

Case Report

Partial Laminate Veneers for a Maxillary Midline Diastema Closure: A Case Report

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Abstract: Background: A variety of approaches can be employed to close diastemas using conservative and non-conservative restorative techniques such as composite restorations, laminate veneers, and crowning if there is no indication for orthodontic treatment. **Objectives:** This paper aimed to discuss the mechanical properties of sectional laminate veneers, the preparation, and the ceramic material used for their manufacturing. **Material and methods:** A case of a maxillary midline diastema closure using feldspathic partial laminate veneers with an ultra-conservative preparation is described. **Results:** Feldspathic sectional laminate veneers achieve an esthetically pleasant diastema closure. The ultra-conservative preparation and adequate polishing technique preserve dental and gingival tissues. **Conclusion:** It can be concluded that sectional partial veneers are an esthetic option with low mechanical properties that must be carefully indicated.

Keywords: Partial laminate veneers, ceramic, diastema closure.

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INTRODUCTION

Midline diastema could be created by developmental, pathological, or iatrogenic factors such as mesiodens, microdontia, hypodontia, abnormal oral habits, enlarged frenum, etc. The diagnosis of a diastema must be based on a medical/dental history, clinical examination, and radiographic survey [1]. Once defined its etiology, different and concomitant treatments can be performed, including surgery, orthodontic treatment, direct composite restoration, and prosthetic restoration with full crowns or laminate veneers. Nowadays, a novel ultra-conservative treatment is proposed: sectional laminate veneers or partial veneers. These ultra-thin ceramic restorations can be indicated in cases of midline diastema closure. As with no-preparation-veneers these restorations don't require tooth preparation so no temporization is needed

and favorable esthetic results can be reached. Although, there is a lack of detailed information about their mechanical behavior and their long-term performance [2]. This clinical report describes a step-by-step procedure in which a maxillary midline diastema closure was performed using sectional porcelain veneers.

CASE REPORT

An 18-year-old male patient was referred to the department of prosthodontics, Farhat Hached Hospital, Sousse, Tunisia. His complaint was the unaesthetic appearance of his maxillary midline diastema. The clinical examination revealed moderate diastema, healthy dentition, and periodontal tissues, and the patient oral hygiene was good. After examination of study models, radiographic images, and intraoral

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photographs, various treatment approaches were considered, including orthodontic treatment, which was immediately refused because of its long duration. Prosthetic treatment of four veneers was also proposed. A diagnostic wax-up was performed by the addition of wax to the preliminary model allowed the visualization of the prospective restorative results. But the patient refused this plan and wants an ultra-conservative esthetic treatment without including the lateral incisors. A treatment plan was designed to address the patient's concerns. It was decided to perform sectional veneers constructed with minimal tooth preparation. A preliminary mock-up with direct composite restorations was performed to obtain the patient's confirmation. In fact, in the case of diastema closure, additive wax-up and mock-up are fundamental tools of analysis for the execution of partial veneers with suitable dental width/length proportion [3]. The preparation consisted of interproximal 0,5mm round margin and minimally extended buccal surfacing to remove the aprismatic enamel. The impression was made with condensation silicone (Protesil® putty base and catalyst, light base). In advance, a gingival retraction cord was used to obtain a better emergence profile. For the opposing arch, an irreversible hydrocolloid (Cavex CA 37®) was used. The partial veneers were constructed with feldspathic porcelain (IPS Style Ceram®). Before cementation, the restorations were evaluated in terms of

marginal adaptation and esthetics, and a transparent dual-cure resin cement color was selected (variolink®N intro pack). Adhesive procedures were performed using a rubber dam. The inner prosthetic surfaces treatment was etching with 9% hydrofluoric acid (Porcelain Etch®, Ultradent) for 90 seconds, washing, drying, and application of silane agent (Monobond® N) for 1minute. Prophylaxis was performed on the dental structure; the tooth surface was etched with 37% phosphoric acid (N-Etch®, Ivoclar Vivadent) for 30 seconds, followed by washing with water and air-jet. The adhesive was applied to the tooth with a micro brush and to avoid inaccuracies of fit, it was not light-polymerized. The partial veneers were placed, using finger pressure until full seating and a micro brush was used to remove excess luting material extruded from margins. A flash polymerizing (2 seconds) ensured stabilization of the partial veneers then the residual cement on the interproximal side was removed. The restoration margins were covered with glycerin gel to prevent the formation of an oxygen inhibited layer. Surfaces were light polymerized for 40 sec each. Residual excess cement was further removed with a 15c scalpel. Diamond burs, polishing discs, and silicone polishers were used to finish the veneers. The patient was recalled after 1 week for adjusting static and dynamic occlusion, and enhancing the restorations polish.



