

INNOVATIVE FULL-ARCH REHABILITATION WITH THE ALL-ON-4® PROTOCOL AND CAD/CAM-FABRICATED SCREW-RETAINED HYBRID PROSTHESIS: A CASE REPORT

Prosthodontics

Dr. Mohan Mahajan	Senior Resident, Department of Prosthodontics and Crown & Bridges, King George's Medical University, U.P, Lucknow
Dr. Sunit Jurel	Professor, Department of Prosthodontics and Crown & Bridges, King George's Medical University, U.P, Lucknow
Dr. Pooran Chand	Professor and Head, Department of Prosthodontics and Crown & Bridges, King George's Medical University, U.P, Lucknow
Dr. Apurva Verma	Prosthodontist, Department of Prosthodontics and Crown & Bridges, King George's Medical University, U.P, Lucknow
Dr. Satyendra Pratap Singh*	Junior Resident, Department of Prosthodontics and Crown & Bridges, King George's Medical University, U.P, Lucknow *Corresponding Author

ABSTRACT

The All-on-4® treatment concept offers a transformative solution for full-arch rehabilitation in edentulous patients, delivering predictable outcomes with minimal invasiveness. This case report presents the successful implementation of the All-on-4® technique with an immediate loading protocol and a screw-retained hybrid prosthesis in a 26-year-old male with significant maxillary and mandibular tooth loss. Utilizing cone-beam computed tomography (CBCT) for guided implant placement enabled precise angulation and optimal bone use, while angulated posterior implants minimized the need for grafting and improved load distribution. The integration of CAD/CAM and direct metal laser sintering (DMLS) technologies ensured the fabrication of a prosthesis with excellent fit, function, and aesthetics. The treatment resulted in immediate functional and aesthetic restoration, with postoperative assessments confirming implant stability, satisfactory occlusion, and high patient satisfaction. Continued follow-up demonstrated the prosthesis's durability and the absence of complications, underscoring the All-on-4® approach as a highly effective and patient-centered method for full-arch rehabilitation, further supported by advancements in digital workflows and biomaterials.

KEYWORDS

All-on-4®, Hybrid Prosthesis, Implant-Supported Restoration, Full-Arch Rehabilitation, Immediate Loading

INTRODUCTION

The All-on-4® technique represents a revolutionary approach to prosthodontic rehabilitation, offering an innovative solution for patients experiencing extensive tooth loss or edentulism. Designed as an alternative to traditional removable dentures and complex implant procedures, this technique provides a fixed, full-arch restoration with remarkable efficiency and predictability¹. Conceptualized by Dr. Paulo Malo, the All-on-4® approach challenges conventional treatment protocols and expands possibilities for edentulous patients². By strategically placing four dental implants—two anterior implants in a vertical orientation and two posterior implants at an angle of up to 45 degrees—clinicians can support a complete arch of prosthetic teeth while minimizing the need for bone grafting procedures³.

The All-on-4® technique heralds a paradigm shift in prosthodontic rehabilitation, offering numerous advantages over traditional approaches. It reduces treatment complexity, cost, and rehabilitation time, enabling patients to regain oral function and aesthetics efficiently⁴. This case report details the application of the All-on-4® technique with an immediate loading protocol, culminating in a fixed hybrid screw-retained prosthesis.

Case Presentation

A 26-year-old male presented to the Department of Prosthodontics with the chief complaint of missing maxillary and mandibular teeth due to trauma sustained two years earlier. Clinical examination revealed the presence of maxillary canines with a faulty prosthesis with mobility and a completely edentulous mandibular arch. (Fig.1) Based on the available bone volume and the patient's willingness, an All-on-4® implant-supported prosthesis was planned for both arches⁵.

Preoperative CBCT imaging facilitated precise implant size selection and placement using CS 3D imaging software. The surgical phase, performed under local anesthesia and antibiotic coverage, commenced with the extraction of the maxillary canines and reflection of the mucoperiosteal flap. Anterior straight and posterior angulated implants (45 degrees) were placed in osteotomy sites using a Malo guide with a torque exceeding 35 Ncm, ensuring primary stability. Angulated titanium multi-unit abutments (30°) were used for posterior implants⁶. Post-operative OPG was taken to confirm accurate implant positioning.(Fig.2)

Following surgery, interim dentures were modified to accommodate titanium cylinders and ensure proper fit and function. Premature interferences were eliminated in the prosthesis and screwed into the patient's mouth with a torque not exceeding 15 Ncm⁷. Cantilever were avoided in immediately loaded prosthesis during the healing phase. (Fig.3)

Final Prosthetic Phase

After healing, Implant-level impressions were made using the open-tray technique and polyvinyl siloxane impression material (Imprint™ 3 VPS, 3M ESPE, St. Paul, MN, USA).(Fig. 4 A) The master cast was poured after placement of implant analog and soft tissue mouldage material like gingimask (GI-mask Automix, Coltene). Verification Jig is fabricated using pattern resin (GC Corporation, Tokyo, Japan) and tried into the patient's mouth to ensure precise fit, accuracy, and alignment of framework or prosthesis. (Fig. 4 B) The denture base and rims were fabricated over the master cast. Facebow transfer using spring bow earpiece type facebow was recorded and transferred to a semi-adjustable HANAU articulator after centric relation record. The tooth-setting trial was done further to evaluate esthetics, phonetics, and occlusion.

