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Case Report

Implant-supported Full Mouth Rehabilitation Utilizing Dynamic Abutments for Non-axial Implants

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ABSTRACT

This clinical report describes a full mouth rehabilitation using implant-supported fixed prostheses in a 63-year-old completely edentulous female. The placement of the maxillary implants tended to result in improper angulation, prompting the use of dynamic abutments to correct the unfavorable orientation and ensure proper screw access for the final prosthesis. Definitive prostheses fabricated in monolithic zirconia were selected for durability, biocompatibility, and pleasant optical properties. The full mouth rehabilitation process included creating diagnostic wax arrangements, taking impressions, and occlusal adjustments to define and illustrate functional and esthetic relationships. Definitive prostheses were finally seated with patient approval after positive comments about esthetics and functionality, and a sense of satisfaction with the overall final result. This clinical case displayed the possibility of dynamic abutments for non-axial implants and provided a successful functional, durable, and esthetic prosthesis with both advanced materials and technology. Ongoing follow-up care and regular maintenance for the patient may give the best possibility for establishing the long-term success of implant-supported restorations.

Keywords: Dynamic abutments, full mouth rehabilitation, implant-supported prosthesis, monolithic zirconia, non-axial implants, screw-retained prosthesis

Introduction

Because of the high success rates of implants, implant-supported prostheses have become a very well-accepted treatment option for edentulous patients.[1] This type of prosthesis can be endorsed to totally or partially edentulous patients by worldwide scientific associations.[2] Four basic criteria allow one to distinguish an implanted retained prosthesis: (1) Retention type: Screw retained, cement retained, or a combination where one machined bar is retained by separate cemented crowns; (2) prosthetic material combination (metal-acrylic resin, metal-composite resin, monolithic zirconia or zirconia-ceramic, metal-ceramic, and non-metal polymer materials such as polyetherketone ketone and polyetheretherketone); (3) Framework design: 1-piece, segmented, or combination; and (4) use of prosthetic gingiva: Denture base acrylic resin, gingival composite resin, gingival porcelain, gingival staining, or none.[3] The soft tissue contour decides the esthetic outcome of implant-supported restorations, which include proper placement of the implant and the reality that the presenting architecture of the anterior maxilla does not often allow the angulations of the implant to secure a screw-retained restoration without the added complexity of using other components in an implant-retained prosthesis.[4] Anatomic limitations of the maxilla to consider are pneumatization of the maxillary sinus and proximity of the nasal floor. However, if there is angulation of the implants in the maxilla that is less than ideal, when you also consider the esthetic needs, it immediately complicates treatment and requires technique sensitivity.[5,6] The most prudent consideration, in these circumstances, is what form of retention is best, as retention will directly influence the stability and retrievability of the prosthesis.[2] When planning for a screw-retained prosthesis, the primary consideration for implant angulation is ensuring that the access holes show through the occlusal surfaces of the posterior teeth and the lingual fossa of the anterior teeth. If the access holes are located labially or through the incisal margin of the anterior teeth, one can choose a cement-retained prosthesis design. Nevertheless, the retained design of the cement makes retrieval for maintenance and intervention challenging; residual excess cement

has also been documented to be the main cause of peri-implant disease[7,8] the placement of implants in non-axial positions must always be considered in the planning and design of the definitive prosthesis to meet both esthetic and functional needs.[9] Some prosthetic choices for controlling the implant angulation in the edentulous maxilla are angled abutment, Ti base abutment, angled multi-unit abutment, dynamic abutment, and lateral screw abutment. The angled abutments offer relative simplicity to a manageable solution to ensure the angle of the prosthesis satisfies resorption with minimal changes required to the ideal angulation of the implant. A dynamic abutment is a semisphere on which a burnout chimney is seated and can offer greater angulation with a degree of flexibility, noting it is possible to achieve more than 28°, with a more precise alignment of the abutment and prosthesis. The fixation screw is specially designed to enable off-axis tightening, using a screwdriver with a 1.30 mm hexagonal faceted sphere.[10] Ti base abutments and lateral screw abutments offer additional fixation, as well as stability to the prosthesis when there is significant divergence from ideal angulation. This clinical report will outline the steps taken in a full mouth rehabilitation of a 63-year-old woman with fixed prostheses supported by implants in both the maxillary and mandibular arches by using dynamic abutments to address the non-axial positioning of certain maxillary implants.

