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CAD/CAM VENEERS FOR DIASTEMA CLOSURE USING DIGITAL WORKFLOW: A CASE REPORT

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Abstract

Objective: To present a clinical strategy to manage a case of diastema with CAD/CAM veneers using digital workflow. Case report: A healthy 32-year-old female patient presented to the Department of Prosthodontics with the chief complaint of spacing between the maxillary anterior teeth. Labial frenectomy was done to eliminate the etiological factor followed by prosthetic rehabilitation with porcelain laminate veneers using the digital impression employing CAD/CAM technology. Conclusion: The practical benefit of CAD/CAM technology are quality dental care allied with minimally invasive preparation, least possibility of errors and eliminating the need of multiple appointments.

Key words: Veneers, CAD/CAM, Digital workflow, Diastema

Introduction

A patient's smile should always be the main focus of any cosmetic procedure. The goal of a cosmetic dentist is to enhance patients' self-confidence as well as their physical appearance. The display of an attractive dentition is an essential component of any beautiful smile. The dental profession has been forced to confront more challenges in esthetic dentistry. Adhesive bonding technologies and new tooth-coloured restorative materials greatly impacted aesthetic dentistry, and porcelain laminate veneers have contributed significantly to this. Recently, a revolutionary concept called "digital workflow" has been evolved, eliminating the conventional procedures in Porcelain Laminate Veneers (PLV) fabrication. Digital workflow employs digital systems for clinical applications such as intra- and extraoral photography, diagnostic wax-up, mock-up, intraoral camera, and CAD/CAM devices. The advent of CAD/CAM technology has allowed the fabrication of ceramic veneers more efficiently with predictable results[1]. The CAD/CAM technology enables the clinician to produce thin restorations of thicknesses ranging from 0.3mm-0.7 mm with the least possible errors using computers[2]. Midline diastema is usually a sequela of normal dental development during the mixed dentition period. Several other factors too can cause diastema that requires intervention. One of the most common etiological factors of diastema is the papillary and papilla penetrating labial frenum. Spacing greater than 0.5 mm between the proximal surfaces of adjacent teeth in the midline is defined as midline diastema[3]. Midline diastema requires a multidisciplinary approach for diagnosis and developing an effective treatment strategy. The current case report demonstrates the fabrication of porcelain laminate veneers to manage diastema with CAD/CAM technology using digital workflow.

Case Report

A healthy 32-year-old female patient presented to the Department of Prosthodontics with chief complaint of spacing between the maxillary anterior teeth. A complete intraoral and extraoral examinations were performed. All patient related documents including pre-operative photographs (Fig:1) were taken and maxillary and mandibular diagnostic impressions were made during the first visit. Tooth components such as dental midline, incisal length and visibility, tooth dimensions, zenith points, interdental contact areas and contact points and soft tissue components such as smile line, interdental embrasures and gingival health were assessed. Clinical examination revealed diastema between 12,11,21 and 22. The pull test revealed papillary penetrating type of labial frenum attachment. The patient had missing 15,16 and 36 which also was a concern to the patient. Labial frenectomy was planned followed by porcelain laminate veneers for the diastema correction, taking into account the patient's aesthetic needs. The areas of missing teeth were decided to rehabilitate using implants. Prior to beginning of the therapy, informed consent was obtained from the patient.

Fig 1: Preoperative intraoral photograph

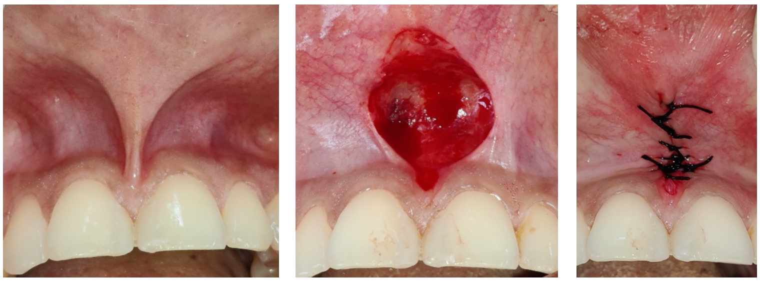
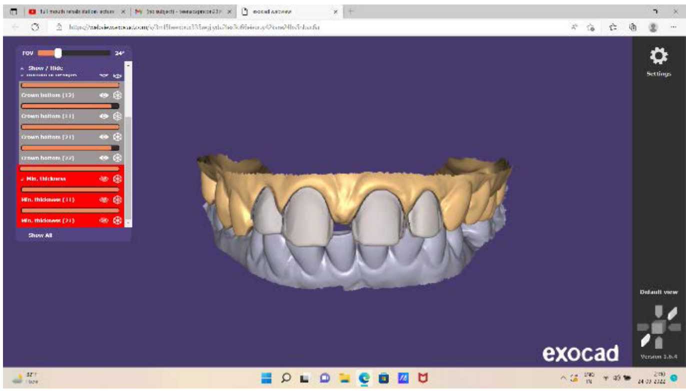


