A Case Report

Crafting Lifelike Smiles: Achieving Esthetic Excellence With Layered Zirconia Prostheses In Modern Dentistry

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Abstract

Dealing with the intricate challenges involved in restoring anterior teeth to attain a natural appearance requires a thoughtful consideration of various factors such as inappropriate size, shape, gingival contour, and aesthetically displeasing shades. The growing desire for solutions that combine aesthetic appeal with the absence of metallic elements has driven the widespread adoption of dental zirconia, acknowledged for its outstanding aesthetic qualities and advantageous mechanical properties. This case report delves into clinical encounters related to custom-designed layered zirconia fixed dental prostheses specifically crafted for the restoration of anterior teeth. The report emphasizes the importance of prosthetic restoration for both endodontically treated and vital abutments, investigating the influence of zirconia composition, layering technique and the distinctive challenges associated with each condition. The specific characteristics of the abutments intricately influence the choices made regarding zirconia composition, framework design, and shade in layered zirconia prostheses. This interdependence underscores the significance of adopting a considerate and personalized approach to meet the distinctive requirements of each clinical scenario.

Key words –Aesthetics,CAD-CAM, CEREC,E-max, Layered dental zirconia.

Introduction

The pursuit of esthetic excellence stands as a core tenet in the realm of restorative dentistry, wherein dental ceramics have endured as a preferred choice for their exceptional properties and a semblance akin to that of natural teeth. Zirconia, in particular, has garnered widespread acclaim as a material of aesthetic allure within the dental domain.[1] Traditional fixed dental prostheses often employ a zirconia substructure coupled with veneering porcelain. Nonetheless, challenges such as breakage, fracture, delamination, and chipping have prompted a discernible shift towards the adoption of monolithic zirconia crowns. Renowned for their complete contour design, monolithic zirconia crowns have witnessed a surge in popularity due to their manifold advantages. This predilection for monolithic zirconia crowns assumes notable significance, especially in the context of maxillary anterior teeth, where the attainment of optimal aesthetics and functionality is of paramount importance.[2,3]

Presented herein is a detailed case study, showcasing the efficacious treatment of an educator through the application of zirconia all-ceramic crowns. The resultant outcome not only attains exacting aesthetic standards but also ensures complete functional proficiency, thereby yielding a favorable psychological and mental impact on the patient. It remains imperative for the dentist engaged in

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the crafting of ceramic crowns to exhibit sensitivity to the esthetic predilections of the patient, recognizing that technical precision alone may fall short of fulfilling the nuanced symmetry and aesthetic aspirations of the individual. Achieving triumphant results necessitates a comprehensive comprehension of the patient's expectations, coupled with meticulous attention to anatomical considerations.[2,5]

The utilization of CAD/CAM (computer-aided design CAD and computer-aided manufacturing CAM) zirconia material in the treatment is expounded upon in the case study, with particular focus on a patient grappling with discolored maxillary anterior teeth. The discourse underscores the increasing prominence of zirconia in contemporary dental procedures.[6,7]

Case

A 27-year-old female patient presented herself at the department of prosthodontics and crown & bridge, expressing concerns regarding the absence and discoloration of teeth in the maxillary anterior region, which could be traced back to a history of trauma. A thorough intraoral examination revealed that Tooth 21 had undergone endodontic treatment, with X-ray diagnostics indicating satisfactory treatment extending to the apex without any apical issues, albeit with notable discoloration. Additionally, Tooth 22 was absent.

Various treatment options were meticulously deliberated, encompassing implant prosthodontic rehabilitation, the crafting of a full coverage fixed prosthesis using porcelain-fused-to-metal, or an all-ceramic full coverage prosthesis. The patient, desiring a prompt completion of treatment and expressing a strong inclination towards the most aesthetically pleasing material, leaned towards the creation of an all-ceramic zirconia fixed partial denture, meticulously fashioned with CAD/CAM technology. This preference aligns seamlessly with the patient's expectations and underscores both efficiency and aesthetic excellence within the proposed dental restoration plan.

The shade selection was performed using a conventional shade guide (Vitapan classic, Vita Zahnfabrik, Bad Säckingen, Germany) (Fig. 2). Tooth preparation was done with 21and 23 for all ceramic.The maxillary, mandibular arch and buccal bite registration were scanned using CEREC Omnicam(Fig.3) and the digital impression of prepared abutment teeth in the maxillary arch and mandibular arch were obtained (Fig.4).

After the conclusive data acquisition, the prepared structure underwent meticulous analysis using construction software (CEREC SW 5.2.2, DentsplySirona, Charlotte, USA). The assessment of occlusal reduction yielded satisfactory outcomes, devoid of any detected undercuts. The automatically determined preparation limit seamlessly transferred without necessitating modifications. Recent updates have markedly improved the restoration proposals automatically generated by the software, delivering reliable restorations with minimal adjustments.The optical impression, conveyed to the computer, was employed to delineate the restoration boundaries, and the volume and shape of the intended restoration were defined. Following the selection of the shade, a CEREC MTL Zirconia medi block (Fig. 5) was opted for in the C2 shade.