Clinical Report

A 63-year-old completely edentulous female presented to the clinic seeking a fixed prosthesis for her condition. The patient provided written informed consent for treatment and publication of this report. Patient's medical history did not indicate any significant findings, and her dental history indicated an extraction of her teeth due to dental caries and dental infections thereafter. The patient had 6 unrestored implants in each arch (3i, Palm Beach Gardens, FL, USA), placed by an oral surgeon who was previously affiliated with the center. There was no direct communication with the surgeon, as he had left the center before I joined. Implant-related information was obtained through the center's records system. The clinical examination indicated that the implants were osseointegrated without any signs of infection, inflammation, and malpositioned implants in most of those placed in the maxilla [Figure 1]. The radiographic examination indicated moderate bone resorption, an impacted tooth #28, and maxillary sinus pneumatization [Figure 2].The decision was made to create a diagnostic teeth arrangement first to assess prosthetic space before choosing the material for definitive prostheses. For diagnostic purposes, open tray impressions were carried out using polyvinyl siloxane (PVS) impression material (Elite HD+, Zhermack, Badia Polesine, Italy) and stock trays, poured with type III dental stone (Kulzer, Hanau, Germany). Open tray impression copings were placed on the study cast and connected again using pattern resin (GC America Inc., USA). After the pattern resin set, a sheet of base plate wax (Kerr Dental, USA) was added, and custom trays were fabricated using light-cured resin (Triad, Dentsply Sirona, USA).

After 24 h, sectioning of the pattern resin was done at the cast and placed in the patient's mouth, and a radiograph was taken for verification of seating [Figure 3]. The sectioned pattern resin was reconnected intraorally, and a final impression was taken using PVS impression material (Elite HD+, Zhermack, Badia

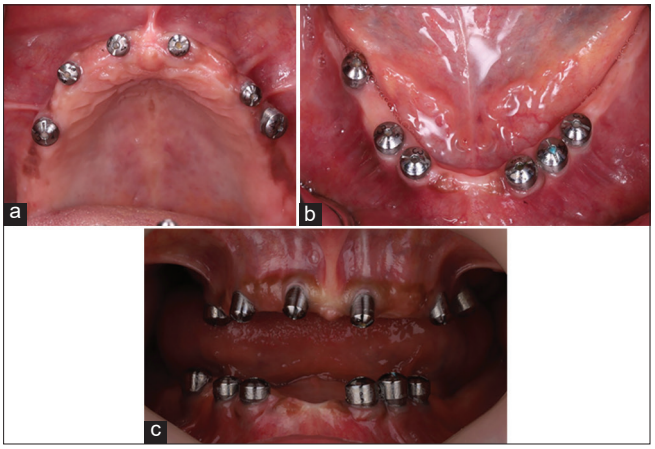

Figure 1: (a) Occlusal view of maxilla showing 6 implants placed and covered by healing abutments. Note malapostioned implants; (b) occlusal view of mandible showing 6 implants placed and covered by healing abutments; (c) Intraoral frontal view

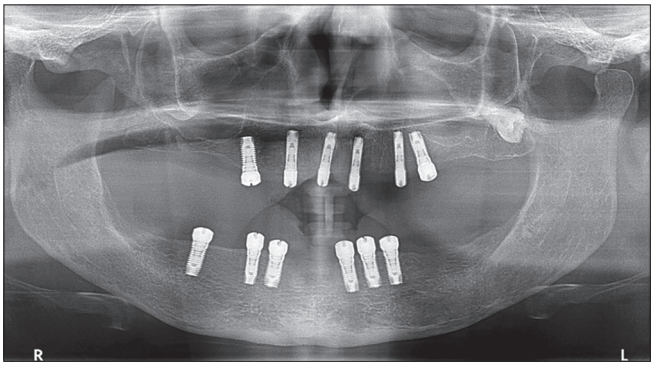

Figure 2: Radiographic presentation of patient before definitive prosthodontic treatment shows 6 implants in each arch with stable bone levels around all implants

