

Zirconia Based Crowns for Esthetic Dental Rehabilitation: A Challenge to Overcome

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| Received: 10.01.2019 | Accepted: 15.01.2019 | Published: 30.01.2019

DOI: 10.36347/sjmcr.2019.v07i01.015

Abstract

Case Report

This article discusses the management of inaesthetic smile associated with midline diastema and unsatisfactory extensive composite restorations. A 48 year old female patient presented to the Fixed Prosthodontics Department. She was looking for an improvement of her smile and she was worried about the aesthetic appearance caused by affected teeth. The treatment plan included a prosthetic therapy consisting on CAD/CAM Zirconia based crowns restoring the altered properties of anterior teeth, both aesthetic and mechanical. Internal bleaching technique was rejected because of time consuming procedure. Thanks to a well-planned approach the result was esthetically acceptable and the patient was satisfied.

Keywords: Esthetics, Midline diastema, all ceramic systems, Zirconia based crowns, anterior teeth.

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INTRODUCTION

In daily clinical practice, the reestablishment of a good smile is a common presenting complaint of patients [1]. The rehabilitation of anterior teeth affected by caries, discoloration, midline diastemas, anatomic alteration or hypoplastic defects, would alter the entire appearance of the patient by providing them with a beautiful smile [2].

The patient gains not only a new improved appearance, but also a potential moral "boost" that acts positively on their mental health and self-esteem [2]. Thanks to the improvements in the techniques, restorative materials, and luting cements, the practitioner is able to achieve outstanding esthetic and functional results [3].

In the age of digital dentistry, the evaluation and decision-making process of the treatment planning of each clinical situation should be based on many predetermining factors. And, the best approach should have been widely discussed [2].

According to the 'Therapeutic gradient' of Gill Tirllet and Jean Pierre Attal, many therapeutic modalities are proposed from the less invasive to the most mutilating, from microabrasion, dental bleaching,

composite veneers or porcelain ones to full coverage crowns[4].

The aim of this paper was to present a challenging clinical case which discusses the management of inaesthetic smile associated with midline diastema and unsatisfactory extensive composite restorations and describes the clinical protocol using all ceramic crowns for smile enhancement to restore the dental harmony of anterior teeth.

CASE REPORT

A 48-year female patient presented at the fixed prostheses department for restoring her maxillary teeth. She was not satisfied with the color, the shape of her teeth and the midline diastema and her chief complaint was to improve the esthetic appearance of her smile.

During the clinical examination, the facial aspects, the smile harmony, the gingival contour, oral hygiene and the dental characteristics were evaluated. Intra oral examination revealed the presence of midline diastema between maxillary central incisors (~2 mm) and cervical decay with significant substance loss. In the other hand, the central incisors, the right lateral incisors and canines have been filled with a composite resin dating for three years. However, the

right first premolar [14] had been filled with amalgam for five years. After this preliminary oral analysis, the incisal edge, occlusal plane and parafunctional habits were checked. A deep bite had been founded (Figure 1).

According to the treatment planning and digital smile design (a virtual planning that utilizes information gathered through diagnostic procedures to create an esthetic treatment scheme) crown lengthening should be necessary to find an adequate dental proportion.

The dental substance loss was important and the occlusal context presented was unfavorable. Therefore, veneers cannot be indicated. Ceramic full

crowns were indicated for maxillary incisors, canines, first premolars and second premolar.

The esthetic treatment plan alternatives were discussed with the patient, including caries treatment and crown lengthening, followed by ceramic full crowns. However, the patient had refused to realize surgical crown lengthening.

In the other hand, to be able to cover the entire discolored abutment, the preparation should be extended in the sulcus. That's why, zirconia was probably, the best used in such a clinical situation without compromising the value of the definitive result.



Fig-1: Intra oral views of initial situation (a,b)and Aesthetic planning(c)

After tooth scaling, radicular surfacing and treatment of decay, teeth preparation was done with appropriate instrumentation.

Then, the abutment tooth of the second left premolar was refined after placement of glass fiber post and composite core built up. Moreover, the first right premolar was reconstituted with a metallic post and core (Figure 2).



Fig-2: Prepared and restored abutments

Temporary prosthesis were elaborated by isomoulage technique using a silicon index and autopolymerized resin (Texton: SS White, Ce 0473,

Prima Dental Group, England) and cemented with temporary non eugenol cement (Temp Bond: Type I Class 1Ce 0086, Kerr, Italy).

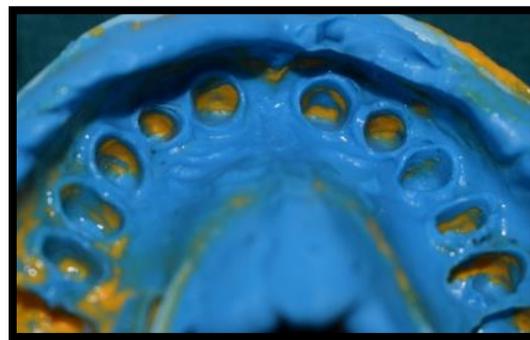


Fig-3: Arch impression after multidisciplinary treatment

A complete arch impression was made with a silicone impression material (HydroC, Detax, Germany) (a combination of heavy - and light silicon) (Figure 3). Then, it was transferred to the laboratory to be casted. The shade was determined with a shade guide (Vitapan 3D Master).