CEREC MTL Zirconia, infused with yttrium oxide, stands as the epitome among zirconium oxide materials, leaving scant room for unfulfilled expectations. Forged and introduced by VITA Zahnfabrik, a standout feature of this material lies in its distinctive color technology, marked by a multilayer color gradient. The MTL (multi-transitional layer) technology, harmonizing with remarkable translucency, plays a pivotal role in achieving profoundly natural aesthetics without compromising strength. This defining attribute positions CEREC MTL Zirconia as a genuine innovation, rendering it an exemplary choice for a myriad of dental applications, spanning bridges, crowns, inlays, onlays, and veneers.The visible augmentation in color transition enhances the overall esthetic allure, while the 3-point flexural strength surpassing 850 MPa ensures an exceptional level of resilience. This high strength enables minimally invasive crown preparation, allowing for a reduction in wall thickness to as low as 0.6 mm. Such strength combined with minimal wall thickness contributes to the creation of posterior restorations with an ideal anatomical design, affording clinicians heightened flexibility in the CEREC workflow.

The framework was meticulously crafted through a dry-milling process (MC-XL, DentsplySirona, Charlotte, USA), utilizing a multilayer translucent zirconia block (CEREC MTL Zirconia medi, DentsplySirona, Charlotte, USA). Throughout the fabrication process, the "fine" milling mode was chosen, maintaining the occlusal and radial spacer settings at 120 µm, adhering to the established standard configurations (Fig. 6).

Subsequent to this, the crafted framework was detached from the retention pin, and the connecting area underwent refinement. Following these steps, the framework underwent a speed sintering process (CERECSpeedfire, DentsplySirona, Charlotte, USA) (Fig. 7).

Following this, the framework was adorned with E-max in C2 shade, and the anatomical and esthetic characteristics of the anterior restoration were meticulously defined. Subsequently, the prosthesis underwent staining using DS Body Stain S1, DS Incisal Stain I1, and DS Overglaze High Flu from DentsplySirona in Charlotte, USA (Fig. 8).

The restorations were delicately positioned on a firing tray with a firing pad (DeguDent, Hanau-Wolfgang, Germany) and subjected to firing at 760°C (Fig. 7). A thorough examination was conducted on the prosthesis to assess both marginal and interproximal fit. The restoration underwent preparation for the final cementation process, accomplished through air-abrading with fine-grained alumina (50 µm) at a pressure range of 0.1-0.2 MPa. The prosthesis was then cemented using adhesive resin cement (Calibra Ceram, Dentsply Sirona, Charlotte, USA). Excess cement was meticulously removed, followed by tack-curing. Both static and dynamic occlusion were thoroughly evaluated (Fig. 10).

Fig. 1 Intraoral preoperative view

Fig. 2 Vitapan Classic Shade Guide

Fig. 3 CEREC Omnicam

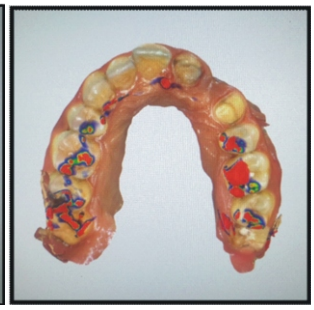

Fig. 4 Digital impressions of maxillary and mandibular arches

Fig. 5 MTL Zirconia Block

Fig. 6 CEREC MC XL Milling Unit

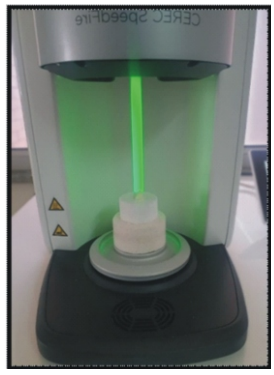

Fig. 7 CEREC SpeedFire

Fig. 8 Stains and Glaze

Fig. 9 Final Restoration

Fig. 10 Final Cementation

Discussion

This case report outlines the chairside creation of a monolithic zirconia fixed partial denture enhanced with E-Max layering. Typically, such restorations can be produced in a single appointment. Nevertheless, it is essential to note that this procedure is contingent upon specific technical prerequisites, including superfast milling, a speed-sintering process, and the utilization of multilayer zirconia material.[8]

The employment of a swift-sintering process stands as a pivotal technical prerequisite. In this current case narrative, a distinct sintering furnace designed for the CEREC system (CERECSpeedfire, DentsplySirona, Charlotte, USA) found application. It's imperative to note that zirconia materials can solely undergo swift-sintering when in a desiccated state.ne must take into account that speed-sintering represents a comparatively recent processing method. Numerous in vitro investigations have substantiated that for appropriate zirconia materials, this economical and time-efficient process exerts no adverse effects on mechanical and optical attributes. These include factors such as hardness, fracture toughness, Weibull characteristics, hydrothermal aging behavior, and translucencies.[9,10]

