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Full-Mouth Rehabilitation of Completly Edentulous Maxillary and Mandibular Arches with Implant-Supported Fixed Prostheses: An All-on-4/All-on-6 Case Report

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Abstract
Complete edentulism remains a widespread and disabling condition that compromises mastication, speech, esthetics, and psychosocial well-being. While conventional complete dentures have long been the mainstay of treatment, their limitations in retention, stability, and masticatory efficiency have driven the adoption of implant-supported fixed prostheses as a predictable alternative. This report describes the full-mouth rehabilitation of a 53-year-old male farmer with completely edentulous maxillary and mandibular arches (Atwood Order III, Prosthodontic Diagnostic Index Class I) using the All-on-6 implant-supported fixed prosthesis concept for the mandibular arch and All-on-4 implants in the maxillary arch. Following comprehensive diagnostic work-up including primary and secondary impressions, jaw-relation records mounted on a semi-adjustable articulator, diagnostic wax try-in, and cone-beam computed tomography-guided implant-site selection, six endosseous implants were placed in the lower arch with multi-unit abutments and four implants were placed in the upper arch. A staged prosthetic protocol progressing from a temporary prosthesis through digital impressions, verification jig trial, resin trial, metal trial, and bisque trial culminated in a definitive metal-ceramic fixed prosthesis. At delivery, the patient demonstrated harmonious occlusion in centric, protrusive, and lateral excursions, together with satisfactory esthetics and function. This case illustrates that a systematic, sequential diagnostic and prosthetic protocol can yield predictable, functionally and esthetically favorable outcomes in the all-on-4 / All-on-6 rehabilitation of the completely edentulous patient.

Keywords: *All-on-4, All-on-6; complete edentulism; implant-supported fixed prosthesis; full-mouth rehabilitation; multi-unit abutment; Atwood classification; cone-beam computed tomography.*

I. Introduction

Edentulism, the complete loss of natural dentition, continues to be a major global oral health burden that disproportionately affects older adults and is closely linked to socioeconomic status, education, and access to dental care[1]. A systematic review and meta-analysis of the Global Burden of Disease Study estimated that severe tooth loss affects hundreds of millions of people worldwide, with prevalence rising sharply with age[32]. Beyond its functional consequences for mastication and speech, edentulism has been associated with impaired nutrition, diminished self-esteem, social withdrawal, and reduced oral health-related quality of life[33].

Conventional complete dentures have historically been the primary treatment modality for the edentulous patient. However, their well-documented shortcomings — inadequate retention and stability, accelerated residual ridge resorption, and compromised masticatory efficiency — often leave patients dissatisfied. The introduction of osseointegrated dental implants by Brånemark and colleagues transformed the prosthodontic management of edentulism[9,10], and implant-supported prostheses — whether removable overdentures or fixed restorations — are now regarded as predictable, long-term solutions. The McGill and York consensus statements formally established that a mandibular two-implant overdenture should be considered, at minimum, the standard of care for the edentulous mandible[24], while implant-supported fixed prostheses supported by four to six implants (the All-on-4

and All-on-6 concepts) have emerged as the treatment of choice for patients seeking a non-removable, tooth-like restoration[12,20].

The All-on-4 immediate-function protocol, first described by Maló and colleagues for the edentulous mandible and subsequently for the maxilla, uses two axial anterior implants and two distally tilted posterior implants to support a full-arch fixed prosthesis while avoiding bone grafting procedures[12,13]. Long-term follow-up studies of up to ten years have confirmed high implant and prosthesis survival rates with this approach[14,15,34]. The All-on-6 concept extends this philosophy by distributing occlusal load across six implants, which may offer improved biomechanical stability, a more favorable crown-to-implant ratio, and a built-in margin of safety should an individual implant fail, and has been reported as a predictable, cost- and time-effective solution for rehabilitating the atrophic edentulous jaw without the need for extensive grafting[16,17,19,20]. A recent systematic review and meta-analysis comparing the two concepts found comparable short-, mid-, and long-term implant survival rates for All-on-4 and All-on-6 protocols, with marginal bone loss and complication rates that were broadly similar between groups[19].

Successful outcomes with either protocol depend on rigorous pre-treatment diagnosis using classification systems such as the American College of Prosthodontists' Prosthodontic Diagnostic Index (PDI) for complete edentulism[1] and Atwood's classification of residual ridge resorption[3,4], together with three-dimensional radiographic evaluation of available bone using cone-beam computed tomography (CBCT)[25,26]. This report presents the complete diagnostic and prosthetic sequence of an All-on-4 / All-on-6 full-mouth rehabilitation performed in a completely edentulous patient, and discusses the case in the context of the current evidence base for full-arch implant-supported fixed prostheses.