The cast was then scanned using a lab scanner (Shining 3D Autocan DS EX Pro), and the framework was designed and milled using CAD software and DMLS technology (Exocad). (Fig. 4 C) The framework was tried in the patient's mouth for passive fitting, and the necessary adjustments were made. Afterward, the trial dentures were fitted over the framework, and the final try-in was done in the patient's mouth. Hybrid prostheses were processed using the Injection molding technique.

The final screw-retained hybrid prosthesis was inserted in the patient's mouth. Occlusion was adjusted according to implant-protected principles, and Shimstock clearance was provided at the molar site. The final tightening of prosthetic screws was done at 20-25 Ncm torque using a torque ratchet and screw access holes were sealed using light cure composite material (Ivoclar Te-Econom Plus). (Fig.5)

DISCUSSION

The All-on-4® treatment concept is a transformative approach in implant dentistry, providing predictable, cost-effective, and minimally

invasive solutions for full-arch rehabilitation in edentulous or compromised dentitions [10]. This case report demonstrates the successful implementation of the All-on-4® protocol using a hybrid prosthesis to restore both function and esthetics. The placement of angled posterior implants optimizes available bone use while avoiding critical anatomical structures such as the maxillary sinus and mandibular nerve. The angulated posterior implants reduce cantilever forces and improve load distribution, enhancing the long-term stability of the restoration. [11].

Hybrid prostheses—typically comprising a titanium framework and acrylic or composite teeth—offer superior durability, aesthetics, and patient satisfaction compared to removable options. This case demonstrated the successful restoration of the patient's occlusion, phonetics, and facial aesthetics, significantly improving their quality of life [12].

Comprehensive preoperative evaluation, meticulous surgical execution, and individualized treatment planning were critical to achieving optimal results. CBCT imaging and diagnostic wax-ups facilitated precise implant positioning, while careful attention to occlusal design minimized parafunctional forces. The patient's bone volume and quality were sufficient to avoid grafting, aligning with the minimally invasive philosophy of the All-on-4 approach. Challenges such as achieving optimal implant angulation and vertical dimension of occlusion were carefully addressed during surgery and prosthetic fabrication. A screw-retained hybrid prosthesis was chosen to allow easy retrieval for maintenance or adjustments. In order to lower the incidence of peri-implantitis, a strong emphasis was placed on patient education regarding maintaining appropriate oral hygiene. The patient experienced immediate improvements in mastication, speech, and esthetics upon prosthesis delivery. Postoperative follow-ups ensured maintained prosthesis integrity and oral hygiene. [13].

The All-on-4® approach is not appropriate in every situation, even with its high success rate. Alternative methods can be necessary for patients with extensive bone loss, unfavorable occlusal conditions, or certain systemic health problems. Additionally, long-term studies are needed to assess the durability of hybrid prostheses, particularly regarding wear and fracture resistance.

CONCLUSIONS

This case underscores the reliability and versatility of the All-on-4® concept combined with a hybrid prosthesis for full-arch rehabilitation. With meticulous planning, precise execution, and ongoing maintenance, this technique consistently delivers predictable outcomes that enhance patient satisfaction and quality of life. Future advancements in materials and digital workflows hold promise for further improving the efficiency and success of this treatment modality.

Consent

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

Ethical Approval

This case report complies with ethical guidelines and was conducted following the principles of the Declaration of Helsinki. Ethics committee approval was not required as it is a single case report with informed patient consent.

Conflict of Interest

The authors declare no conflicts of interest.

