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Case Report

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Full Ceramic Aesthetic Applications: 3 Case Reports

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Abstract

One of the most important issue of today's dentistry is the preservation of tooth structure. Following biomimetic principles, employing minimally invasive applications and adhesive technologies are of paramount importance for successful restorations. Ceramics are materials that allow minimally invasive approach in the anterior region. As ceramic materials develop and patients demand for aesthetic restorations goes up, practitioners must keep up with the material science. The authors suggest guidance to the practitioner in selecting the proper all-ceramic systems for crowns when faced with different aesthetic desires. In this article, three cases of full ceramic restorations were obtained by different production techniques are presented.

Keywords: CAD-CAM, Case series, Full-ceramic, Laminate Veneer

Introduction

Patients are annoyed by anaesthetic teeth in especially anterior region. Anaesthetic smile leads to social anxiety and loss of confidence [1]. For years, metal ceramic crowns have been used for restorations on anterior region. However, patients were unsatisfied with metal ceramic crowns as aesthetic demands increased. These growing demand for superior aesthetic outcomes requires restorative materials with optical properties similar to natural teeth [2, 3]. These materials must include a wide range of colours and also be able to reproduce the translucence, opalescence, and fluorescence of natural teeth [4]. Ceramics are preferred for aesthetic restorations since they offer excellent potential to simulate optical dental characteristics [5, 6]. The purpose of ceramics is to imitate the optical properties of natural teeth while maintaining acceptable biomechanical and biocompatibility characteristics.

Numerous kinds of ceramic systems have been developed for clinical use [7, 8]. According to the manufacturing techniques, full ceramics can be classified as cast ceramics, compressible ceramics and CAD-CAM systems [9].

Ceramics, metal alloys and various composites can be used in CAD-CAM systems. Commonly used ceramics are alumina (including those that allow glass infiltration later), zirconia and feldspar porcelain based ceramics [10]. Similar to the ceramics shaped by heat and pressure, CAD-CAM system ceramics are also available in prefabricated blocks. These blocks are cut by milling with computer-controlled devices.

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Preparation Requirements

All-ceramic preparation: There are different preparation techniques used in restorative dentistry [11]. However studies proved that rounded shoulder preparations show the highest fracture loads among these techniques [12]. The prepared tooth must have a taper of 6 to 10 degrees and smooth contours to reduce the risk of stress concentration in the ceramic and to ease the impression and cementation. The occlusal reduction should be 1.5 mm and axial reduction should be 1.0 to 1.5 mm [11]. Taking into consideration the minimally invasive dentistry and the better adhesion in enamel, the preparation must be as conservative as possible. With severe discolouration, however, minimum reduction can be inadequate to ensure optimal esthetics. In such cases other strategies like using rather opaque alumina, zirconia or magnesium core bases will be necessary to mask the darkness.

Laminate preparation: Generally, porcelain laminate veneers are prepared at a minimum of 0.5 mm to allow for minimal porcelain thickness. In regard to most acceptable opinion, preparation should not be made more than 0,3 mm in 1/3 of cervical and not more than 0,5 mm in 2/3 incisal such that dentin is not removed [13].

In general, four different types of incisal preparations are accepted; window inside the enamel, incisal preparation with no angle (feather), incisal preparation at 30-40 ° angle (bevel), preparation covering the entire incisal margin and ending in the palatal region of the tooth (incisal overlap). The most preferred form of preparation includes the entire incisal margin and it terminates in the palatinal surface. The incisal margins are cut to 0,75-1,5 mm (1mm on average) in accordance with the expectation of restoration. Porcelain laminate veneer becomes more resistant as it increases the mass of porcelain

by this preparation [14,15].

Cementation: The order of surface conditioning of the inner surface of the porcelain laminates and sectional veneers is showed in Table 1, and the cementation order of these restorations appears in Table 2.