II. Case Report

Patient History and Chief Complaint

A 53-year-old male patient, employed as a farmer, reported to the Department of Prosthodontics with the chief complaint of difficulty in chewing food due to missing teeth. His dental history revealed extraction of the remaining natural teeth approximately six months prior to presentation, and his medical history was non-contributory, with no relevant systemic disease reported.

Figure 1. Pre-treatment frontal photograph of the patient.

Clinical and Radiographic Examination

Extraoral examination revealed no significant facial asymmetry, and intraoral examination confirmed completely edentulous maxillary and mandibular arches. Ridge assessment using Atwood's classification of residual ridge morphology placed both arches in Order III, corresponding to a well-rounded ridge form that, while past the immediate post-extraction stage, still offered favorable height and contour for prosthetic and implant therapy[3,4]. A diagnostic orthopantomogram (OPG) was obtained to screen bone availability and to rule out any pathology of the jaws prior to further three-dimensional evaluation.

Front view *Right lateral view* *Left Lateral view*

Figure 2. Pre-prosthetic extraoral views.

Maxillary arch *Mandibular arch*

Figure 3. Pre-prosthetic intraoral views of the edentulous arches.

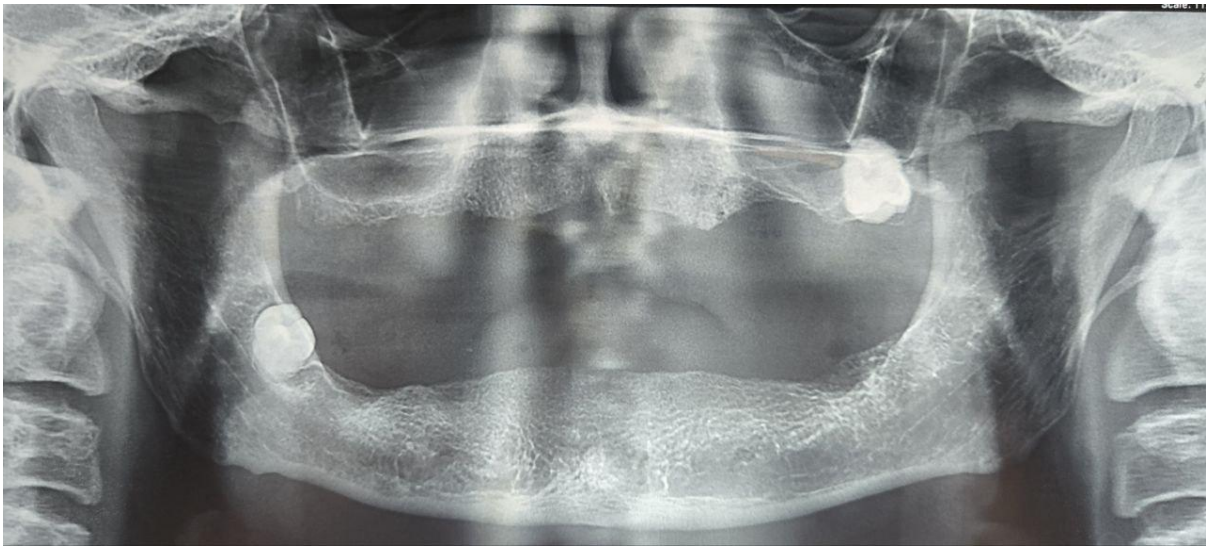


Figure 4. Pre-treatment diagnostic orthopantomogram (OPG).

Diagnosis

Using the American College of Prosthodontists' Prosthodontic Diagnostic Index for the completely edentulous patient, the case was classified as Class I, reflecting favorable diagnostic criteria: residual bone height of 21 mm or greater in both arches, a residual ridge morphology resistant to horizontal and vertical displacing forces, muscle attachments favorably positioned relative to the denture-bearing area, and a Class I maxillomandibular relationship[1]. This Class I categorization indicated a comparatively uncomplicated clinical scenario amenable to a range of prosthetic solutions.

Treatment Options Considered

Four treatment options were discussed with the patient in keeping with the accepted spectrum of prosthodontic rehabilitation for the edentulous patient:

- Conventional complete dentures for both the maxillary and mandibular arches.
- Implant-supported overdenture (removable partial denture-type retention, RP4/RP5).
- Implant-supported fixed prosthesis using four implants per arch — the All-on-4 concept (FP1/FP2/FP3).
- Implant-supported fixed prosthesis using six implants per arch — the All-on-6 concept (FP1/FP2/FP3).

For the present patient, the All-on-4 protocol was selected for the maxillary arch, whereas the All-on-6 protocol was selected for the mandibular arch.