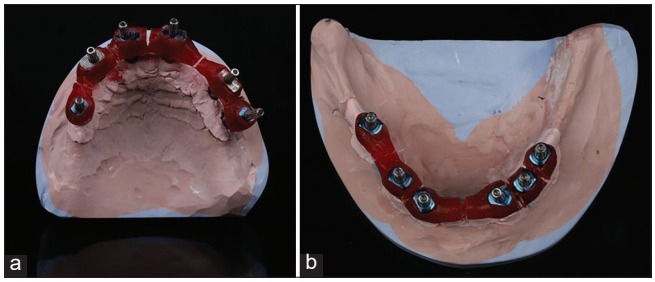

Figure 3: (a) Occlusal view of maxillary cast with impression copings after sectioning the pattern resin; (b) Occlusal view of mandibular cast with impression copings after sectioning the pattern resin

Polesine, Italy) and a custom tray [Figure 4], then poured with type IV dental stone (Kulzer, Hanau, Germany). A verification device for both maxillary and mandibular definitive casts was fabricated using Type IV dental stone (GC Fujirock EP Classic; GC Europe N.V., Leuven, Belgium) [Figure 5] and screw retained bite blocks were constructed using a temporary abutment (Zimmer Biomet Dental, Palm Beach Gardens, FL, USA) [Figure 6]. Posterior PVS (Zhermack, Badia Polesine, Italy) records were used to record centric relation and the casts were mounted on a semi-adjustable articulator (Denar Mark II, Whip Mix Corporation, Louisville, KY, USA) using a centric relation record and an arbitrary facebow transfer (Slidematic Facebow, Whip Mix Corporation, Louisville, KY, USA) [Figure 7]. Anterior teeth set up was completed and the anterior esthetics and phonetics were verified and approved by the patient, which was then followed by the posterior teeth set up [Figure 8]. Evaluation of occlusal vertical dimension, esthetics, phonetics, and occlusal plane were performed and approved by the patient. As vertical space analysis indicated that the prosthetic space was 12 mm, for the definitive prostheses, a monolithic zirconia was selected. A temporary prosthesis was milled from polymethyl methacrylate (PMMA) discs (Ceramill TEMP, Amann Girrbach, Koblach, Austria) [Figure 9]. The screw access was determined by the angulation of the implants and located labially in most of the upper implants, which were corrected using Dynamic Abutments® (Dess Dental Smart Solutions, Barcelona, Spain). This enabled the screw accesses of the implants to be directed to the palatal surfaces of the restoration. The design of the Bisque was made and fabricated and clinically and radiographically verified for seating and passive fit [Figure 10]. At this stage, the patient's esthetics and occlusion were re-evaluated and confirmed.

The final prosthesis was fabricated from multilayer monolithic zirconia (Zolid Gen-X, Amann Girrbach,

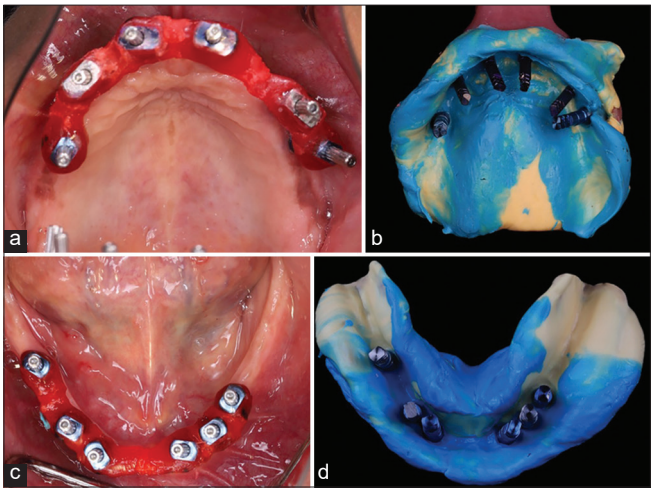

Figure 4: (a) Occlusal view of maxillary arch with splinted impression copings; (b) Maxillary final impression; (c) Occlusal view of mandibular arch with splinted impression copings; (d) Mandibular final impression

