Esthetic rehabilitation of anterior tetracyline teeth using porcelain laminates veneers and porcelain fused zirconia bridge - a case report

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ABSTRACT
The increasing demand by patients for esthetic and metal-free restorations has driven the development of ceramic restorations with good esthetic and mechanical stability. The use of porcelain laminates veneers to solve aesthetic and or functional problems has been shown to be a valid management option especially in the anterior aesthetic zone. The current porcelain veneers are esthetically superior, conservative and durable treatment modality. The present case report describes the treatment of discoloured tetracycline teeth in the anterior dentition with thin porcelain laminate veneers and Yttrium-oxide partially stabilized zirconia (YTZP) bridge for missing upper right lateral incisor tooth and treated for problem. The restorations were evaluated clinically over for retention, colour match, surface texture, marginal integrity and gingival response. The patient was very satisfied with the result and had no complaints during 1.5 years of follow-up.
Keywords: tetracycline, porcelain, veneer, zirconia, aesthetics

INTRODUCTION

The increasing demand by patients for esthetic and metal-free restorations has driven the development of ceramic restorations with good esthetic and mechanical stability.[1] In daily clinical practice, aesthetics of anterior teeth is a common presenting complaint of patients, which is affected by caries, malformation, anatomic alteration, discoloration/staining, and hypoplastic defects.[1] Dissatisfaction with tooth color and shape has increased the demand for cosmetic dental treatment. Available options to restore unaesthetic teeth and create bright smiles consist of all porcelain restorasion and indirect veneer treatment.[2]

Porcelain veneers is a thin bonded ceramic restoration that restores the facial surface and part of the proximal surfaces of teeth requiring esthetic restoration.[3,4] The indications of dental veneers include 1) discoloured teeth due to many factors such as tetracycline staining, fluorosis, amelogenesis imperfect, age and others 2) restoring fractured and worn teeth, 3) abnormal tooth morphology, 4) correction of minor malposition 5) Intra-oral repair of fractured crown and bridge facings. Unfavourable conditions of dental veneers include 1) patients with parafunctional habits such as bruxism 2) edge to edge relation, 3) poor oral hygiene, and 4) insufficient enamel.[4–6]

The concept of no preparation or minimal-preparation has followed the development of appropriate enamel bonding procedures. The colour and integrity of dental tissue substrates to which veneers will be bonded are important for clinical success using additional veneers with a thickness between 0.3 mm and 0.5 mm, 95-100% of enamel volume remains after preparation and no dentin is exposed.[3,4] According to multiple clinical studies, porcelain veneers have excellent aesthetic results, the longevity of the treatment and patient's satisfaction.[4,5] Many studies investigated the longevity of porcelain veneers. They showed good results over a period of 10 years and more, with a survival rate of 96% after 10 years and 91% after 20 years.[5,7] Also, Smales and Etemadi reported a survival rate of 95% for porcelain veneers throughout 7 years.[5]

When there is missing tooth, the major factors that may influence the final restoration choice are esthetics and strength of the prostheses. Transformation-toughened zirconia is prone to be a successful alternative in the different clinical situations compared to other all-ceramic systems. Their mechanical and optical properties allowed them to be used as a framework material. In vitro studies demonstrated a flexural strength of 900–1200 MPa and a fracture toughness of 9-10 MPa.$m^{1/2}$. Nowadays, all ceramic prostheses are replacing, more and more, metal-based restorations. A variety of ceramic systems are developed for single crowns or fixed dental prostheses (FDPs) with an excellent esthetic outcome.[8]

Zirconia framework is esthetically better accepted than metallic framework, but it remains clinically too white and opaque. Therefore, manufacturers introduce colored zirconia framework to ameliorate the overall matching color. Different techniques have been proposed: adding pigments

to the initial zirconia ceramic powder, dipping zirconia milled frameworks in dissolved coloring agents, applying liner material to sintered framework. Thinner veneer is then required to mask the underlying framework.[8,9]

The present case report describes the treatment of discoloured tetracycline teeth in the anterior dentition with thin porcelain laminate veneers and porcelain fused zirconia bridge for missing right lateral incisor of maxillary arch to restore esthetics and function.

CASE

A-50-year-old female patient reported to the Department of Prosthodontics, Faculty of Dentistry University of Indonesia with a chief complaint of missing of upper right lateral incisor and discoloured anterior teeth. The patient was unhappy with the appearance of her teeth and restrained herself from smiling due to self-consciousness. Complete dental and medical history of the patient along with preoperative photographs was ta-ken.

