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Immediate Implants with Immediate Loading for Rehabilitation of Maxillary Arch Using All-on-X Concept Followed by Definite Prosthesis in Stage IV, Grade C Periodontitis Patient: A Case Report

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Abstract: The "All-on-X" treatment concept was developed to maximize the use of available remnant bone in atrophic jaws, allowing immediate function and avoiding regenerative procedures that increase the treatment costs, surgical visits, patient morbidity, and complications inherent with these procedures. The protocol uses four implants in the anterior part of complete edentulous jaws to support a provisional, fixed and immediately loaded prosthesis. The two most anterior implants are placed axially, whereas the two distally tilted implants, along with two pterygoid implants in the pterygomaxillary region and angled to minimize the cantilever length and to allow the application of prosthesis with up to 14 teeth, thereby enhancing masticatory efficiency. An increasingly common strategy to conserve bone and reduce treatment times is immediate implants following extraction. Through the preservation of soft tissues, this method also enhances aesthetics. Immediate implant placement followed by immediate loading is technically challenging and requires good clinical skills both surgically and prosthetically. This article describes a case report of maxillary full arch rehabilitation with immediate loading on All-on-X implant treatment.

Keywords: *Maxillary Full Arch Rehabilitation, All-on-X Concepts, Pterygoid Implants, Immediate Implants, Immediate Loading, and Immediate Temporisation.*

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I. INTRODUCTION

Periodontitis is a chronic inflammatory disease that affects the supporting tissues of the teeth and, in severe cases, causes tooth movement, masticatory dysfunction, and tooth loss. According to the current classification, Stage IV periodontitis is the most complex type of illness, characterized by significant attachment loss, substantial tooth loss, and functional impairment, whereas Grade C implies rapid advancement and increased risk of future breakdown. Such patients frequently present with impaired dentitions that necessitate full-arch rehabilitation rather than isolated tooth replacement, making implant-supported prosthetic treatment a viable alternative when strategic planning and primary stability are accomplished.

Rehabilitation of edentulous arches using dental implants has become rather common due to the widespread use of dental implants for the restoration of missing teeth.[1] Success or failure in implant therapy is determined by the final outcome. However, even if the aesthetic component is important, the functional component cannot be overlooked. Excellent outcomes for prosthetic restorations on implants are made possible by technological advancements in the creation of new materials and innovative approaches in implant therapy.[2] In addition to aesthetics, the doctor tends to consider phonation, social image, social inhibitions, and a variety of limitations in addition to the patient's subjective assessment.

In case of the edentulous patient, functions must be restored as quickly as possible whereas in patient with severely compromised periodontal conditions or partially

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dentate with insufficient prosthetic work, the therapeutic solution should aim to extract all remaining teeth.[3] Based on these considerations, it is believed that all on 4 or all on X variations with immediate loading is an option to take into account. Comprehending the anatomy of the maxillary bones and accounting for the alveolar mucosa is essential for achieving satisfactory outcomes. Together, these factors will help identify the optimal horizontal and vertical implant site.[4]

Placement of dental implants in the posterior maxilla is challenging due to low-density trabecular bone and the amount of bone is frequently compromised by the maxillary sinus pneumatization.[5,6] After the extraction of posterior maxillary teeth, there is a progressive expansion of sinus volume, in addition to which the alveolar bone resorbs and loses height.[7,8]

The various therapeutic options for placement of implants in the posterior maxilla includes maxillary sinus augmentation, short implants, tilted implants, zygomatic and pterygoid implants.[9]

Sinus augmentation is performed by adding graft material to the sinus floor which is a staged procedure, increases the patient's morbidity and treatment duration. Placement of short implants can be considered when the bone height is deficient but has a higher risk of failure in comparison to longer implants.[10,11] Zygoma implants are anchored directly to the zygomatic bone but the procedure is highly invasive and traumatic as there is a risk of serious harm to important anatomical structures and may cause sinusitis, oroantral fistulas, soft tissue infections and Ehiscence.[12]

Pterygoid implants are an alternative method in the maxillary tuberosity or in the pterygomaxillary region, which eliminates cantilever, gives support and retention for implant and provides bone anchorage in the posterior maxilla without the need for sinus augmentation or further grafting.[13,14] Long implants can enhance initial stability and facilitates long-term success in engaging the cortical bone of the pterygoid plate.[15] However, the procedure may not be suitable for patients who have decreased mouth opening and impacted third molars.[16] The procedural risk includes trismus, intraoperative venous haemorrhage, and implant displacement into the pterygoid fossa.[17]

Clinical evidences have demonstrated the role of immediate implants in limiting physiological bone remodelling following tooth extraction and immediate loading techniques have gained a lot of importance among patients and clinicians.[18] High survival rates and a low incidence of complications demonstrate the predictability of implant treatment, regardless of the loading regimen involved.[19]

This clinical case report presents all on X immediate implant placements with immediate loading followed by definite prosthesis as a treatment modality for rehabilitation of the periodontally compromised maxillary arch.

