Double Full-Arch Implant-Supported Fixed Complete Dental Prostheses (IFCDPs): advanced monolithic zirconia solutions

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Abstract

Among the latest generation of prosthetic materials, zirconia represents one of the most versatile ceramic materials offering options for rehabilitation of both anterior and posterior sectors. In the last two decades, zirconia frameworks have become increasingly popular in the implant prosthesis and the introduction of CAD/CAM technology has made it possible to approach full-arch restorations in a different way and with promising success rates. In this case report we present Double Full-Arch Implant-Supported Fixed Complete Dental Prostheses (IFCDPs) using digital technology to fabricate advanced monolithic zirconia solutions. We report a brief examination of the advantages of the two solutions in comparison.

Key words: Zirconia, monolithic zirconia, metal bar, Implant-supported fixed complete dental prostheses.

Introduction

The recent evolution of ceramic materials in prosthetic dentistry is aimed at increasing the mechanical and aesthetic properties and simplifying the manufacturing and decision-making processes for clinicians and technicians. Until a few years ago it was universally recognized in the literature that the most mechanically resistant ceramics offered less advanced aesthetic characteristics, most of the time resulting more opaque, therefore less translucent and attractive[1]. In the panorama of the latest generation of prosthetic materials, zirconia represents one of the most versatile ceramic materials offering options for rehabilitation of both anterior and posterior sectors. The 3mol% Y-TZP and the recent 4/5mol% Y-TZP are heterogeneous materials in composition, structure, mechanical and optical properties and offer dentists and laboratories solutions that can be layered or monolithic with a different compromise between strength and aesthetics[1-6]. In particular, the introduction of monolithic zirconia for its characteristics of reliability and practicality has led to a downsizing in prosthetic design with indisputable advantages for clinicians and technicians[7-9]. In the last two decades, zirconia frameworks have become increasingly popular in the implant prosthesis and the introduction of CAD/CAM technology has made it possible to approach full-arch restorations in a different way and with promising success rates[10-13].
The aim of this clinical report is to describe the prosthodontic management of a female patient with Double Full-Arch Implant-Supported Fixed Complete Dental Prostheses (IFCDPs) using digital technology to fabricate advanced monolithic zirconia solutions: monolithic screw-retained zirconia design in the upper jaw compared to the innovative design which features monolithic zirconia supported by a metal bar made of cobalt chromium (Co-Cr) in inferior arch. We report a brief examination of the advantages of the two solutions in comparison.

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How to Cite
A. Berzaghi, S Bortolini.
Double Full-Arch Implant-Supported Fixed Complete Dental Prostheses (IFCDPs): advanced monolithic zirconia solutions
Annali Di Stomatologia, 15(1), 17-20.
https://doi.org/10.59987/ads/2024.1.17-20

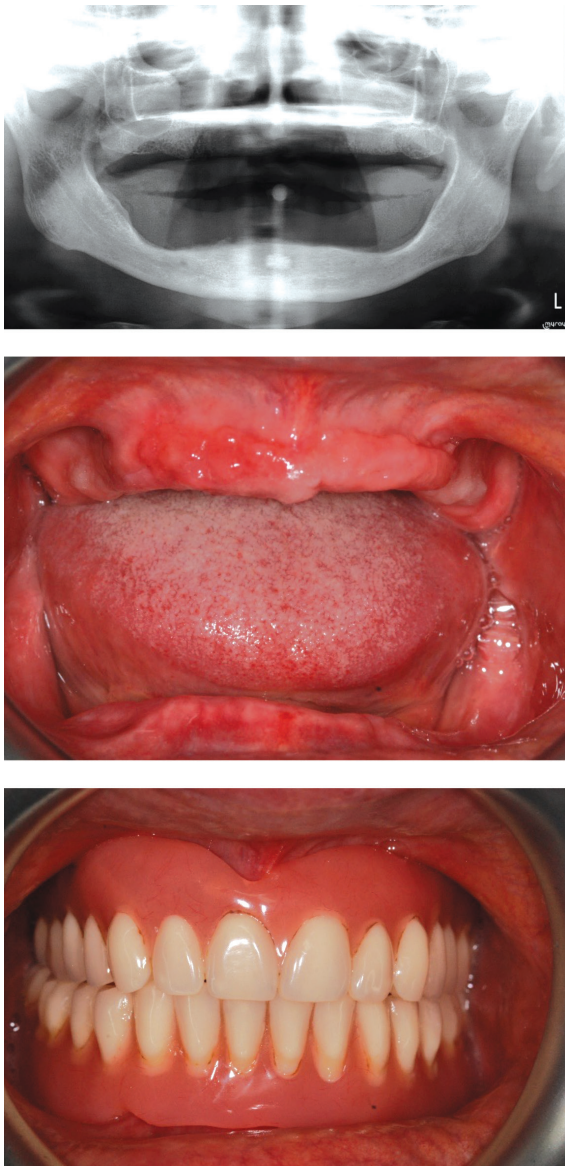

Figure 1-3. Panoramic radiograph and photos of the initial case. Patient comes to our observation with incongruous complete dentures.