Given the patient's Class I diagnostic profile, favorable Order III ridge form, and stated preference for a fixed, non-removable restoration that would most closely replicate natural dentition, a full-mouth implant-retained fixed prosthesis using the All-on-4 and All-on-6 protocol was selected as the definitive treatment plan. Six implants for the lower arch were chosen over four to distribute occlusal load more broadly and provide additional biomechanical redundancy across the arch[16,19,20], consistent with the outcomes reported for six-implant-supported fixed prostheses in the literature [17,20,21,22,35.] The All-on-4 treatment concept was selected for the upper arch because of inadequate bone availability in the bilateral posterior maxillary regions.[35]

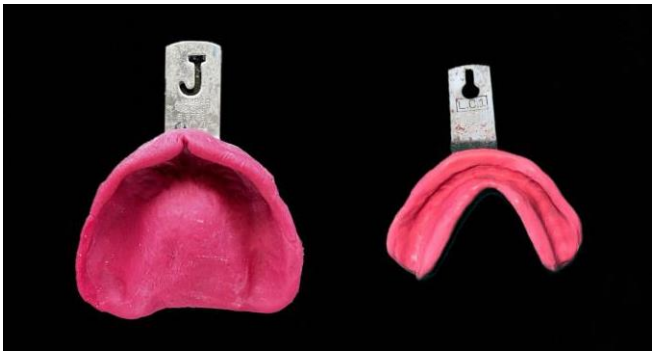
Overall Treatment Sequence

Treatment proceeded in three broad phases: a diagnostic phase, a surgical phase, and a prosthetic phase, following the sequence outlined below.

- Case history, clinical examination, and diagnosis.
- Primary impression and preliminary cast fabrication.
- Secondary (final) impression for a master cast.
- Maxillomandibular relation and facebow record, with mounting on a semi-adjustable articulator.
- Wax try-in and evaluation of the diagnostic denture set-up.
- Fabrication and insertion of a diagnostic/interim complete denture.
- CBCT imaging for three-dimensional implant-site selection.
- Surgical placement of implants in the maxillary and mandibular arches.
- Insertion of an implant-supported temporary (provisional) prosthesis and follow-up.
- Digital impression of the healed implant sites.
- Verification jig trial to confirm master-cast accuracy.
- Jaw relation and facebow record at the implant-supported prosthetic stage.
- Resin trial, metal trial, and bisque (biscuit) trial of the definitive prosthesis.
- Delivery of the final prosthesis and post-insertion follow-up.

Phase I — Diagnostic Phase

Preliminary (primary) impressions of both arches were made to fabricate custom trays, followed by final impressions using border-molding techniques to accurately record the functional depth and width of the denture-bearing areas of the maxillary and mandibular ridges. Maxillomandibular jaw relation was recorded with a facebow transfer, and the casts were mounted on a semi-adjustable articulator to reproduce condylar guidance and enable an anatomically guided diagnostic tooth arrangement. A wax try-in was evaluated intraorally for esthetics, phonetics, and occlusal vertical dimension before the diagnostic complete denture was processed and inserted. This interim denture served both as a functional prosthesis during the diagnostic phase and as a radiographic and surgical guide template for subsequent implant planning.



Maxillary arch *Mandibular arch*

Figure 5. Diagnostic (primary) impressions.

Figure 6. Final (secondary) impressions of the maxillary and mandibular arches.

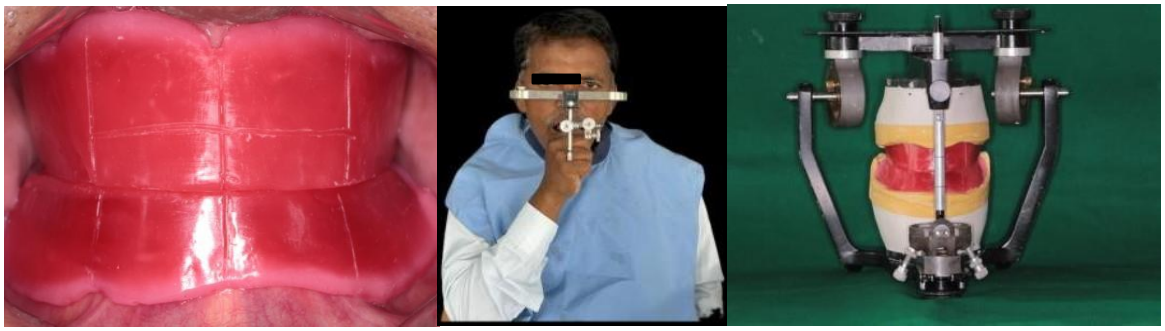


Figure 7. Jaw relation and facebow record, with mounting on a semi-adjustable articulator.

Front view *Right lateral view* *Left lateral view*

Figure 8. Wax try-in of the diagnostic denture set-up.

Figure 9. Insertion of the diagnostic/interim complete denture (frontal view).