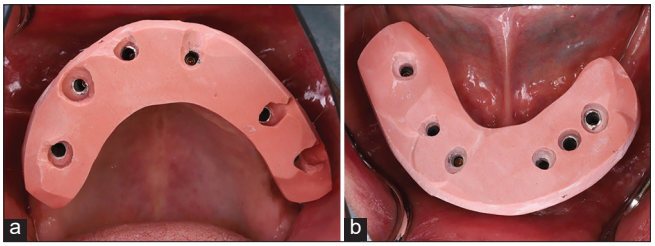

Figure 5: (a) Occlusal view of maxillary stone jig; (b) Occlusal view of mandibular stone jig

Figure 6: Screw retained bite blocks

Koblach, Austria) with gingival ceramic porcelain (E. max Ceram Gingiva, Ivoclar Vivadent, Schaan, Liechtenstein). It was sectioned between teeth #43 and #44 to accommodate mandibular flexure, then inserted intraorally. All abutment screws were torqued to 25 Ncm, and the access holes were sealed using Teflon® tape (Chemours, Wilmington, DE, USA) and light-polymerizing flowable composite resin (Tetric EvoFlow, Ivoclar Vivadent, Schaan, Liechtenstein) [Figure 11].

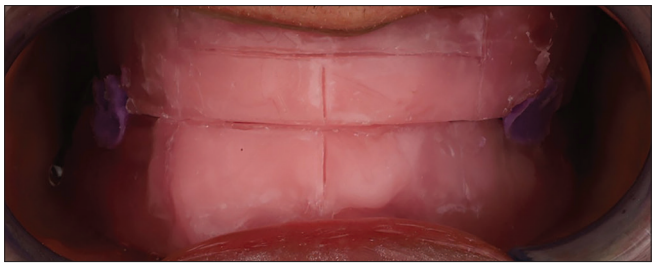

Figure 7: Centric relation record

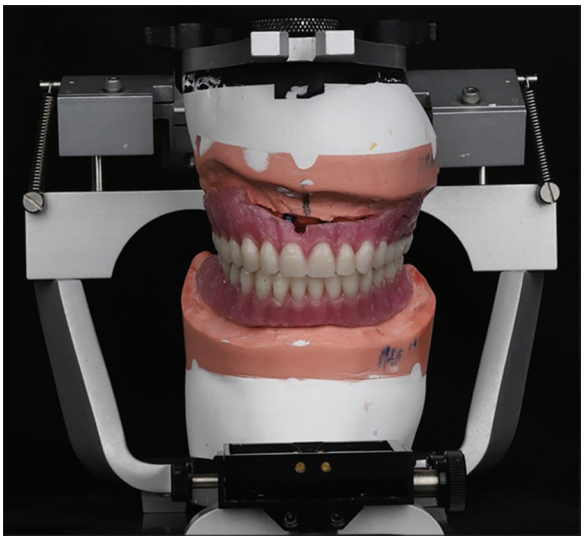

Figure 8: Teeth set up on mounted casts

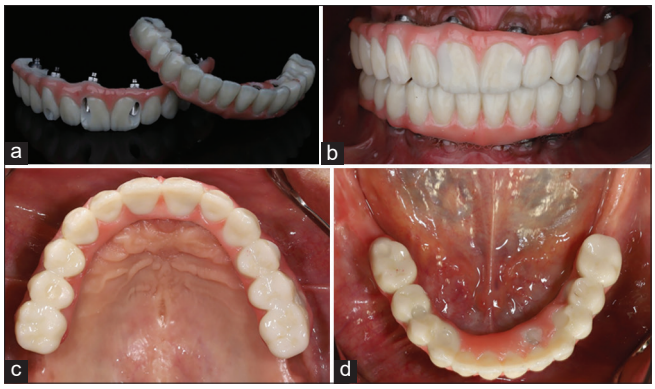

Figure 9: (a) Provisional prostheses; (b) Intraoral frontal view of provisional prosthese; (c and d) occlusal view of provisional prostheses