Case Report

An 80-year-old female patient, an edentulous patient with Complete Dental Prostheses, comes to our observation requesting a fixed Double Full-Arch prosthodontic solution. Patient's existing complete dentures made by his general dentist was deemed unsatisfactory to the patient and the clinician (Figg.1-3). Patient's medical history revealed that she had a history of multiple implant failures. Patient also had a history of smoking for several decades and was aware of his bruxism. Based on patient's history, clinical and radiographic findings, the patient was diagnosed with a Class C Classification System ABC[14]**.** 8 implants were planned for being restored with a maxillary screw-retained monolithic zirconia IFCDP. 6 mandibular implants were planned on being restored with Metal-Zirconia Implant Fixed Hybrid Full-Arch Prosthesis: restoration that provides monolithic zirconia supported by cobalt chromium bar. After the surgical implant placement (implants Even Mech & Human), both arches were loaded immediately using standardized prosthodontic techniques to produce an interim resin prosthesis. The definitive prosthodontic treatment was initiated after 10 weeks of loading the maxillary and mandibular implants. Appropriate abutments were placed on the implants to obtain parallelism and path of draw. Final impression of the implants were made using polyether impression material after rigidly splinting all impression copings. Using standard prosthodontic protocols, maxillomandibular relationships and trial denture procedures were accomplished to fabricate prototype prosthesis (interim acrylic resin prosthesis) using CAD/CAM technology. In maxilla a screw-retained interim acrylic resin prosthesis while in the mandible an interim acrylic resin prosthesis supported by a Co-Cr metal bar were made. Minor adjustments were made to prosthetic contours, occlusion and esthetics. The bar was milled from a solid block of Co-Cr**.** The bar was planned on incorporating a zirconia overlay prosthesis (Fig. 4) only up to the last tooth on either side. After confirmation of the aesthetic and functional result, patient's written approval was obtained in order to use this for copy milling the definitive zirconia prosthesis (Zirconia Ceramotion Z Hybrid 1300/1020 Mpa, Dentaurum s.p.a). The overlay mandibular prosthesis and the maxillary monolithic screw-retained zirconia was milled from a solid blank of pre-sintered zirconia, which was then infiltrated with stains and veneered with feldspathic porcelain at aesthetic and gingival region (Figg. 5-7). Passive fit of both prostheses was confirmed. A post-treatment panoramic radiograph was taken to confirm seating of the prostheses (Fig.8).

Figure 4. Zirconia superstructure coupled to the metal bar. Zirconia Ceramotion Z Hybrid 1300/1020 Mpa (Dentaurum s.p.a) was chosen for the superstructure.

monolithic zirconia: zirconia on a metal bar in lower arch, screw-retained zirconia in upper arch. Gingival and dental aesthetic ceramization with Ceramotion One Touch ceramic pastes (Dentaurum s.p.a). Dental technician Mdt Germano Rossi.

Discussion

The advantages of the monolithic screw-retained prosthesis are many. The screw-retained prosthesis traditionally represents the first choice in full-arch implant-prosthetic rehabilitation for fewer biological complications and easier management of complications[15,16]. Zirconia guarantees advanced mechanical properties with a low complication rate; excellent biocompatibility;