Phase II — Surgical Phase

A CBCT scan of both arches was obtained for three-dimensional evaluation of available bone height, width, and density, and for precise selection of implant sites. CBCT-based planning offers superior visualization of critical anatomical structures relative to two-dimensional panoramic imaging and has been shown to provide clinically acceptable accuracy for linear bone measurements relevant to implant site selection[25,26].

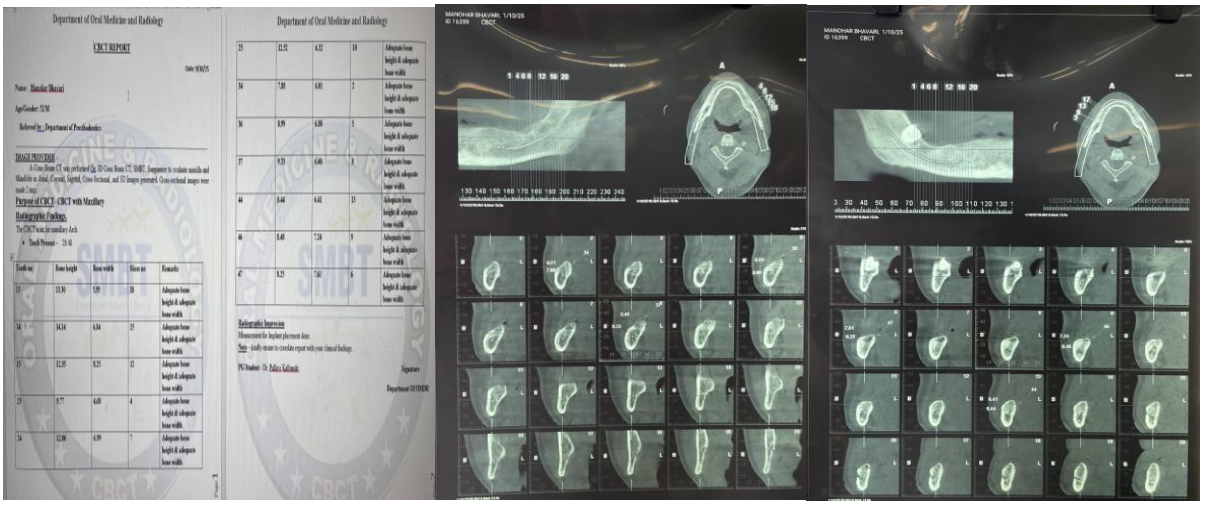


Figure 10. Cone-beam computed tomography (CBCT) imaging used for implant-site selection.

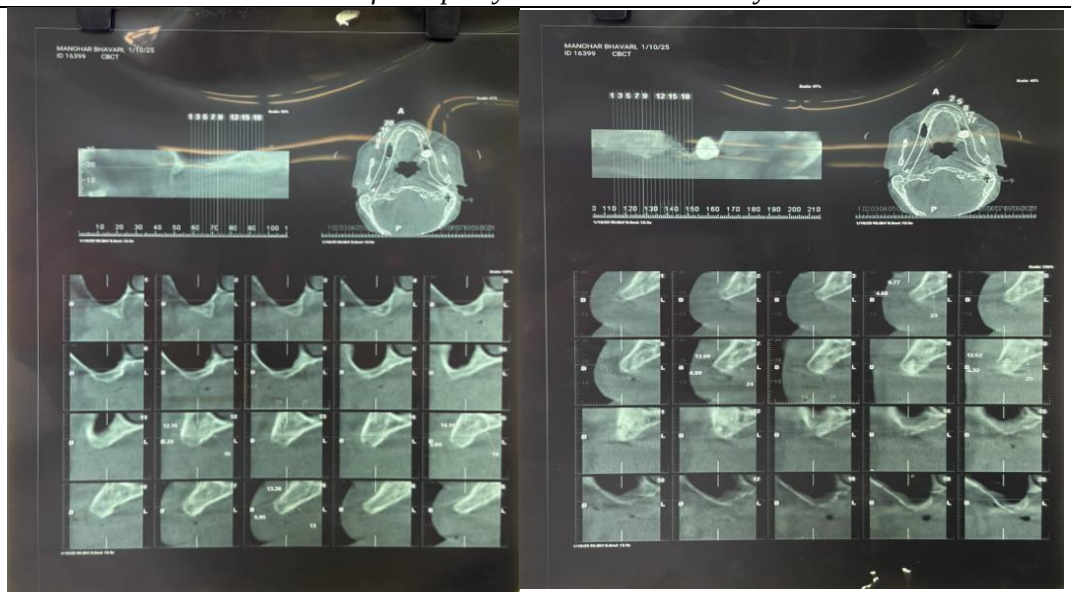
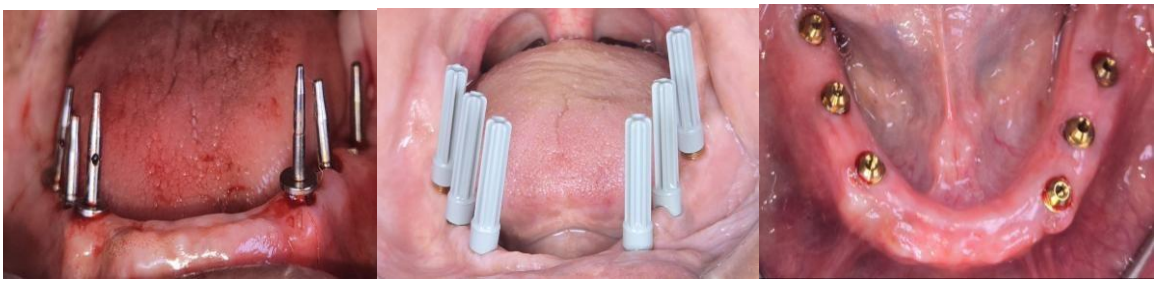