Figure 10: Intraoral frontal view of bisque try-in

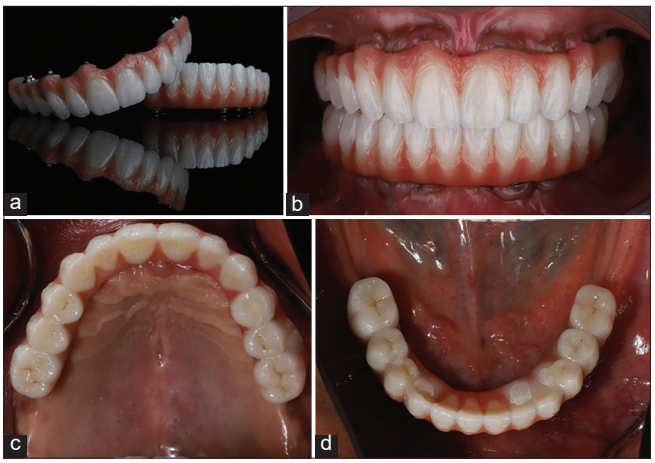

Figure 11: (a) Final prostheses; (b) Intraoral frontal view of final prostheses; (c and d) occlusal view of final prostheses

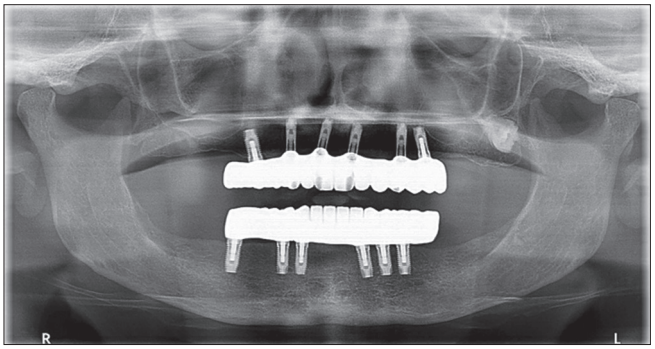

Figure 12: Panoramic radiograph taken after final prostheses with dynamic abutments used for the four ante-rior maxillary implants

A post-treatment panoramic radiograph was taken, confirming the optimal fit of the prosthesis [Figure 12]. An occlusal nightguard was fabricated from heat-pressed material (Erkodur®, Erkodent, Germany) with permissive occlusal surfaces to protect the prosthesis [Figure 13].

The patient expressed a high level of satisfaction with the esthetic and functional outcomes of the prosthodontic therapy. A follow-up appointment was made for 24 h later to assess the patient. At this appointment, only minor occlusal adjustments were needed. At the 1-week follow-up appointment, an occlusal device was delivered and the patient was instructed to wear it nightly and daytime as needed. Follow-up visits were scheduled at 2–4 weeks to evaluate occlusion. Maintenance visits were planned every 6 months.

Discussion

This clinical report demonstrates a clinical and laboratory workflow for the fabrication of a full-arch

Figure 13: Intraoral frontal view of occlusal nightguard

implant-supported monolithic zirconia prosthesis. In this particular case, multiple maxillary implants were placed with unfavorable angulations and were successfully corrected using dynamic abutments.