A detailed family history, medical history and dental history was obtained. In family history, none of his family members had similar problem. Medical history was also not relevant. Extra oral examination could elicit no abnormal findings. Intraoral examination revealed no significant finding except amalgam filling in lower molars. The maxillary anterior exhibited variable degrees of pitting with yellowish to brownish discoloration of the surface (Fig. 1). All teeth were vital and had no hypersensitivity.

Figure 1 Initial condition of patient

The patient exhibited a canine guided occlusion, bilaterally. Following a careful evaluation of the objective parameters of the patient's smile, all treatment options were discussed. As the patient wanted fixed prosthodontic therapy, a conservative, aesthetic procedure using porcelain fused zirconia bridge and laminate veneers was selected. Porcelain laminates veneer for anterior maxillary segment from 21-24 and porcelain fused zirconia bridge for 11-13 was planned. Preparation for bridge 11-13 was planned after cementation of veneers because final colour of shade guide will be taken after control the veneers, because the colour after control was usually different because of the colour the cement we used.

MANAGEMENT

Pre-prosthetics and initial appointment

Diagnostic impressions were made using irreversible hydrocolloid (Aroma, GC), poured with type IV dental stone. Study models was used for wax up of the anterior teeth 13-24. In order to test the final outcome of the proposed smile design, the mock up was tested using Bisacryl composite material (Hantemp, Korea). After infiltration anesthesia was given, 0.5 mm depth cutting burs were used to achieve the required depth and were marked with a pencil. The preparation on the tooth was followed by tapered diamond bur (Laminate Veneer System-Set 4151, KOMET USA). Labial surface preparation was done until the pencil marks disappeared (Fig.2). The chamfer cervical preparation was made on the labial surface parallel to the gingival margin. In the proximal area, the chamfer marginal preparation was done without eliminating the proximal contact area, and the result of the preparation was smoothed with a finishing bur. After the preparation was completed, the entire tooth surface was then cleaned with pumice powder and water by using a rotary brush.

Figure 2 Preparation of 11-14 based on mock up

Gingival displacement was done (#00 cord with AlCl3 solution) and 2-stage final impression with addition polysiloxane was made (Aquasil, Dentsply Sirona) (Fig.2) and natural die shade guide was taken (Ivoclar, Vivadent) (Fig.3). After that, bite registration was conducted, and temporary veneer was made with Bisacryl composite material (Hantemp, Korea). Pressable ceramic, glass-ceramic lithium disilicate was used (IPSe. Max Press, Ivo-

Figure 3 Shade guide selection

clar Vivadent). The try-in procedures were done after the temporary veneer was removed, and the occlusion was inspected. Veneer surfaces were cleaned, air-dried, and the silane coupling agent (Internal surfaces of the veneers were etched with 9.5% hydrofluoric acid (Ultra dent, Germany) for 20 second and were silanized with a silane coupling agent (Silane-Ultradent Products, Inc. South Jordan, Utah, USA).

Acid etching was done with 37% phosphorric acid (Total Etch, Ivoclar Vivadent) and the etchant was thoroughly rinsed off after a duration of 15 s. All the teeth surfaces and inner surface of veneers were coated with bonding agent in thin layer and light polymerized for 25–30 s. Dual cure composite luting agent (Variolink-II, Ivoclar) of appropriate shade was selected and placed in the inner surface of porcelain veneers (Fig.4). The cement excess was removed using an explorer, the veneer was cured for another 20 seconds on all aspects.

Figure 4 Veneer cementation

After veneer 21-24 was controlled, preparation for 11 and 13 was done and sharp angles of the preparation were rounded off, with shoulder marginal preparation. Gingival displacement was done (#00 cord with AlCl3 solution) and 2-stage final impression with addition polysiloxane was made (Aquasil, Dentsply Sirona). and natural die shade guide was taken (Ivoclar, vivadent). Shade was selected using Vitapan Classical shade guide (Vita Zahnfabrik, Germany) (Fig.5) based on last colour of veneer 21-24.

Figure 5 Shade selection for porcelain fused zirconia bridge 11-13

Trial and fitting of copping bridge 11-13 (Fig. 6A), the marginal fitness of coping and space for porcelain layering were checked, then final layering of porcelain was made in laboratory. Insertion for bridge 11-13; the cementation procedure was same as cementing the veneers. Dual cure composite luting agent (Variolink-II, Ivoclar) was used. Occlusion and lateral excursion were checked to ensure that no contact existed on tooth-porcelain interfaces. The patient was satisfied with her new emergence and smile (Fig.6B).