Figure 11. Additional CBCT cross-sectional views used for implant-site selection.

Following site selection, six implants were surgically placed in the mandibular arch according to the All-on-6 concept, while four implants were placed in the maxillary arch according to the All-on-4 concept. Each was fitted with a multi-unit abutment to facilitate a parallel prosthetic platform despite variations in individual implant angulation. A pilot drill guided by parallel pins was used to verify trajectory prior to osteotomy preparation and implant insertion.



Pilot drill with parallel pins *Implant placement with multi-unit abutment*

Figure 12. Implant placement in the mandibular arch according to the All-on-6 protocol.

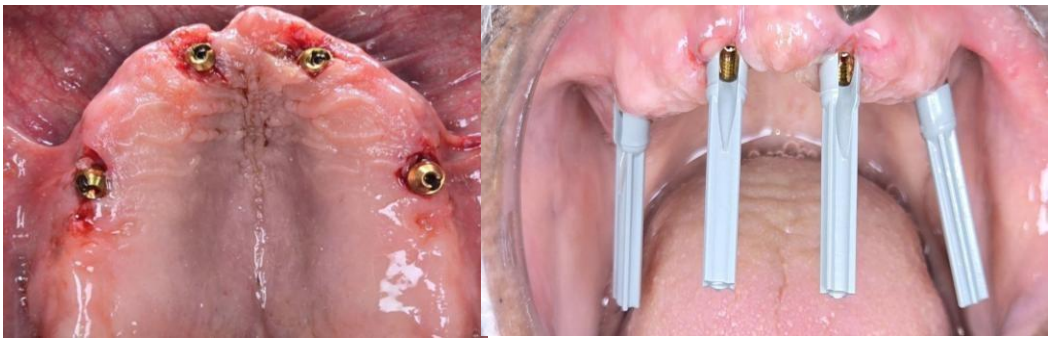


Figure 13. Implant placement with multi-unit abutments in the maxillary arch according to the All-on-4 protocol.

Post-surgical placement was verified with an OPG.

Figure 14. Post-implant-placement orthopantomogram (OPG).

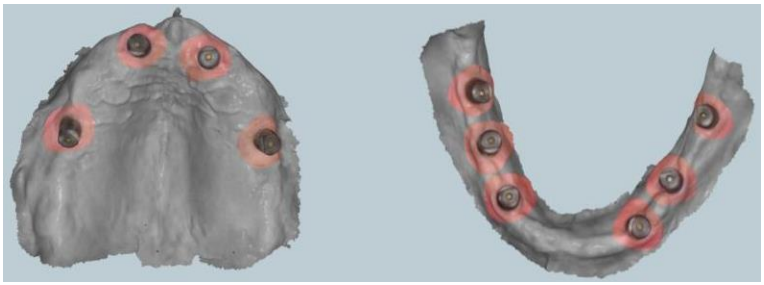
This principle of using axial and angulated implants with multi-unit abutments to compensate for anatomical constraints while avoiding grafting procedures mirrors the biomechanical rationale underlying the original All-on-4/All-on-6 immediate-function protocols[12,13,17]. Following implant placement, an implant-supported temporary (provisional) prosthesis was delivered for both arches . The patient was placed on a structured follow-up schedule through the osseointegration period, consistent with staged-loading protocols reported for All-on-4/All-on-6-implant-supported full-arch rehabilitation[20,22].

Front view *Right lateral view* *Left lateral view*

Figure 15. Implant-supported temporary (provisional) prosthesis.