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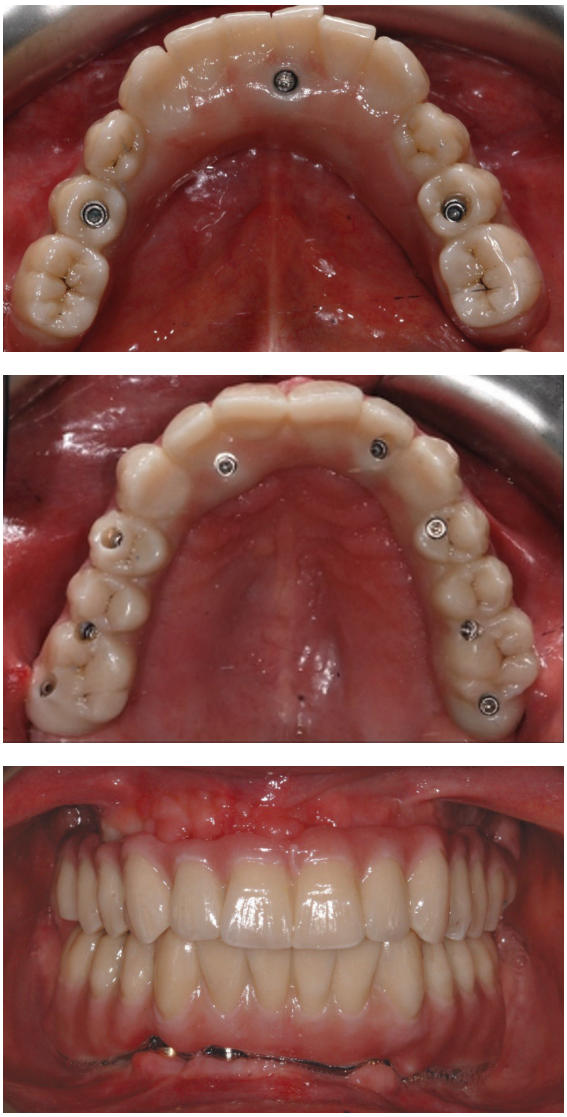

Figure 5-7 Case concluded. Double Full-Arch Implant-Supported Fixed Complete Dental Prostheses in monolithic zirconia: zirconia on a metal bar in lower arch, screw-retained zirconia in upper arch. Gingival and dental aesthetic ceramization with Ceramotion One Touch ceramic pastes (Dentaurum s.p.a). Dental technician Mdt Germano Rossi.

favorable wear characteristics; reduced accumulation of plaque and biofilm; satisfactory gingival and dental aesthetics associated with minimal ceramization of non-functional areas; reduced pigmentation compared to acrylic resin. The CAD-CAM design and production of zirconia has led to further advantages: better precision of the prosthesis thanks to modern manufacturing systems; availability of a permanent digital file with the possibility of duplicating the prosthetic restoration; possibility of making temporary posts in PMMA. However, the monolithic zirconia screw-retained design remains a complex prosthetic solution, in which clinical success is linked to the knowledge of the materials and the high precision required by 3Y-TZP[17,18,19]. The need to guarantee the framework suitable dimensions in areas at risk of fracture, the impossibility of recovery of the structure in the event of failure, the low tolerance to imprecision imprecisions and the opacity of the high-strength material represent the current limits of this prosthesis[17,20]. Metal-Zirconia Implant Fixed Hybrid Full-Arch Prosthesis currently represents the most advanced implant-prosthetic design in the field of implant-supported restorations and represents the evolution of screw-retained monolithic solutions, potentially able to solve some critical issues[21,22]. The metal bar gives stiffness, excellent tensile strength, high fracture strength, passive fit and allows you to manage long spans between adjacent implants and extend cantilevers. It also allows versatile use on different implant platforms, compensates for problems of unfavorable angles and offers the possibility, if necessary, to be segmented. The metal frameworks obtained by laser sintering/melting procedures have improved the “fit”, the “bonding” and the corrosion resistance compared to the bars obtained by casting[23]. The monolithic zirconia in this prosthetic design represents the first choice solution for reasons related to the intrinsic characteristics of the material and to the prosthetic technologies. From an aesthetic point of view, the metal framework gives the possibility to take full advantage of the new generations of translucent zirconia without risk of structural failure. Starting from the CAD design information on the bar, we can create PMMA provisionals that act as prototype prostheses useful in the preliminary evaluation and approval phase[17,20].

Figure 8 End of case panoramic radiograph.

Conclusion

The innovative design of the implant-supported rehabilitation of the lower arch that uses a monolithic structure in zirconia on a metal bar was born to exploit the aesthetic potential of the latest generation zirconia even in the presence of extensive cantilevers. The diffusion of CAD/CAM technology together with the promising characteristics of aesthetics, reliability and versatility of this advanced solution make monolithic zirconia on bar a successful and widespread rehabilitation in the coming years. The use of the latest generation multilayered zirconia for the construction of monolithic structures allows to overcome the limits of the traditional 3Y-TZP. The incorporation of 4Y-TZP in multi-translucent implant-prosthetic structures allows to provide degrees of aesthetics and reliability unthinkable until two years ago for monolithic screw-retained structures. The new generations of 4Y-TZP and multi-translucent monolithic zirconia materials, incorporating 3Y, 4Y and 5Y-TZP with varying translucency levels, appear to be promising in these designs as well. In particular, some types of 4Y-TZP with high mechanical performance[24,25] can represent promising materials in this sense.

Acknowledgments

The authors would like to thank Dentaurum Italia S.p.a. for supporting this article.
We thank for the technical realization Mdt Germano Rossi, Alba Adriatica (Te).

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