Figure: (a) Intraoral anterior view of teeth before treatment; (b) Occlusal view of the diastema



Figure: (a) Right lateral occlusal view; (b) Left lateral occlusal view



Figure: Direct mock-up



Figure: Minimal preparation for sectional veneers



Figure: Color selection



Figure: (a) and (b) Feldspathic partial veneers on the cast



Figure: (a) Operative field isolation with a dental dam ;(b) Phosphoric acid etching of dental tissues; (c) Application of adhesive system



Figure: (a) Hydrofluoric acid etching of the inner prosthetic surfaces; (b) Application of the silane



Figure: Light-polymerization after sectional veneers placement



Figure: (a) and (b) Finishing and polishing procedure



Figure: (a) Initial situation showing frontal view; (b) Facial view after cementation of Partial veneers

DISCUSSION

A midline diastema presents a higher prevalence in the maxilla than the mandible and has a multifactorial etiology. The treatment of maxillary median diastemas (MMDs) stands out as one of the most noticeable esthetic alterations performed on patients. The current literature suggests a variety of approaches for the closing of diastemas, such as orthodontic treatment, restorative treatment, or a combination of both. The decision is based on factors such as etiology, economics, time availability, and the patients' desires. Small diastemas can be closed in 3-6 months by a simple Hawley retainer [2]. But an orthodontic treatment is indicated in case of large or multiple diastemas with malocclusion. This very conservative option is on counterpart a time-consuming treatment and more uncomfortable for the patient. Faster treatments are related to restorative procedures such as full crowns, ceramic veneers, and composite resins. Direct adhesive restorations possess many advantages. It is non-invasive, can be performed in a single appointment, and is cost-efficient, it allows esthetic results and can easily be repaired. Conversely, the major drawback relates to its color changes and marginal accuracy over time. Moreover, it is a highly technique-sensitive procedure [3]. Porcelain laminate veneers have been described as successful restorative treatments, offer much better esthetics and durability than composite resin. In recent years "minimal preparation" porcelain veneers with an ultra-thin thickness of 0,3mm to 0,5mm are favored when the entire vestibular surface must be replaced. "No preparation" veneers are also suggested but they are only indicated for selected cases. More recently "sectional veneers" also called "partial veneers" have been described as an innovative ultra-conservative technique that covers only part of the tooth surface with no or minimal preparation. Sectional veneers have many advantages. The procedure will be reversible [3] when no preparation is needed, with no post-operative sensitivity and the needless of provisional restorations,

also the impression technique will be simplified [4]. These indirect restorations can correct small diastemas and re-anatomizations (Farias-Neto *et al.*, 2015) or small fractures (Sinhori *et al.*, 2018), abfractions, and gum recessions. But this approach is contraindicated if the dental substrate is discolored.

Veneers or partial veneers without dental preparation are indicated in situations in which dental structure allows for material to be added since they do not modify or create an over contour, otherwise minimal tooth preparation will be needed. For diastema closure, it is depending on the shape of the natural teeth, a minimal dental preparation may be necessary to eliminate proximal undercuts and create a horizontal insertion axis for the veneer [12].

Despite conservative tooth preparation principles for bonded porcelain restorations, the removal of a minimum amount of sound enamel is still required to respect the geometric and mechanical parameters, to facilitate placement and positioning during bonding procedure, and to ensure marginal accuracy. So a conservative preparation was performed with a proximal 0,5mm round margin with an extension on the buccal surface to just remove the aprismatic enamel.

For the construction of partial veneers, both feldspathic and glass-ceramics are described.

The use of feldspathic ceramic permits to vary the opacity and chroma levels in different parts of the restoration which offer great aesthetic effect and high translucency with small thickness. So for partial veneers, feldspathic ceramic should be favored because it is much more mimetic than reinforced glass ceramics due to the predominance of the vitreous matrix. However, these restorations are fragile (low fracture resistance: 56.5 MPa), susceptible to fracture under mechanical stress, also, they can crack easily during fabrication and placement [11].

