IMPLANT-SUPPORTED CAD/CAM FULL-ARCH ZIRCONIA BRIDGES FOR MAXILLARY EDENTULOUS ARCHES: A CASE SERIES AT TWO YEARS OF FUNCTION

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ABSTRACT

Implant therapy is considered highly predictable and successful for the oral rehabilitations of fully and partially edentulous patients. Today, advances in dental materials technology have led to the introduction of zirconium-oxide frameworks fabricated with Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) system. Zirconium-oxide framework is more biocompatible when compared to conventional metal alloys. Zirconium oxide frameworks also provide a high standard of aesthetics, reduce the number of metals used in the oral cavity and have lower density compared to metals which reduces the weight of large frameworks.

This article describes rehabilitation of four maxillary edentulous patients with implant-supported full-arch fixed prostheses using all-ceramic frameworks fabricated from zirconium-oxide. Patients were then followed up for 18 to 24 months (mean = 21 months). All restorations were in function and no complete fractures were noted during the follow-ups, accounting an implant and prosthetic cumulative survival rate of 100%. Five of 50 unit zirconia crowns experienced cohesive veneering ceramic material fractures with a clinical prosthetic success rate of 90% at unit base, however, could easily be polished. According to the findings of this clinical study, zirconia-based, implant supported, cross-arch restorations can be considered as a reliable alternative to conventional porcelain-fused-to-metal restorations for rehabilitating the maxillary fully edentulous arches.

Keywords: Dental Implant, Fixed Prosthesis, Maxillary Edentulous Arch, Zirconium-oxide, CAD-CAM

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ÜST ÇENE TAM DIİŞSIZ ARKLARDA İMPLOANT DESTEKLI TÜM ARK CAD-CAM ZİRKONYA KÖPRÜLER: İKİ YILLIK FONSİYONDA VAKA SERİSİ

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ÖZ

Anahtar Kelimeler: Dental Implant, Sabit Protezler, Maksiller Dişsiz, Zirkonyum, CAD-CAM

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INTRODUCTION

When the final remaining teeth in the dental arch are lost, patients are confronted with a challenging state of edentulousim, which is associated with discomfort and psychological stress.1-3 Today, the successful treatment of edentulous arches with oral implants has been confirmed in various investigations. The prosthetic rehabilitations of such edentulous arches can be restored with implant-retained, implant-supported, or fixed implant-supported prostheses.3-5 Although, studies have shown that the survival rate of implants supported with fixed dental prostheses are greater and the chewing capacity with fixed reconstructions are better than the removable ones, the overall patient satisfaction was comparable because of the metallic frameworks.1,3 The frameworks of fixed full prostheses, which are usually made of gold, cobalt-chromium, or titanium alloys, are heavy, often have large dimensions, and therefore frequently miscast.1 Also, the technical complications associated with implant-supported fixed dental prostheses has been reported as chipping or fracture of the veneering material, abutment or suprastructure screw loosening or fracture, and fracture of the framework.4 And poorly-fitting frameworks were consistently cited as reasons for these complications.5 To overcome these problems, computer-aided-design and computer-aided-manufacturing (CAD/CAM) technology was developed. Today, it became possible to fabricate large and complex frameworks by milling zirconium-oxide blanks.1,3 Zirconium-oxide framework is more biocompatible when compared to conventional metal or gold alloys reducing bacterial and plaque adhesion, preventing soft tissue inflammation and preserving long term stability of the marginal bone around implants.1,6-11 Zirconium oxide frameworks also provide a high standard of esthetics, reduce the number of metals used in the oral cavity and have lower density compared to metals which reduces the weight of large frameworks.1-5 However, there is a lack of data evaluating the clinical success of large span implant-supported zirconia ceramics for edentulous arches. This article describes the rehabilitation of four maxillary edentulous arches with implant-supported fixed prostheses using one-piece allceramic frameworks fabricated from zirconium-oxide. Patients were then followed up clinically and radiologically.

CASE REPORTS

Four patients (3 men and 1 women) with a mean age of 63.8 (range between 44 to 74) presented to a private practice seeking prostodontic rehabilitation for their edentulous arches. The patients’ main demand was to restore their maxillary edentulous arches with fixed prosthesis for function and cosmetic appearance. After the clinical and radiological examinations, and discussing the findings with the patients, the patients selected fixed implant-supported zirconia restorations for the treatments of their maxillary arches. Two patients were smokers (more than 10 cigarettes per day) and one of them also presented a history of hypertension and controlled diabetes, all others were medically healthy. All the patients had at least maxillary edentulous arches to be restored. The opposite arches were or were to be restored with implant-supported or tooth-supported zirconia, or porcelain-fused-to-metal (PFM) restorations or natural dentition.