Phase III — Prosthetic Phase

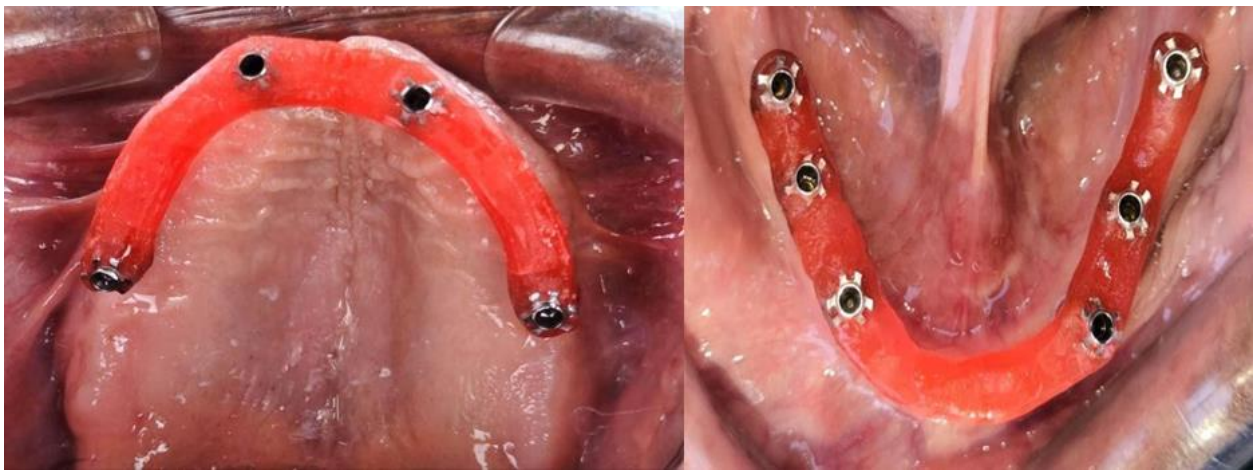
Following an adequate healing and osseointegration interval, digital impressions of the maxillary and mandibular implant positions were captured directly using an intraoral scanner. Digital scanning of multiple splinted implants has been reported to offer accuracy comparable to, or in some scanning protocols superior to, conventional open-tray impressions for full-arch implant work, while improving patient comfort and chairside efficiency, although accuracy can vary with inter-implant distance, scan-body design, and scanner type[27,28].



Maxillary scan *Mandibular scan*

Figure 16. Digital (intraoral scanner) impressions of the healed implant sites.

A verification (splint) jig was subsequently fabricated and tried in for both the arches to confirm the passive accuracy of the master cast prior to framework fabrication.



Maxillary jig *Mandibular jig*

Figure 17. Verification (splint) jig trial.

Jaw relation records were then re-established at the implant-level stage using a facebow transfer, and intraoral verification confirmed a reproducible centric relation record.

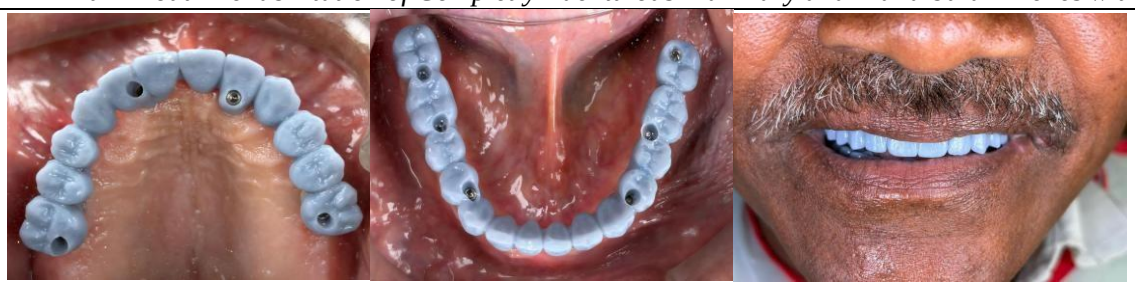
Intraoral view *Facebow record*

Figure 18. Jaw relation record at the implant-level prosthetic stage.

The prosthesis was developed through a sequential trial protocol: a resin trial to verify tooth position, esthetics, and vertical dimension of occlusion; a metal trial to confirm the passive fit and occlusal scheme of the metal substructure; and a bisque (biscuit-bake) trial to evaluate the ceramic-veneered framework prior to final glazing.

Front view *Right lateral view* *Left lateral view*

Figure 19. Resin trial of the prosthesis.



Maxillary occlusal view *Mandibular occlusal view* *Extraoral view*

Figure 20. Resin trial — occlusal and extraoral evaluation.

Front view *Right lateral view* *Left lateral view*

Figure 21. Metal trial of the framework.

Maxillary occlusal view *Mandibular occlusal view*

Figure 22. Metal trial — occlusal evaluation.