Table 1: Surface conditioning order of inner surface of porcelain laminates and sectional veneers

1	Etching with hydrofluoric acid (1 min) [16].
2	Rinsing with copious amounts of water (1 min)
3	Application of silane coupling agent, with allowance of time for evaporation (1 min)
4	Application of adhesive (no photopolymerization)
5	Application of cement on cementation surface of porcelain laminate and sectional veneers

Table 2: Surface conditioning order of teeth and/or restoration complexes

1	Roughening of enamel with diamond bur and air abrasion
2	Etching of enamel with 38% phosphoric acid (30 s)
3	Rinsing with water (1 min)
4	Application of adhesive (no photopolymerization)
5	Positioning of veneer with cement
6	Photopolymerization (10 s)
7	Removal of excess resin cement with probe
8	Photopolymerization from multiple directions (40 s each direction)
9	Removal of excess resin cement with diamond burs
10	Polishing of margins with polishing rubbers and polishing paste

Case 1: 27-year-old female patient who has discoloured, crowded anterior teeth and applied to our clinic. The results of the intraoral examination showed that there is a crowding on number 11 and 21 and this observation directed us to plan laminate on number 11 and 21. Teeth number 11 and 21 are prepared as mentioned above. In order to minimize the crowding, the paralleling of the longitudinal axis of teeth to each other took into consideration during preparation. In preparations, incisal overlap and rounded chamfer are preferred as mentioned above. Veneers are obtained in CAD-CAM system with using Vitablock Mark II blocks. Restorations were cemented with Panavia F2.0 according to the manufacturer's instructions for use through the steps described in the Table2. (Figure 2-4).

Figure 1: Her smile when she applied to our clinic

Figure 2: Laminate veneer preparation of incisal overlap

Figure 3: The patient's smile after cementation of laminate veneers

Case 2: A 20-years-old female patient who was complaining of unaesthetic smile. According to intraoral and radiological examinations irregularity in gingiva and conical shapes of anterior teeth were detected. There was also a congenital deficiency in lateral teeth which canines were in their place due to orthodontic treatment. Laser (Er,Cr: YSGG) gingivectomy of anterior six teeth and laminate restorations of teeth 15-24 were planned. First, gingivectomy is applied between the teeth number 15-24, zenith points are levelled with using Er,Cr:YSGG laser. After healing for one-week, veneer preparations were made in the type of incisal overlap and were rounded chamfer to the anterior teeth between number 15-24. Veneers were obtained in CAD-CAM system with using Vitablock Mark II blocks. Restorations were cemented with Rely X-Veneer Cement (3M-ESPE) according to the manufacturer's instructions for use, through the steps mentioned in the Table 2. (Figure 4-7).

Figure 4: Intraoral photograph of the patient: conical form teeth and congenital lateral deficiency

Figure 5: Laminate veneer preparations of incisal overlap

Figure 6: Laminate veneer restorations between teeth number 15 - 24

Case 3: A 22-years-old female patient applied to our clinic with discoloration of the anterior teeth. Following intraoral examinations, full ceramic crowns were planned. It was planned to prepare each crown separetaly for the health and easy cleaning of gingiva. Teeth between number12-22 were prepared as rounded shoulder which is subgingival. Prior to the impression step, gingival retraction was done with gingival retraction cord (Ultrapack 000). Impressions were made with addition silicone. Crowns were obtained with compressible system. Lithium disilikat reinforced IPS e max press (Ivoclar Vivadent, Leichtenstein) which is used as ceramic material. Cementation were made with Panavia F2.0. (Figure 7-9)

Figure 7: Intraoral photograph of the patient: Flood and discoloured restorations are observed

Figure 8: Intraoral photograph of the patient: After cementation of IPS e-max crowns

Figure 9: Crown praperation of rounded shoulder

Discussion

The first step in treating non-aesthetic smile is to determine the correct indication. Previous studies provides information to guide the treatment plan in these cases [17, 18]. First, the selection of restoration type was a prominent consideration. A variety of treatment options are available to restore fractured, misaligned and malformed or hypoplastic anterior teeth. For many years, full-coverage crowns were indicated in this situation, but this treatment option is now considered invasive because there is a need to remove excessive tissue. Progress in adhesive technologies has made possible a variety of more conservative restorations. For instance, when the colour of the existing substrate (the patient's teeth) is acceptable, thin porcelain laminate veneers (0.3–0.7 mm) are more suitable.