Procedure

One clinician performed the surgical and prostodontic treatments. A written informed consent was obtained from each patient before starting the treatments. Six implants (Straumann, RN, SP; Basel, CH) for a total of 24 implants were placed into 4 maxillary edentulous arches with good primary stability to support cross-arch zirconia restorations. The panoramic radiographs showed the correct position of the implants and implant integration. The provisional acrylic dentures relined with soft material (Voco, Cuxhaven, Postfach 767, Germany) were inserted immediately after the implant operation. The patients were given a soft diet for 3 weeks. The healings were uneventual and lasted for 4-8 weeks. After the osseointegration was established, the abutments were tightened with a torque of 35 Ncm. Impression copings were placed and polyether impressions (Impregum, 3M ESPE, Seefeld, Germany) were made with customized acrylic resin trays (LeadDent, Germany). Jaw registrations were performed and a face-bow registration was obtained (Artex, Amann Girrbach, Germany) where necessary. The final casts (Sheraalpin, Shera Werkstoff-Technologie GmbH Co., Lemförder, Germany) were then articulated on a semi-adjustable articulator. All-ceramic frameworks of the implants were fabricated using CAD/CAM technology. The cast models were scanned with a 3-dimensional-imagescanner (Dental Wings, Montreal, Canada) and the frameworks were milled from zirconium-oxide blanks (Copran, White Peaks Dental GmbH Co., Essen, Germany). Four one-piece zirconia frameworks were fabricated to support the maxillary full arch implants. Each
zirconia cross-arch restoration consisted of 12 – 14 dental units, resulting in a total of 50 single zirconium oxide full-contour crowns. 3 of 4 restorations presented 1 or 2 unit distal cantilevers on each side (totally 7 unit cantilevers). The contours and the passivity of the frameworks were controlled intraorally and considered satisfactory. The frameworks were then veneered with feldspathic ceramic (Vita VM9, Vita Zahnfabrik, Bad Sackingen, Germany). Finally, the zirconium-oxide suprastructures were cemented to the implant abutments intraorally using self adhesive resin cement (Rely X, 3M ESPE, Seefeld, Germany). (Figures 1 and 2) The patients were instructed on the maintenance of interproximal gingival health with the aid of dental floss (Super Floss, Oral B, Frankfurt am Main, Germany).

**DISCUSSION**

All the patients were clinically and radiologically followed up for 18 to 24 months (mean= 21 months). No implants were lost, and all the prostheses were in function at the time of controls. (Figure 3) No pathologic conditions in the marginal area of the implants were seen on radiographic follow-ups and no complete fractures occurred within the zirconia restorations, accounting for a cumulative implant and prosthetic survival rate of 100%. All the restorations were structurally intact, and only chip-off fractures of the veneering ceramic occurred in two patients. Five of 50 units experienced chipping of the veneering ceramic with a cumulative prosthetic success rate of 90% at unit base. No replacements of the prostheses were necessary. The chip-off fractures were evaluated as “cohesive” as exposure of the core material was not seen. The cohesive fractures were found at the I. and II. Premolars and I molar of the right maxillary arch in one patient and at the I. molars on both sides in the second patient; however, this did not affect the function and could easily be polished intraorally (Figure 4). Fracture of veneering ceramic or "chip-off" is a frequent problem with implant- or tooth supported zirconia restorations, and sometimes cannot be solved with simple chairside polishing procedures.6,9-15 In our two cases, veneer chippings were small even the patients did not notice. The veneering ceramic is weaker (flexural strength 92.7 MPa) than the zirconium oxide (1120 MPa) and is more prone to failure under complex tensile forces.6 In both cases, the veneering ceramic fractures were on the stress bearing posterior areas. However, no zirconia core exposures were observed. Within the limitations of this clinical report, full arch implant-
supported cemented zirconium-oxide rehabilitations with CAD-CAM technology may improve esthetic and function in the reconstructions of maxillary edentulous patients and can be a strong alternative to porcelain-fused-to-metal restorations because the survival rates of the implants and the prostheses were 100% in this report. More patients with longer follow-ups are needed to verify the results of this clinical report.

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Laboratory Procedures
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REFERENCES