Fig 2: Frenectomy procedure. 2a) Thick and wide labial frenum with high frenal attachment and midline diastema. 2b) Immediate postoperative picture. 2c) Placement of 4-0 suture

Fig. 3: Tooth preparation. 3(a) and (b) Frontal view showing the chamfer gingival and proximal finish lines. 3c) Palatal view showing the incisal overlap preparation.

Procedure

Frenectomy was performed using the classical technique introduced by Archer[4] (1961) and Kruger[5] (1964). (Fig.2a, 2b, 2c). After one month, once healing was completed diagnostic models of both maxillary and mandibular arch were obtained using alginate impression and Type III dental stone. Diagnostic wax up was made and the desired results were verified with the mock up at the second appointment. Scaling and root planning were done. Shade selection was per-



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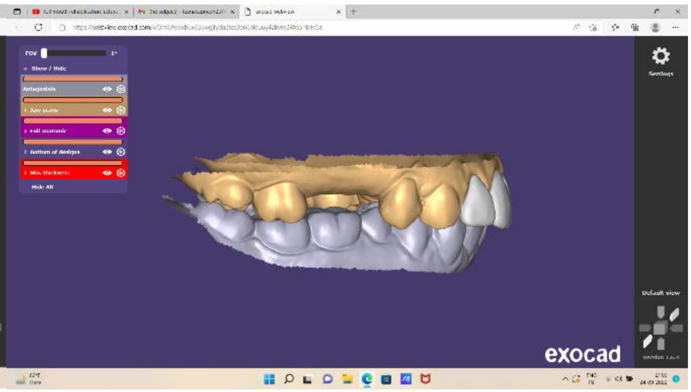

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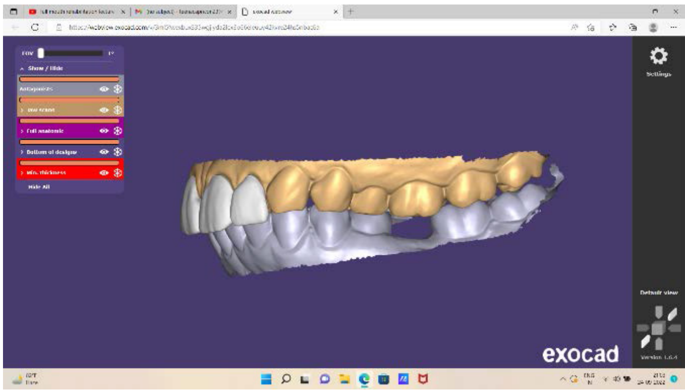

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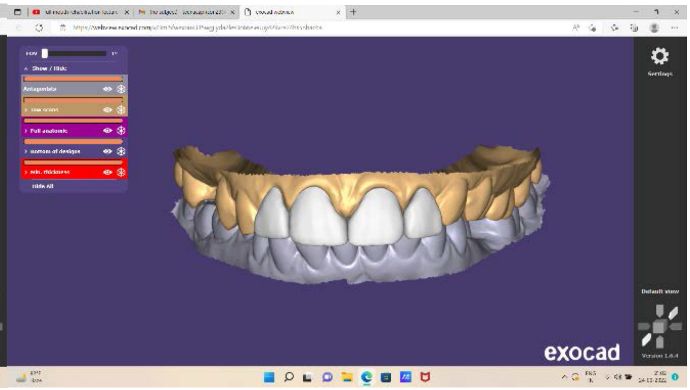

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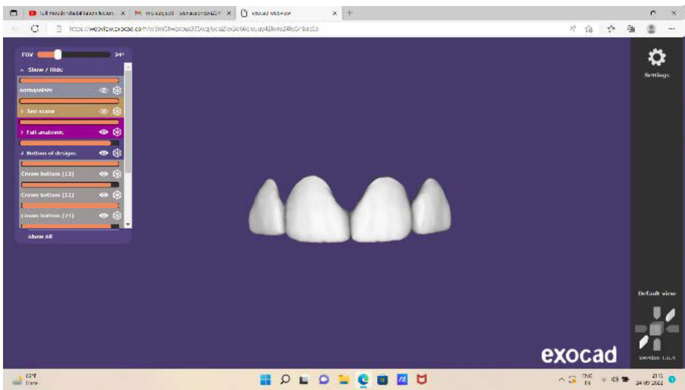