Patient was given instructions to daily flossing, additional use of a mouthwash, downward massage of the gums, and a 6-monthly follow-up was advised. There was considerable improvement in overall appearance of the patients in terms of aesthetics as seen in post rehabilitation photographs.

Figure 6A Trial copping bridge 11-13, **B** insertion bridge 11-13

The restorations were evaluated clinically over for retention, colour match, surface texture, marginal integrity and gingival response. The margin was smooth; there is no catch or penetrate of explorer. The restoration matches the shade and translucency of adjacent tooth tissues/veneers restoration. Patient is very satisfied with the color of restoration. There is no gingiva inflammation or visual evidence of gingival recession from restoration level. The patient was very satisfied with the result and had no complaints during 1.5 years of follow-up (Fig.7).

Figure 7 Folllow up after 1.5 years

DISCUSSION

Diagnosis is the first important stage in the treatment and it is important to design the future treatment planning. Thus, information about patient's motivation, patient's history of dental and general health, and patient's problems related with his/her daily habits should be explored as complete as possible. Future treatment plan is determined based on the clinic examination. The selection of material used will be based on both patients' expectation of care and their economic status.[10]

The selection of the indirect veneer 21-24 with porcelain material in this case is because it can give aesthetic and strength as same as those in the original teeth, such as the colour quite stable

and natural. Indirect porcelain veneer was indicated for the discolored and hypocalcified teeth, diastema, tooth-shaped correction, and tooth malposition which cannot be managed orthodontically. Porcelain veneers have also been proven to be highly effective for stabilising the colour of tetracycline stained teeth.[2] There are contraindications for porcelain indirect veneer, such as bruxism patients, inadequate enamel thickness for retention, severe tooth fracture, large diastema, shortened-crown tooth, teeth with large restoration, and severe tooth discoloration.[4,6]

Indirect porcelain veneers have more advantages than composite resin veneer because it has better esthetic, color stability, durable to withstand high abrasions, biocompatible, and non-porous. Therefore, plaque accumulation and its adverse effects on the gingival health can be minimized. Sowmya, et al stated that the advantages of porcelain veneers are resistant to plaque attachments, and the preparation was limited to the enamel to protect the tooth structure underneath. Maintaining sound tooth structures as much as possible are an essential part that should be considered in the dental restoration.[4]

In this case, preparation teeth for veneers are performed on the mock-up as if it was a natural tooth, which was called the mock up driven technique. This technique results in considerably less invasive dental preparations, since it takes into account the final contour desired for the veneer.[3] The use of the mock-ups, followed by a wax-up, and silicone index for checking the preparation will not only allow the dentist to achieve the best aesthetic, phonetic and functional outcome, but also to communicate this to the patient, and laboratory.[11]

For the missing tooth 12, Yttrium-oxide partially stabilized zirconia (YTZP) was choosen as the material. Zirconia framework is esthetically better accepted than metallic framework, but it remains clinically too white and opaque.[8] Based on the aesthetic demands that increase the interest for non-metallic and biocompatible restorative materials and with the development of zirconia based prostheses, YTZP became commonly used for anterior teeth when the abutments were discoloured, or for opaque teeth.[9] The clinical techniques and aesthetic-driven sequence for an outcome-based protocol that enhances therapeutic cohesiveness in failed crowns, and ensures the sequential transfer of design objectives for the improvement of aesthetics must be understood. An opaque zirconia core overlaid by translucent enamel has a more natural appearance, and provides greater aesthetic results.[9]

In addition, the success of the aesthetic restoration treatment on the anterior teeth related with the satisfaction of patients towards the results obtained is also determined by the communication not only between dentist and patient, but also between dentists with the laboratory technician. Instruction after the insertion process must be informed to the patient. Besides that, patient was informed to avoid eating hard foods and chewing excessive burden then asked to come to control a week later, and to have regular control every 6 months.

It is concluded that aesthetics is very subjective and necessitates excellent communication between the dentist, patient and ceramist. The case has to be carefully selected and treatment planned. Indirect porcelain veneer is an alternative treatment that can conservatively improve the aesthetic appearance by taking the enamel tissue as little as possible and leaving the healthy tooth tissue as much as possible. Yttrium-oxide partially stabilized zirconia bridge merges excellent aesthetic quality with outstanding toughness. The patient was very satisfied with the result and had no complaints during 1.5 years of follow-up.

So, it is suggested that diagnosis is the first important stage in the treatment and it is important to design the future treatment planning. Future treatment plan is determined based on the clinic examination. The success of the aesthetic restoration treatment on the related anterior teeth is also determined by the communication between dentists and patients, and between dentists with the laboratory technician.

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