II. CASE REPORT

A 30-year-old female patient reported to the Department of Periodontics with the chief complaint of loose teeth in her upper and lower jaws for the past two years. She also complained of reduced chewing efficiency and self-conscious about her social image.

She presented with a history of extraction two years ago. On intra-oral examination, missing teeth i.r.t 15, 25, 16, 22, 26, crossbite i.r.t 23 and 33, grade I mobility i.r.t 11, 14, 24, 27, 32, 33, 34, 37, 46, 47, grade II mobility i.r.t 23, 31, 36, 42, 45, trauma from occlusion w.r.t 11and 41, generalized gingival recession, and generalized deep periodontal pockets were noted (figure 1).

Fig 1a: Front View Fig 1b: Right Lateral View Fig 1c: Left Lateral View
Fig 1 Pre-Operative Photographs

On radiological examination, generalised severe bone loss was noted. Patient was diagnosed with Generalised Periodontitis stage IV, grade C (figure 2).

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Fig 2 Pre-Operative Radiograph

She underwent ultrasonic scaling and root planing with gracey curettes for both the arches. Splinting was done from 35 to 44 region followed by open flap debridement for the salvage of the mandibular arch (figure 3).

Fig 3a Fig 3b Fig 3c

Fig 3 Open Flap Debridement done (fig 3a: from 31 to 35, fig 3b: from 42 to 44, fig 3c: Splinting)

Considering the aesthetics, loss of inter maxillary relation and precarious situation of the remaining teeth in the maxillary arch, it was decided to extract all the teeth and insert 6 implants.

Cone beam computed tomography revealed deficient bone in zone three. To increase the anteroposterior (AP) spread and reduce cantilevering force, 2 pterygoid implants were planned, i.r.t 17, 27 and 4 implants out of which 2 axial and 2 distally tilted implants in zone one and zone two respectively. Due to the aesthetic requirements, loading was decided immediately after the insertion of the 6 implants (Quickdent).

➢ *At the Preliminary Appointment:*

- A pre-extraction impression was made using alginate (Algitex).
- The cast was poured with type 3 gypsum product (Kalabhai labstone).
- Jaw relation recorded, the patient's vertical dimension was established and face bow transfer was done onto Hanau's articulator.
- Teeth and shade selection was done.
- Jerbi's cast modification technique was performed on the master cast, teeth arrangement was done and processed, finished and polished.

➢ *Surgical Stage:*

- Local anesthesia 1:80,000 dilution was administered.
- A crevicular incision was given in the dentulous region, and a crestal incision was made in the edentulous region from one tuberosity to the other bilaterally, crossing the midline (figure 4).
- Atraumatic extraction of all the remaining teeth was carried out (figure 5).
- A full-thickness flap was raised both buccally and palatally to expose sufficient visualization of both buccal and palatal cortical plates.
- Alveoloplasty was done to remove irregularities and flatten the ridge.
- In 17 and 27 regions, osteotomy site preparation was performed using pterygoid osteotome and mallet tapping, followed by the placement of pterygoid implants measuring 4.2*20mm (Korticale TPR IH) in both regions with 60Ncm torque (figure 6).
- The anterior sinus wall was traced using a surgical marker in 15 and 25 regions. All on 4 surgical guide was stabilized in the midline, and sequential drills were used to prepare the osteotomy site for implant with 30° angulation measuring 4.2*13mm (OSSI IH) with 50Ncm torque (figure 7).
- Simultaneously axial implants were placed i.r.t 12 and 22

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region measuring

- 4.2*13mm (OSSI IH) 60Ncm torque.
- Relative parallelism was required to obtain a passive adaptation of the prosthetic work, this was achieved by using multi-unit-abutments (MU) of 45° for the pterygoid implants, 30° distally tilted abutments, 17° and 0º angulation for axial implants with different threshold heights, respectively.
- The flap was repositioned and sutured with continuous interlocking suture using 4.0 Vicryl (figure 8).
- Post surgical instructions were given. Antibiotics and analgesics were prescribed for 7 days.

Fig 5 Extraction Socket.

Fig 4 Crestal Incision was given.

Fig 6a Fig 6b

Fig 6 Osteotomy Site Preparation with Pterygoid Osteotome Mallet Tapping i.r.t 17 (Fig 6a) and 27 (Fig 6b).

Fig 7a Fig 7b

Fig 7 Osteotomy Site Preparation Using all on 4 Surgical Guide i.r.t 15(fig 7a) and 25(fig 7b)

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Fig 8 All 6 Implants Placed, Flap Repositioned and Sutured.