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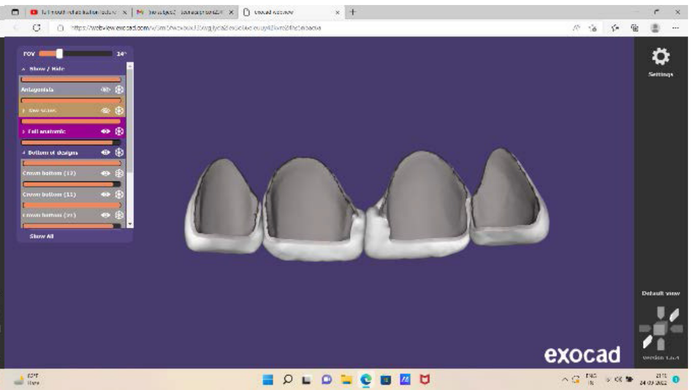

4e

Fig. 4: Final view of the restoration design with the corrected restorations on digital impressions completed after the preparation

formed using VITA Toothguide 3D -MASTER.

The maxillary teeth were prepared starting from maxillary right lateral incisor to maxillary left lateral incisors to receive porcelain laminate veneers. A depth-cutting diamond and a tapered diamond with a diameter of 1 mm were used to keep the tooth preparation within the enamel at a depth of 0.5 mm. Depth orientation grooves were prepared using a three wheeled diamond bur (0.3mm in gingival 3rd and 0.5 mm in incisal third) on the labial surface. The chamfer finish line was extended subgingival. Centric stops were deliberately avoided while creating the palatal finish line. The proximal preparation was extended beyond the proximal contact area to avoid the margin visibility. Incisal overlap design was chosen because it is easy for the technician to fabricate the veneers. the palatal chamfer provides high degree of freedom in positioning the incisal edges[6]. Sharp angles were smoothened and gingival retraction was performed. (Fig. 3)

After the tooth preparation was completed, digital impression of both maxilla and mandible and occlusal bite registration were made using Exocad CAD-CAM software. (Fig. 4a, 4b,4c). The mesiodistal and incisogingival measurements were made on the computer. Symmetry was assessed and the final restoration design was completed using the software. (Fig.4d, 4e,4f).

After completing the design, restorations were milled by Ivoclar IPS Emax blocks. (Fig.5)

The porcelain laminate veneers were cemented using a light-activated adhesive resin cement (Variolink Veneer, Ivoclar Vivadent, Schaan, Liechtenstein) in accordance with the manufacturer's instructions. The adhesion surface of each veneer was etched with 5 % hydrofluoric acid. (Vita Ceramics Etch, VITA Zahnfabrik, Bad Säckingen, Germany) for 20 seconds and subsequently rinsed with water and dried. Monobond S (Ivoclar Vivadent) was applied as a silane coupling agent for 60 s to the inner surfaces of the veneers. Phosphoric acid (37% Total Etch, Ivoclar Vivadent) was applied to the prepared tooth surfaces including enamel for 30 seconds. Adhesive bonding agent (Heliobond, Ivoclar Vivadent) was applied to both the adhesion surfaces of the teeth and the veneers and cure for 20 seconds. Resin cement was applied to the inner surfaces of the veneers. Following these procedures, the porcelain laminate veneer restorations were seated, and excess luting cement was removed with a brush. Porcelain laminate veneers were cervically precured for 5 seconds prior to final curing in order to completely remove any remaining resin cement from the cervical and interproximal regions using hand instruments and dental floss. These procedures were made separately for each porcelain laminate veneer, before the