E-max crowns stand apart with several noteworthy advantages compared to their counterparts, particularly porcelain fused to metal crowns. Revered as the epitome of natural tooth resemblance, E-max crowns showcase a transparent hue and an authentic appearance, effortlessly harmonizing with one's native dentition. Significantly, the absence of a metal alloy base eliminates the occurrence of an unsightly grey line near the gum line, contributing to a more aesthetically pleasing outcome. Beyond their cosmetic virtues, E-max crowns earn recognition for their robustness and longevity, surpassing the performance of various crown types. Their durability renders them less susceptible to cracks or fractures, ensuring a enduring solution for individuals seeking both functional and visually appealing dental restorations.[11]

The innate automation within CAD/CAM (Computer-Aided Design/Computer-Aided Manufacturing) technology works to minimize inaccuracies, ensuring precision in the crafting of dental restorations. Furthermore, these systems play a crucial role in reducing the risks associated with infectious cross-contamination, thus elevating the safety standards in dental procedures. Remarkably, machinable zirconia ceramics emerge as exceptionally well-suited materials for the application of CAD/CAM techniques. These ceramics can be adeptly designed and milled while in their pliable pre-sintered state, allowing for intricate shaping and customization. The subsequent sintering process further enhances the physical properties of the milled restorations, establishing machinable zirconia ceramics as a versatile and dependable choice in the field of dental prosthetics.[12]

Conclusion

This case report delves into a detailed analysis of the restoration process for anterior teeth that are both missing and affected by discoloration. Prioritizing the patient's aesthetic concerns, the selected treatment approach involved an all-ceramic restoration, specifically opting for a layered zirconia restoration. Zirconia restorative prostheses, crafted using advanced CAD/CAM technology, showcase exceptional biocompatibility. This not only minimizes wear on neighboring teeth but also ensures enduring aesthetics with reliable color stability. These inherent qualities play a vital role in assisting patients to regain a fulfilling social life and boost their confidence and self-esteem. In the field of prosthodontics, zirconia-based restorations hold tremendous promise due to their outstanding mechanical, chemical, and clinical performance.

References

1. Ahmed WM, Shariati B, Gazzaz AZ, Sayed ME, Carvalho RM. Fit of tooth-supported zirconia single crowns-A systematic review of the literature. ClinExp Dent Res. 2020 Dec;6(6):700-716.
2. Ahmed SA, Dallak AE, Mohammed AK, Ahmed MS, Mohammed MM: Maxillary lateral incisor with two separated canals diagnosed with cbct technology: a six-month follow-up case report and minireview. SMJS. 2021, 2:1-10.
3. Al Moaleem MM, Alkhayrat FM, Madkhali HA, Geathy IH, Qahhar MA, Yaqoub A, Mattoo KA. Subjective differences between dentists and patients about the relative quality of metal ceramic restorations placed in the esthetic zone. J Contemp Dent Pract. 2017;18:112-6.
4. Moaleem MM, AlSanosy R, Ahmari NM, Shariff M, Alshadidi AA, Alhazmi HA, Khalid A. Effects of khat on surface roughness and color of feldspathic and zirconia porcelain materials under simulated oral cavity conditions. Medicina (Kaunas). 2020;56:234.
5. Moaleem AI, Madkhali MM, Judayba MH, Mobaraky AA, Mobarki AH. Aesthetic management of a patient with different levels of fluorosis: clinical and technical report. Saudi J Oral Dent. 2016;1:2-6.
6. Alessi S, Pitarresi G, Spadaro G. Effect of hydrothermal ageing on the thermal and delamination fracture behaviour of CFRP composites. Compos B Eng. 2014;67:145-153.
7. Alghazzawi TF, Lemons J, Liu PR, Essig ME, Bartolucci AA, Janowski GM. Influence of low-temperature environmental exposure on the mechanical properties and structural stability of dental zirconia. J Prosthodont. 2012;21:363-9.
8. Kontonasaki E, Rigos AE, Ilia C, Istantsos T. Monolithic Zirconia: An Update to Current Knowledge. Optical Properties, Wear, and Clinical Performance. Dent J (Basel). 2019 Sep 2;7(3):90.
9. Jansen JU, Lümkemann N, Letz I, Pfefferle R, Sener B, Stawarczyk B. Impact of high-speed sintering on translucency, phase content, grain sizes, and flexural strength of 3YTZP and 4Y-TZP zirconia materials. J Prosthet Dent. 2019;122(4):396–403.
10. Mayinger F, Pfefferle R, Reichert A, Stawarczyk B. Impact of high-speed sintering of three-unit 3Y-TZP and 4Y-TZP fixed dental prostheses on fracture load with and without artificial aging. Int J Prosthodont. 2021;34(1):47–53.
11. Oswal S, Nene P, Madanshetty P, Dugal R. Esthetic rehabilitation of anterior discolored teeth with lithium disilicate all-ceramic restorations. Univers. Res. J. Dent. 2016;6(2):190-1.
12. Vinothkumar TS, Kandaswamy D, Chanana P. CAD/CAM fabricated single-unit all-ceramic post–core–crown restoration. J. Conserv. Dent. 2011;14(1):86–9.