In the laboratory, Zirconia frameworks were manufactured using indirect CAD/CAM technology. Then, they were tried and the space left to the feldspathic ceramic was verified (Figure 4).

DISCUSSION

Due to advancement in dental materials and the increased demand for esthetic and metal-free restorations, the use of all-ceramic restorations has become pervasive [5]. Recently, ceramic materials restorative systems can be classified as: glass- matrix ceramics, polycrystalline ceramics and resin-matrix ceramics [6].

Those systems have expanded significantly the range of restorative treatment options; their clinical applications had included veneers, partial and full coverage crowns [6]. Their successful application depends on the practitioner's ability to select the appropriate material and to respect the cementation

protocol that satisfies the patient's needs and expectations [7]. The selection of a particular ceramic system should be based on physical properties (fracture resistance, wear resistance and long-term outcomes ...) as well as esthetic considerations. Hence, the dentist must understand these materials and systems to be able to indicate the appropriate treatment options.

For the fabrication of esthetic all-ceramic restorations, Zirconia ceramics are a successful alternative for many cases. They are popular and widely used due to their biocompatibility and their important mechanical properties of high strength and adequate fracture toughness. These restorations are fabricated using CAD/CAM technology (similar to the milling process outlined for lithium disilicate). They can be fabricated as monolithic restorations, as well as a layered, or bilaminate crown [8].

In the case of the bilaminate crown, the high-strength zirconia framework is veneered with hand-stacked ceramic layering system designed for zirconia or milled Nano fluorapatite glass ceramic. An exceptional esthetics and an imperceptible integration to the surrounding dentition can be achieved within the veneering ceramics [7,8].



Fig-4(a,b,c): Zirconia frameworks

Finally, esthetic and occlusion relationship were checked and the crowns were cemented after ceramic glazing (Figures 5,6).

In the other hand, Zirconia-based tooth-supported crowns can be advantageous with their high

opacity in case of severe discoloration or of abutments restored by metal post and core as in our case. Also they are suitable alternative to cover remainder implant components.

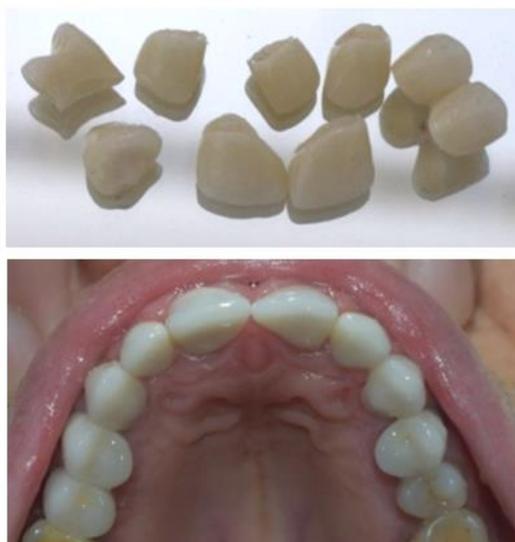


Fig-5: Final restorations



Fig-6(a-b-c): Final result

One of the others advantages of zirconia CAD-CAM crowns is the option for clinician to use conventional luting agents without compromising the strength or the shade of the restoration and to be able to realize intra-sulcular margins[8].

The interaction of zirconia with oral soft tissues may be important to the performance of tooth and implant-supported restorations. The clinical impressions of low biofilm formation and limited inflammation of zirconia restorations are supported by in vitro and in vivo studies [9]. Rimondini *et al.* confirmed these results with an in vivo study where ceramic material made of tetragonal zirconia polycrystals stabilized with yttrium (Y-TZP) accumulated fewer bacteria than commercially pure grade 2 titanium (Ti) in terms of total numbers of bacteria and presence of potential pathogens, such as rods[10]. Bremer *et al.* showed that biofilm was lowest and thinnest on zirconia compared to lithium disilicate restorations [11].

Many factors can affect the final result, such as occlusal relationship and/or the presence of parafunctions like bruxism and clenching that may engender significant overloading. In addition, effect of surface treatment on the performance of all-ceramic restorations is highly important. The systematic review of Larsson *et al.* in 2014 suggested that the five-year survival rate for all of tooth- and implant-supported zirconia-based crowns was 94.29%, and 76.41% of them were considered free of complications.

Yet, chipping was being the most frequent technical complication [12]. According to a recent review [13] in a total of 31 clinical studies evaluating veneered Y-TZP crowns, 15 of them reported chipping of the veneering ceramic with a rate of more than 10 % between 2 and 8 years.

Veneering ceramic layer that is responsible for the final optical outcome and anatomy of the restoration continues to exhibit chipping rate. The high incidence of the fracture of the veneering ceramics or chipping may be due to the thermal compatibility and the flexural strength of the veneering ceramics and the zirconia frameworks. It appeared that roughness of the veneering ceramic due to occlusal function or grinding was associated with the chipping. Hence meticulous polishing of the rough surfaces is crucial [14].

Chipping is considered one type of failure of veneering ceramic on Y-TZP Fixed Dental Prosthesis and it has continued to be a clinical problem degrading the longevity of such reconstructions in prosthetic dentistry.

CONCLUSION

Excellent physical properties, biocompatibility, and superior aesthetics make Y-TZP a popular material among the contemporary all-ceramic material. By eliminating the conventional lab procedures and utilizing the simplified high technology CAD-CAM technique it can definitely satisfy critical aesthetic needs of the patients.

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