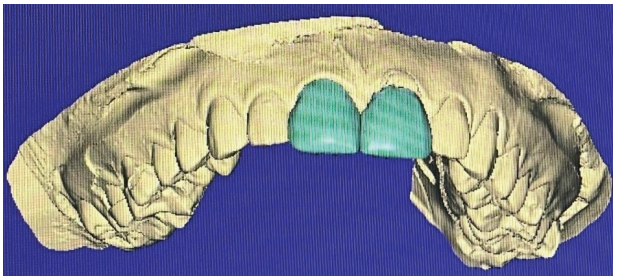

Figure 8: *CAD- CAM designing of veneers.*

Figure 9: *CAD- CAM designing taking into consideration mandibular cast (occlusal view).*

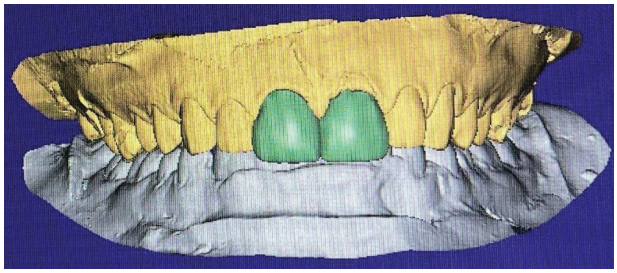

Figure 10: *CAD- CAM designing taking into consideration mandibular cast (labial view).*

Figure 11: *Post-operative clinical view.*

Figure 12: *Post-operative clinical view in contrast.*

Figure 13: *Smile view.*

Figure 14: *6 months follow-up clinical evaluation.*

DISCUSSION

A mesiodens, microdontia, hypodontia, aberrant oral habits, enlarged frenum, and other developmental, pathological, or iatrogenic conditions may cause a midline diastema, or it may be temporary. Diagnosing a diastema requires a comprehensive medical or dental assessment, clinical assessment, and radiographic evaluation due to the possibility of numerous etiologies [3,5]. Removable orthodontic appliance, whole dentition, one arch, or sectioned fixed orthodontic appliance, frenum excision, restoration methods, mesiodens removal, habit-breaking appliance, etc., are some of the various treatment modalities [6]. The most susceptible to restorative and prosthodontic procedures is the diastema based on tooth size disparity. Enamel bonding is more durable and reliable compared to dentin, even with the advancements in dentin bonding agents. The mechanical interlocking that adheres to enamel contrasts with the non-homogeneous, wet, and sometimes sclerotic dentin. Furthermore, porcelain has an elastic modulus that is closer to enamel's than dentin's. Because the two substrates are not as flexible, when this restoration is adhered to dentin instead of enamel, there have been reports of increased debonding and fractured ceramic laminate veneer [1,3].

If at all possible, preparations limited to enamel should be used to provide a high bond strength and increased tooth strength. Additionally, the preparation design that was kept as close to the enamel as feasible is most likely the reason for the lack of postoperative sensitivity [1]. The maximum adults do not desire to spend time and numerous visits improving their smile profile, despite the fact that orthodontic correction is feasible choice [2,6]. Among the following procedures—direct or indirect composite veneers, porcelain laminate veneers, all ceramic or metal ceramic and composite crowns—can be used to restore diastema case [7]. If the diastema is only 1.5 mm in size, it can be closed with microfilled and hybrid resins. Although composite resin is less expensive, easier to use, and requires fewer appointments, it is not as durable or as resistant to surface discoloration as dental porcelain. Composite restoration, ceramic crown prosthesis, and the conventional porcelain fused to metal have been replaced with porcelain laminate veneers (PLVs) [6,7].

The porcelain laminate veneer can be used to successfully modify smiles in a rapid, conservative, and painless manner with striking, long-lasting results. Excellent tissue interaction and a surface which closely resemble the natural dentition are the results [8,9]. In the same way that the natural tooth structure absorbs, reflects, and transmits light, veneers also naturally glow. According to recent research, the combination of translucency, strength, and bondability makes lithium disilicate and hybrid CAD/CAM ceramics perfect for anterior veneers. In order to achieve a natural emergence profile and color stability, Durán et al. (2022) closed a maxillary midline diastema in a single tooth using a glass-matrix ceramic partial laminate veneer [10].

Retrospective studies on pressable glass-ceramic veneers report good results over 5–20 years with low incidence of debonding or fracture when appropriate case selection and adhesive protocols are followed. Long-term data on porcelain laminate veneers also demonstrate high survival rates. Lithium disilicate is another widely used material for anterior crowns and veneers. A study by Malchiodi L. et al (2019) estimated over a mean follow-up of three years, a 98.7% survival rate was reported in this study involving 79 Lithium disilicate (LDS) veneers in anterior teeth [11]. A comprehensive analysis of ceramic laminate veneers' long-term survival rates that pooled 10-year survival for LDS veneers was approximately 96.8%, according to a recent meta-analysis that included LDS and other ceramics (feldspathic, leucite-reinforced) [12]. All these data from literature suggest that Lithium silicate serves superior results comparable to other materials for anterior veneers, and hence it was the material of choice in this case.

The most frequent relative failures for the Direct Composite veneers were surface roughness, marginal discolouration, and adaption. Throughout the observation period, the ceramic based on lithium disilicate used in this study retained smooth surfaces [5]. Special acid etching methods were then developed, which enhanced veneers' prolonged retention. Simonsen and Calamia showed that hydrofluoric acid etching and silane added veneer adheres to luting resin composite with a generally better bond than the same luting resin adheres to etched tooth surface [3,7].

This case limits generalizability and long-term interpretation of veneer performance because it is a single-patient outcome with short-term follow-up. Furthermore, comparative and thorough analysis is limited because alternative treatments and objective functional or soft-tissue evaluations were not assessed.

CONCLUSION

The successful closure of the diastema in this case, coupled with excellent long-term outcomes and patient satisfaction, underscores the potential of ceramic veneers as a conservative and reliable treatment option. With proper case selection, CAD/CAM technology, meticulous execution, and adherence to maintenance protocols, this approach not only enhances smile aesthetics but also promotes restoration longevity and periodontal health.

Clinical Significance:

- Midline diastema, though common, can have multifactorial causes that require a personalized and comprehensive diagnostic approach before initiating treatment.
- Lithium disilicate CAD/CAM veneers offer a predictable, conservative, and highly aesthetic solution for the closure of anterior diastemas, especially in patients seeking minimally invasive alternatives to orthodontic treatment.
- Preservation of enamel during preparation enhances the adhesion and longevity of ceramic restorations, underscoring the importance of conservative tooth reduction protocols.

- Digital workflows, including CAD/CAM design and milling, improve precision, fit, and turnaround time, contributing to superior clinical outcomes and patient satisfaction

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None

Ethical considerations

The authors confirm that they have obtained all consent required by the applicable law to publish any personal details or images of patients, research subjects, or other individuals used. The authors agree to provide the Journal of Nepalese Prosthodontic Society with copies of the consent or evidence that such consent has been obtained if requested.

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