Another restorative technique is using ceramic CAD/CAM fragments. Because of the absence of a pre-defined protocol for these partial restorations, the CAD/CAM technology allows selecting the area to be restored even without preparation. However, there is a lack of reports in the literature using this technology, which is not extensive to laminate veneers. Hence, once there are no delimited margins the challenge is harder. Moreover, they will be located in an area of visibility and light reflection, so the fragment adaptation has to be as accurate as possible to enable the mimetization between restoration and tooth and mask the attachment line with the ceramic material [10]. To enhance matching the color with the natural teeth, there are ceramic blocks with a color gradient (IPS Empress CAD Multi) indicated to treatments with ceramic fragments, showing higher translucency to incisal regions and lower translucency to cervical regions. These proprieties avoid the need for a layering step, therefore reducing the time required to fabricate the restoration. Another case report describes a diastema closure with sectional veneers fabricated with hybrid ceramics blocks by using a CAD/ CAM system with no-preparation design. It was preferred because of the capability to bond composite filling materials and if needed, filling materials could be used for adaptation of the restoration. However, color changes over time are expected [9].

In the presented case, after making the impressions, a dental technician fabricates the partial veneers using feldspathic porcelain on a refractory die. It was preferred to reinforced ceramic materials as they can be fully layered and may lead to more natural aesthetics [8, 12].

The major effort is to obtain a natural shape and match the dental tissues with the margins of the restoration, without bulky edges and overhangs [8] that threaten soft tissue health [9].

Once there is no standard protocol to fabricate ceramic fragments, sometimes, fabricating more than one is required to achieve a better fitting especially when there is no margin delimited by a previous preparation. It might be recommended to fabricate restorations with slight excesses to improve the fit and also to accomplish a good marginal polishing.

In the reviewed literature, the low mechanical properties of such restorations are questionable.

According to some authors, the popularity of the ceramic sectional veneer technique is limited because of the technically demanding clinical procedure and the delicate laboratory fabrication process. Another limitation is the high risk of accidental breakage and post-bonding crack formation on the knife-edged margins due to the reduced ceramic thickness and the unfavorable ceramic/composite thickness ratio [5].

According to a three-dimensional finite element stress analysis, if the porcelain sectional veneer is out of occlusion and the occlusal force is parallel to the longitudinal axis of the tooth, restoration survival can be expected. But if acting directly on the restoration, it may lead to non-tolerated stresses. The oblique forces, induced by anterior excursions or parafunctional habits, for instance, increased the stresses dramatically and threaten the survival of the restorations, even if they are not applied directly on the partial veneers. This feature distinguishes porcelain sectional veneers from ordinary porcelain full laminate veneers. Their thin margins are considered to be a weak point, and they must be positioned carefully and checked regularly. Also, the interior angle opposite to the incisal angle must be taken care of by rounding and providing adequate material thickness. In conclusion, the occlusal scheme and bite force must be noted carefully before choosing this type of restoration to avoid margin chipping rather than fracture or debonding [6]. An *in-vitro* study evaluate the fracture strength of porcelain sectional veneers made from two different sintered feldspathic porcelains, the load was applied at the incisal edge and according to the longitudinal axis of the specimens. This study showed no adhesive failure and the fracture of the porcelain sectional veneer was the most common failure mode [4]. Another *in vitro* study has shown for the first time that partial laminate veneers can exhibit fracture strength values similar to conventional laminate veneers.

In this proposed concept, the bonding procedure is of key importance and is a dominant factor required for the restoration's longevity. According to an *in vitro* study, flaws were observed at the margins after cyclic loading when thin laminates are cemented with greater thickness of luting composite. Consequently, the ratio of ceramic to luting composite should be above 3.0. Another *in vitro*-study conclude that increasing thickness of the cement led to a gradual decrease in fracture strength of the porcelain [14], Magne *et al.*, [15] stated that a poor fit between tooth and restoration causes an uneven cementation area that can lead to concentrated tensions in the bulk of the restorative material and the adhesive interface (Magne *et al.*, 1999).

In this sense, adaptation and an optimal luting protocol might play a more relevant role than the restorative material properties. Delivery of thin porcelain shells on unprepared teeth is particularly challenging because it calls for the use of very thin composite resins to prevent bending forces during seating [16] thence a good internal fit has to be created [17]. An *in vitro* study which was carried out in 2020 deduced that the adoption of an optimal protocol of luting and a good internal adaptation of the partial laminate veneers prevented the cracked ones from performing poorly in the fracture test [7]. Also for the esthetic outcome, a minimum thickness of resin cement

at the interface is required, since resin composites are more prone to wear and discoloration than ceramic restorations.

Finally, Clinicians should dedicate particular care to subgingival finishing and polishing which can be difficult to accomplish [3].

CONCLUSION

The main difficulties regarding diastema closure with partial laminate veneers are related to reaching an appropriate width proportion, a natural esthetic transition, and a marginal fit that does not compromise gingival tissues. Long-term clinical results for sectional veneers are not yet available. Follow-up studies and clinical outcome data need to be carried for predicting results.

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