Case Photos –



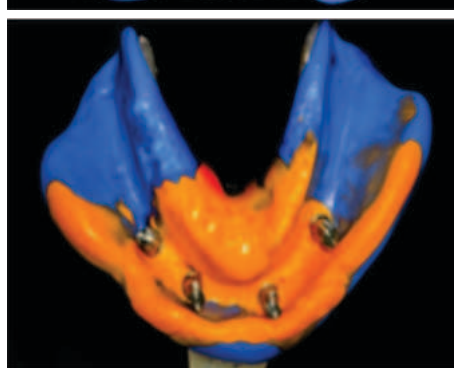
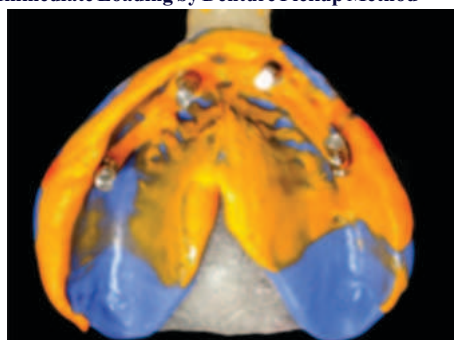
Fig.1) Pre-Operative – Intraoral



Fig.2) Post-Op Xray

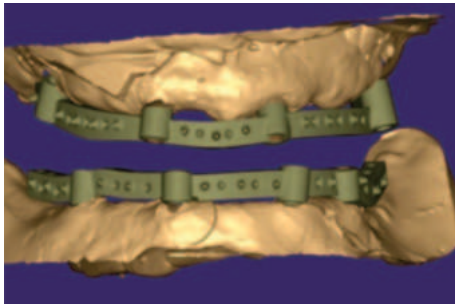


Fig.3) Immediate Loading by Denture Pickup Method



A) Impression Making



**B) JIG Trial****C) CAD Designing of Prosthesis Framework
Fig 4) Prosthetic Phase****Fig 5) The Final Screw-retained Hybrid Prosthesis****REFERENCES**

1. Malo P, de Araujo Nobre M, Lopes A, et al. The All-on-4 concept for full-arch rehabilitation. *Clinical Implant Dentistry and Related Research*. 2003;5(Suppl 1):88-93.
2. Aparicio C, Rangert B, Sennerby L. Immediate/early loading of dental implants: A report from the Sociedad Española de Implantes World Congress Consensus Meeting in Barcelona, Spain, 2002. *Clinical Implant Dentistry and Related Research*. 2003;5(1):57-60.
3. Khatami AH, Smith CR. All-on-4® concept immediate function for edentulous arches. *Compendium of Continuing Education in Dentistry*. 2008;29(3):150-162.
4. Jensen OT, Adams MW, Cottam JR, et al. The All-on-4 treatment concept for the severely resorbed maxilla: A clinical report. *Journal of Prosthetic Dentistry*. 2015;113(3):201-207.
5. Agliardi E, Panigatti S, Clericò M, et al. Immediate rehabilitation of the edentulous jaws with full fixed prostheses supported by four implants: Interim results of a 5-year prospective study. *Clinical Implant Dentistry and Related Research*. 2010;12(Suppl 1):e33-e43.
6. Malo P, Rangert B, Nobre M. "All-on-Four" immediate-function concept with Branemark System implants for completely edentulous mandibles: A retrospective clinical study. *Clinical Implant Dentistry and Related Research*. 2003;5(Suppl 1):2-9.
7. Esposito M, Grusovin MG, Coulthard P, et al. The efficacy of various bone augmentation procedures for dental implants: A Cochrane systematic review of randomized controlled clinical trials. *International Journal of Oral & Maxillofacial Implants*. 2006; 21(5):696-707.
8. Vervaeke S, Collaert B, Cosyn J, et al. A 5-year prospective study on the outcome of implants placed using the All-on-4® immediate-function concept. *Clinical Implant Dentistry and Related Research*. 2014;16(5):683-692.
9. Nkenke E, Fenner M. Indications for immediate loading of implants and implant success. *Clinical Oral Implants Research*. 2006;17(Suppl 2):19-34.
10. Pozzi A, Tallarico M, Moy PK. Immediate loading with a fixed full-arch restoration on four tilted and upright implants: A multi-center retrospective study. *Journal of Prosthetic Dentistry*. 2012;108(6):319-327.
11. Goodacre CJ, Bernal G, Rungcharassaeng K, et al. Clinical complications with implants and implant prostheses. *Journal of Prosthetic Dentistry*. 2003;90(2):121-132.
12. Attard NJ, Zarb GA. Long-term treatment outcomes in edentulous patients with implant-supported prostheses: The Toronto study. *International Journal of Prosthodontics*. 2004;17(4):417-424.
13. Greenstein G, Cavallaro J, Tarnow D. Practical guidelines for immediate implant loading in the edentulous mandible: A literature review. *Journal of the American Dental Association*. 2008;139(9):1170-1179.
14. Chrcanovic BR, Albrektsson T, Wennerberg A. Immediate loading versus conventional loading of dental implants: A meta-analysis. *Journal of Dentistry*. 2014;42(9): 1052-1059.