Front view *Right lateral view* *Left lateral view*

Figure 23. Bisque (biscuit-bake) trial of the ceramic-veneered prosthesis.

Metal-ceramic frameworks fabricated on multi-unit abutment-level substructures, as used in this case, are among the well-documented restorative options for the All-on-4 and all -on-6 fixed prosthesis[17,20,22]. The definitive prosthesis was retained using a screw-retained protocol at the multi-unit abutment interface, a retention strategy generally associated with easier retrievability and a lower incidence of certain biological complications compared with cement retention, albeit with a correspondingly higher rate of mechanical complications such as screw loosening[29,30].

Figure 24. Definitive metal-ceramic fixed prosthesis.

Prosthesis Delivery and Follow-up

At delivery, the definitive fixed prostheses in both arches demonstrated favorable pink-and-white esthetics, harmonious occlusal contacts in maximum intercuspation, and smooth, unobstructed guidance in protrusive and bilateral lateral excursive movements, with appropriate disclusion on the non-working side. Post-operative extraoral and intraoral photographs and a post-operative OPG confirmed satisfactory implant positioning, prosthesis fit, and occlusal relationships. The patient was scheduled for periodic recall visits to monitor peri-implant soft-tissue health, occlusion, and prosthesis integrity.

Front view *Right lateral view* *Left lateral view*

Figure 25. Post-operative extraoral photographs.

Figure 26. Protrusive excursion (front view).

Working side *Non-working side*

Figure 27. Right lateral excursion.

Working side *Non-working side*

Figure 28. Left lateral excursion.

Maxilla *Mandible*

Figure 29. Post-operative occlusal views.

Front view *Right lateral view* *Left lateral view*

Figure 30. Post-operative extraoral photographs (final review).

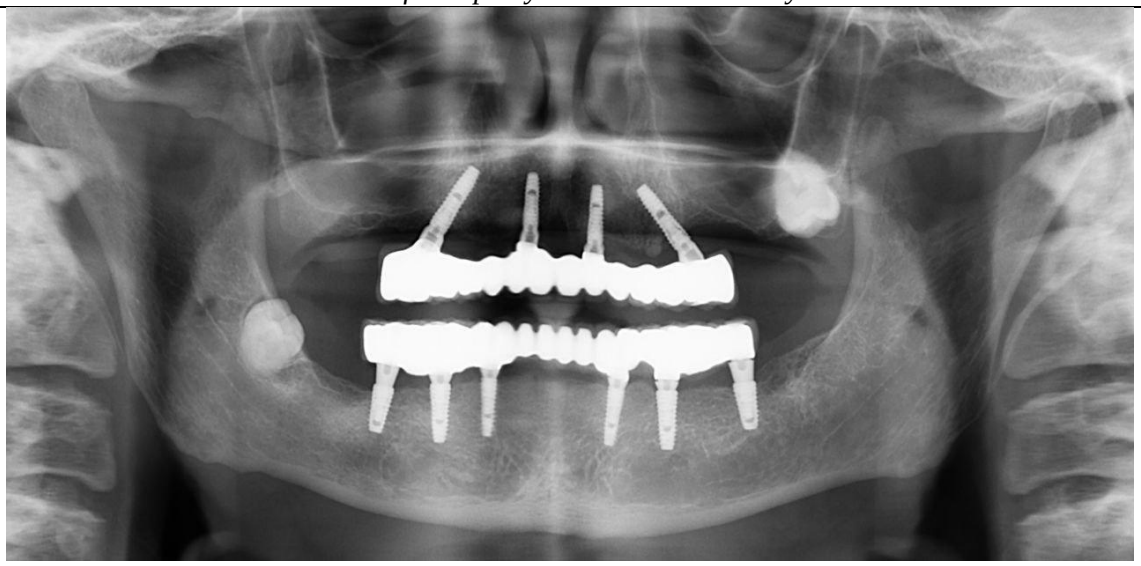


Figure 31. Post-operative orthopantomogram (OPG).

III. Discussion

This case demonstrates a systematic, staged approach to the All-on-4/All-on-6 rehabilitation of a completely edentulous patient, integrating classical prosthodontic diagnostic principles — the PDI classification system and Atwood's ridge assessment[1,3,4] — with contemporary digital and radiographic workflows, including CBCT-guided implant planning and intraoral digital scanning at the implant level[25,26,27,28]. The favorable Class I diagnostic profile and Order III ridge morphology observed in this patient are recognized as positive prognostic indicators for implant therapy, since adequate residual bone height and a ridge form resistant to horizontal and vertical displacing forces reduce the likelihood of requiring adjunctive grafting procedures[1,3,4].