There is a profuse amount of literature supporting the benefits of full-arch implant-supported rehabilitation. Functionally, implant-supported prostheses support speech, restore chewing of a wider range of foods, and certainly reduce the challenges of function than with traditional removable dentition. By distributing masticatory stresses as evenly as possible between both arches, implants can help to improve function, delay facial collapse, and thereby reduce resorption of bone.[11] Equally important are esthetic considerations prosthetic teeth are customized to match the patient's unique facial structure and anatomical features, ensuring they resemble any remaining natural teeth. Recreating a natural-looking smile helps preserve facial balance and esthetics by supporting the lips and maintaining facial shape, which can also enhance self-confidence.[12]

One of the main challenges with implant-supported restorations is achieving an ideal quality of esthetics; this will mainly depend on implant positioning.[13] Particularly in the anterior maxilla, implant placement faces significant challenges. Following tooth extraction, the maxillary arch resorbs palatally and superiorly, producing non-axial implant placement.[14] Compared to angled multi-unit abutments or cement-retained prostheses, dynamic abutments offer a more conservative, cost-effective, and esthetically favorable alternative. They allow precise redirection of the screw channel – up to 28° – enabling screw access through the occlusal surfaces in posterior regions or the cingulum area in anterior teeth, without the need for additional components or bulky prosthetic designs.[10] This flexibility not only improves esthetic outcomes but also facilitates easier retrievability of the prosthesis, without altering implant position or increasing the required vertical restorative space. Importantly, by eliminating the need for cement, dynamic abutments help reduce the risk of excess cement around implants – a well-documented cause of peri-implantitis. In cases of moderate implant angulation, they present a less invasive and more cost-effective alternative to zygomatic implants or extensive bone grafting procedures.[15] Studies have shown that even though angulated screw channels may introduce slightly more stress around the screw, they still maintain reliable biomechanical performance and acceptable torque levels.[16] Clinical outcomes have been promising as well, with one study reporting a 92% success rate at 42 months, even in cases where implants were placed at challenging angles.[17]

From a materials perspective, monolithic zirconia has been shown to perform better than other restorative materials.[18] It has high strength and fracture toughness and provides high esthetic standards, which lessens the ability for the metal to be seen in the mouth.[19] Furthermore, full-arch monolithic zirconia restorations show comparable survival rates to high noble metal-ceramic restorations.[20] Longitudinal studies have shown no bulk fractures or catastrophic failure of monolithic zirconia in over 8 years of follow-up.[18] In contrast, implant-supported hybrid prostheses may present several complications over a 5-year period,[21] including fractures of titanium and gold alloy frameworks, as well as wear or breakage of acrylic teeth resulting from inadequate bonding with the underlying structure.[22] In ceramometal restorations, ceramic chipping or fracture can result from multiple factors, including impact and fatigue loading, occlusal forces, mismatched thermal expansion coefficients, the metal's low elastic modulus, design flaws, microdefects, and traumatic injury.[23] Following the failure of acrylic or metal frameworks, extensive work is required. Alternatively, full-contour monolithic zirconia represents a promising alternative, offering a combination of excellent biocompatibility, favorable optical characteristics, high fracture resistance, and ease of fabrication. These properties make it an increasingly preferred material for full-arch implant-supported restorations.[19] An occlusal night guard was provided to protect the prosthesis from parafunctional forces, distribute occlusal load evenly, and minimize the risk of screw loosening. This is a standard recommendation in full-arch implant prostheses, especially with zirconia materials.

Conclusion

In this case, a patient underwent successful full-mouth rehabilitation using implant-supported definitive prostheses made from monolithic zirconia. This material was selected for its exceptional strength, biocompatibility, and natural esthetics; factors that contributed to long-term durability and high patient satisfaction. Angulation challenges in the maxilla were effectively managed with dynamic abutments, which corrected implant trajectories without the need for additional components. This approach preserved both optimal function and esthetic outcomes.

The patient reported significant improvements in chewing ability, speech, and self-confidence, expressing high satisfaction with the result. This case highlights the value of combining advanced materials with modern prosthetic solutions, such as dynamic abutments, as well as the importance of individualized treatment planning. Ongoing follow-up and maintenance remain essential to ensuring long-term success.

Informed Consent

Written informed consent was obtained from the patient for treatment and publication of this case report and accompanying images.

Supplementary Materials

Not applicable.

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Data Availability Statement

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Acknowledgments

Not applicable.

Conflicts of Interest

“The author declares no conflict of interest.”

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