In a clinical study it was stated that there was no significant difference in patient's gratitude with composite or ceramic laminate veneers immediately after placement, but after two years of follow up, patients were significantly more satisfied with the ceramic restorations [19]. Survival rates for veneer restorations were compared in another study and the findings were as follows; 94% for porcelain restorations, 90% for indirect composite restorations and 74% for direct composite restorations [20].

Especially in regard to advantages of minimal invasive approach, laminate veneer restoration was chosen as a treatment option in case 1 and 2. However, in case 3, the previous gingival and marginal compatibility in the upper teeth of patient were ruined, and discoloured composite restorations were existed and there were a lot of enamel loss in teeth. That is why laminate was not accepted in this case and full crown was applied. Restorations were made as a single crown not as bridge type. As a result, gingival health was tried to be protected at maximum level.

In the practice of dentistry, system selection specialized to the patient is performed with considering a lot of factors like aesthetic, compatibility, cost and production convenience. Full ceramic systems have these criteria with several ratios [21]. In CAD-CAM systems, generally, monolithic block ceramic or metals are used [22]. A disadvantage of porcelain used in block form is that because they are monochromatic, freedom of choice of color is limited. Personal effects can be acquired to the restoration got by using exterior painting and glaze similar to traditional methods [23].

Herrguth et al. reported that the aesthetic of crowns in which prefabricate porcelain blocks were used and exterior painting was applied had similar results with aesthetic of crowns which were obtained by traditional layering technique [24].

Vitablocks Mark II which is feldspatic porcelain (Vita Zahn-fabrik, Bad Sackingen, Almanya), Pro-CAD which is leucite based porcelain (Ivoclar Vivadent, Schaan, Lichtenstein), In-Ceram Zirconia which is zirconium based porcelain (Vita Zahnfabrik) and Paradigm MZ100 which is resin based composite (3M ESPE, St Paul, Minn) are used in CEREC3 and CEREC InLab systems [25]. Even if polymer based materials seem to be more advantageous than porcelain materials in terms of intraoral regulation, polishing, additions applied to occlusal or interproximal surfaces; they are more disadvantageous in terms of low level of wear resistance and bending resistance [26]. Vitablocks Mark II is more enduring than conventional feldspatic porcelains. Because of these reasons, Vitablocks Mark II is preferred in Case1 and Case 2.

Pressable glass ceramics are one of the most popular dental restorative systems because of several factors including ease of fabrication (conventional lost waxing technique), occlusal accuracy and better marginal integrity, translucency, good mechanical properties (crystals reinforcing systems), net-shape forming by pressing, and resultant decreased porosity [27]. Therefore, we preferred lithium disilicate, which is a pressable porcelain system in Case 3. Lithium disilicate is a glassy ceramic which is composed of quartz, lithium dioxide, phosphor oxide, alumina, potassium oxide and other ingredients [28]. The material has high flexural strength up to 440 MPa.

Light cured or dual cure polimerized resins are used in luting. Comparing to dual cure or chemically set materials, light cured ones have advantages and these properties are allowing more time for studying and having more colour stability. However, light transmittance under porcelain veneer has to be sufficient for light cured resin composite polymerization [29, 30]. Resin composites for porcelains which are thicker than 0,7 mm cannot reach at maximum set. For these situations, chemical and light cured set dual cure resin composite is advised. With these luting agents, more strong connections can be established [30]. Because of these advantage, dual cure cement were preferred in all cases.

Conclusion

This case report has described the restoration of the anterior dentition with porcelain laminates and all-ceramic crown. Adhesion, finishing and polishing procedures, which are considered key factors for clinical success have been described in detail. The rationale for various choices in this treatment protocol has been detailed with reference to the pertinent literature.

Conflict of Interest: There is no conflict of interest.

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