The choice between four and six implants per arch remains a subject of ongoing clinical debate. The All-on-4 concept, introduced by Maló and colleagues, was specifically designed to avoid grafting in atrophic jaws through the use of tilted posterior implants, and long-term studies extending to seven and even ten years have reported high cumulative implant survival with this protocol[12,13,14,15,34]. In the present case, the All-on-4 treatment concept was selected for the upper arch because of inadequate bone availability in the bilateral posterior regions of the maxilla.

The All-on-6 concept, as applied in the present case for lower arch, follows the same underlying biomechanical philosophy of maximizing anterior-posterior implant spread while distributing load across a greater number of fixtures, and has similarly been reported to yield predictable, cost- and time-effective rehabilitation of the edentulous, atrophic jaw[16,17,20]. A recent meta-analysis pooling data from 55 studies found broadly comparable short-, mid-, and long-term survival rates between the All-on-4 and All-on-6 protocols, together with similar magnitudes of marginal bone loss and comparable rates of mechanical and biological complications, suggesting that the two approaches represent equally valid options when case selection and implant number are matched to the individual patient's anatomy and biomechanical demands[19]. Additional implants, as used in the present case, may be particularly advantageous when residual ridge anatomy, occlusal load demands, or the desire for a built-in margin of safety favor a broader implant distribution.

The use of multi-unit abutments in this case allowed for a common, parallel prosthetic platform despite the divergent long-axis angulations that typically result from anatomically guided implant placement, a strategy consistent with established All-on-4/All-on-6 surgical and prosthetic protocols[12,17]. CBCT was central to pre-surgical planning; while linear CBCT measurements have been shown to be sufficiently accurate for implant treatment planning purposes[25,26], clinicians should recognize that CBCT alone may be insufficient to predict all peri-operative outcomes, and that surgical judgment, bone quality assessment, and periodontal history remain important adjuncts to purely radiographic planning.

The staged prosthetic protocol employed — progressing from a verification jig, through resin, metal, and bisque trials, to a definitive metal-ceramic prosthesis — reflects the conventional, well-validated sequence for full-arch implant-supported fixed prosthodontics and allows for iterative verification of fit, esthetics, phonetics, and occlusal scheme prior to irreversible fabrication steps[20,22,23]. The transition to digital impression-making at the implant level in this case is consistent with a growing body of evidence supporting the clinical accuracy of intraoral scanning for full-arch implant work, although scanning protocols, scan-body design, and operator experience continue to influence accuracy, and clinicians should remain attentive to these variables when selecting a digital workflow for extensive edentulous-arch rehabilitation[27,28].

The decision to use screw retention at the multi-unit abutment level in this case affords retrievability for future maintenance, which is a particularly valuable property in extensive full-arch rehabilitations where periodic access for hygiene, repair, or component replacement may be required. Systematic reviews comparing screw- and cement-retained implant prostheses have found broadly comparable survival rates between the two retention strategies, though cement retention has been more frequently associated with biological complications such as peri-implant mucositis, while screw retention carries a comparatively higher risk of mechanical complications such as screw loosening[29,30]. Long-term success of any implant-supported fixed prosthesis, irrespective of implant number or retention type, ultimately depends on maintaining implant stability within the criteria originally proposed by Albrektsson and colleagues — absence of clinical mobility, absence of peri-implant radiolucency, and limited annual marginal bone loss after the first year of function[11], underscoring the importance of the structured recall protocol instituted for this patient and of ongoing surveillance for peri-implant disease as defined in the 2017 World Workshop classification[31].

Finally, this case adds to a growing body of published clinical reports documenting successful All-on-4 and All-on-6 rehabilitation of the completely edentulous patient[16,20,21,22,35], and reinforces the broader literature indicating that implant-supported fixed and removable prostheses meaningfully improve masticatory function, esthetics, and oral health-related quality of life relative to conventional complete dentures[24,33]. As with any full-arch implant rehabilitation, careful attention to diagnostic classification, three-dimensional radiographic planning, a systematic staged prosthetic protocol, and a structured maintenance program are the key determinants of long-term success.

IV. Conclusion

Full-mouth rehabilitation of the completely edentulous patient with an

In the present case, an All-on-4 configuration was used for the maxillary arch and an All-on-6 configuration for the mandibular arch, which is a predictable treatment option when supported by systematic diagnostic classification, three-dimensional radiographic planning, and a staged prosthetic protocol. In the present case, favorable diagnostic (PDI Class I) and ridge-morphology (Atwood Order III) findings, combined with meticulous CBCT-guided implant placement and a sequential trial-based prosthetic work-up, resulted in a functionally and esthetically satisfactory outcome. Long-term success will depend on continued peri-implant maintenance and periodic clinical and radiographic follow-up.

Conflicts of Interest

The authors declare no conflicts of interest related to this case report.

Patient Consent

Informed consent was obtained from the patient for publication of this case report and any accompanying clinical images.

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