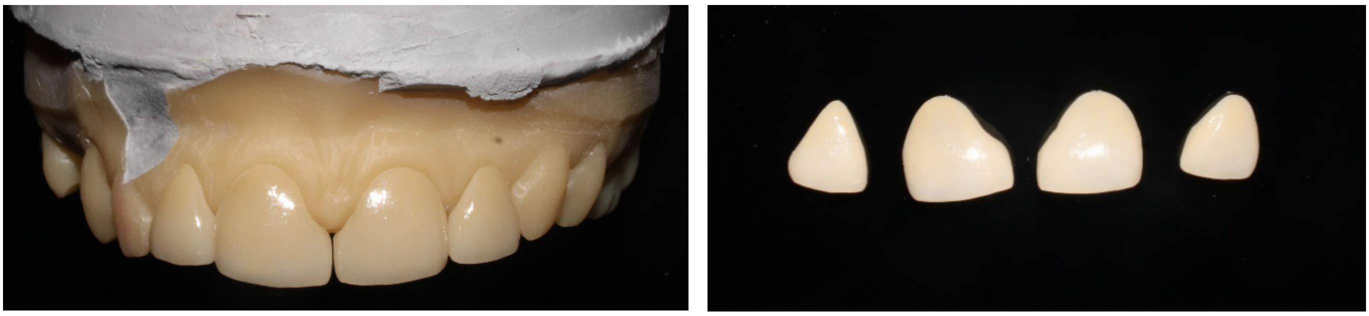

Fig. 5: Porcelain laminate veneers milled with CAD/CAM technology

final cure. Final curing was carried out for 40 seconds on each surface in accordance with the manufacturer's specifications. (Fig. 6). Finally, occlusion was assessed in both protrusive as well as lateral excursions. The patient was recalled six months later and the restoration was assessed. The porcelain laminate veneers were observed to be in good condition. (Fig.7)

Discussion

CAD/CAM milled porcelain laminate veneers fabricated using digital workflow offered excellent esthetic solution for the patient with anterior diastema. Minimally invasive tooth preparation was sufficient to achieve this result. The diagnostic wax up plays a key role in predicting the clinical outcome. The concept of minimally invasive prosthetic procedure (MIPP) focusses on treatment goals such as superior esthetics and long-term function. The development of modern ceramic systems makes it possible to perform tooth preparation with thickness as minimum as 0.3 mm and placing the restoration within the enamel offering excellent bonding[7]. Technology have been developed so that digital impressions created by intraoral scanning (digital data acquisition) can be electronically transmitted to remote laboratories for milling the CAD/CAM lithium disilicate veneers. These digital impressions have become an alternative to conventional impression techniques, creating a virtual model over which the restoration can be designed. Clinical studies have proven that the marginal fit of all ceramic crowns fabricated from intraoral digital impressions are superior compared to crowns from silicone impressions[8]. Saliva, blood, and gingival fluids can destabilize the adhesive phase between resin-based materials and tooth structure, either enamel or dentin, hence a dry environment is essential for adhesive resin materials, such as those used for cement laminate veneers[9,10]. Rubber dam isolation is advisable to avoid contamination of enamel bonding surface, providing a clean restorative environment, with optimal visualization of the gingival margin during the adjustment of the veneer restorations, and ultimately to make it easier to eliminate excess cement.

In this case report, the material chosen was IPS™ e.Max CAD lithium disilicate specifically prepared for CAD/CAM use which possess excellent aesthetics and exceptional mechanical properties.It has been proven that the completely crystallized form of IPSTM e.Max CAD has a reported flexural strength of 262-360 MPa and a fracture toughness of 2.0-2.5 MPa4. This material was produced in accordance with manufacturer requirements by firing at 770 °C for 5 min, then 850 °C for 10 min. Flexural strength of IPSTM E.Max CAD has been demonstrated to be greater than that of conventional leucite-reinforced dental ceramics[11–13]. Since the material was introduced into the market only a decade ago, there is

Fig 6: Final restoration immediately after cementation

Fig 7: Porcelain laminate veneer after six month follow up

distinct lack of literature explaining the long-term survival and success rate of the material.A clinical study on five year clinical outcomes and survival of chairside CAD/CAM laminate veneers found that chair-side computer-aided design/computer-aided manufacturing ceramic laminate veneers were clinically successful restorations with mean survival rate of 99.0 % and success rate of 96.4 % after 5 years[14]. A longitudinal evaluation of CAD/CAM fabricated porcelain laminate veneers concluded that veneers fabricated using CAD/CAM technology may offer comparable clinical outcomes and durability to those made using standard laboratory processing[15]. Proper planning, conservative (enamel-saving) preparation of the teeth, ceramic selection, selection of the materials and methods of cementation, finishing and polishing of the restorations, and planning for the ongoing maintenance of the restorations are critical for the success of the ceramic restoration[16].

Conclusion

The ultimate aim of a restoration is to restore esthetics and function with minimum possible tooth material reduction. CAD/CAM ceramic veneers are an excellent option to restore anterior esthetics. This case report demonstrates fabrication of CAD/CAM porcelain laminate veneers using digital workflow allowing the patient to visualize the final restoration even before the commencement of the preparation thereby eliminating multiple appointments.

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