➢ *Prosthetic Stage:*

- Appropriate titanium sleeves selected and screwed to the abutments (figure 9).
- An impression of the titanium sleeves was made onto the intaglio surface of the denture with light body elastomeric impression material (Waldent flexident) figure 10).
- Windows were created for the copings through the impression on the denture (figure 11).
- The titanium sleeves stabilized to the denture by injecting cold-cure acrylic resin (DPI RR) around the sleeves.
- Occlusion was established.
- After stabilization of the titanium sleeves to the denture, the sleeves were unscrewed, and the denture was removed along with the sleeves.
- Cold cure acrylic resin (DPI RR) was injected onto the intaglio surface of the denture to obtain an even surface without any irregularities.
- The temporary acrylate prosthesis was finished, polished, inserted, and sleeves were screwed (figure 12).
- Post-insertion instructions were given.
- Suture removal was done 2 weeks post operatively and in order to compensate tissue shrinkage after soft healing, rebasing of temporary acrylate prosthesis with rebasing material (Tokuyama Rebase II Fast) (figure 13).
- Patient was recalled at monthly intervals for maintenance.

Fig 9 Titanium Sleeves Screwed to Abutments.

Fig 10 Markings of Titanium Sleeves on Intaglio Surface.

Fig 11a

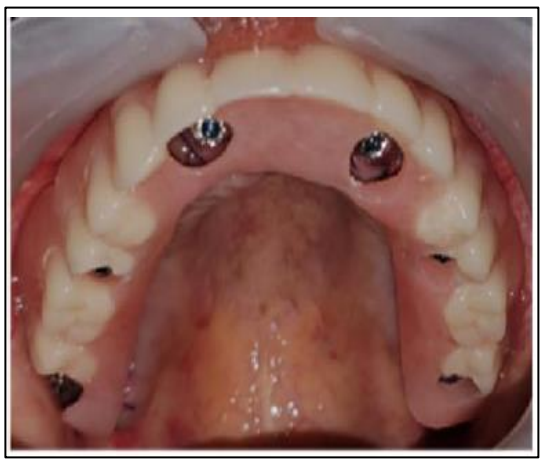

Fig 11b

Fig 11 Windows Created for Titanium Sleeves (11a) and Checked Intra Orally (fig 11b)

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Fig 12a Fig 12b

Fig 12 Temporary Acrylate Prosthesis-Palatal View (12a), Occlusal View (12b).

Fig 13 Provisional Prosthesis after Rebasing.

Patient was recalled after 6 months for definitive prosthesis. Provisional prosthesis was removed, mild inflammation was noted on the mucosa around implants due to pressure (figure 14), to reduce the inflammation of mucosa and to allow it to heal temporary acrylate denture was removed for 2 weeks and healing caps were placed.

Fig 14 Mild Inflammation Noted after Removal of Provisional Prosthesis.

After 2 weeks, reduced inflammation around the healing caps were noted (figure 15). Impression copings were placed, using dental floss all the copings were splinted and pattern resin was added on the floss, jig trail was fabricated and checked for the passive fit (figure 16) and final pickup impression was made w.r.t maxillary arch using putty elastomeric impression material for the fabrication of metal framework. Passive fit of jig was verified on the cast (figure 17).

Fig 15 Reduced Inflammation Around the Healing Caps

Fig 16 Jig Trail Fabrication

Fig 17 Verification of Jig Trail on Cast

After the fabrication of metal framework with NiTi, try in was done intraorally (figure 18 a & b).

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Fig 18a: Frontal View Fig 18b: Occlusal View

Fig 18 Metal Framework Try in Intraorally

Maxillary occlusal rim was fabricated using modelling wax on cold cure acrylic template. Jaw relation was done; as the dental midline was deviated, facial midline was marked, visibility, lip fullness and 2mm freeway space was verified (figure 19).

Fig 19 Jaw Relations Recorded

CAD CAM 3D print mock-up was fabricated (figure 20) according to the jaw relations made, try in of same was done. Midline, visibility, lip fullness, free way space and occlusion were verified (figure 21 a, b & c). Shade selection was done.

Fig 20 CAD CAM 3D Mock up

Fig 21a: Frontal View Fig 21b: Right Lateral View Fig 21c: Left Lateral View

Fig 21 Mock Up Try in done

CAD CAM milled zirconia hybrid FP3 prosthesis was fabricated and was screwed to multiunit abutments (figure 22 a, b & c). Patient was called for follow up every 3 months until one year later every 6 months.

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Fig 22a: Frontal View Fig 22b: Left Lateral View Fig 22c: Right Lateral View

Fig 22 CAD CAM Milled Zirconia Hybrid FP3 Prosthesis

As immediate implants were placed, follow up CBCT was made after 3 months of delivering prosthesis (figure 23 a &b).

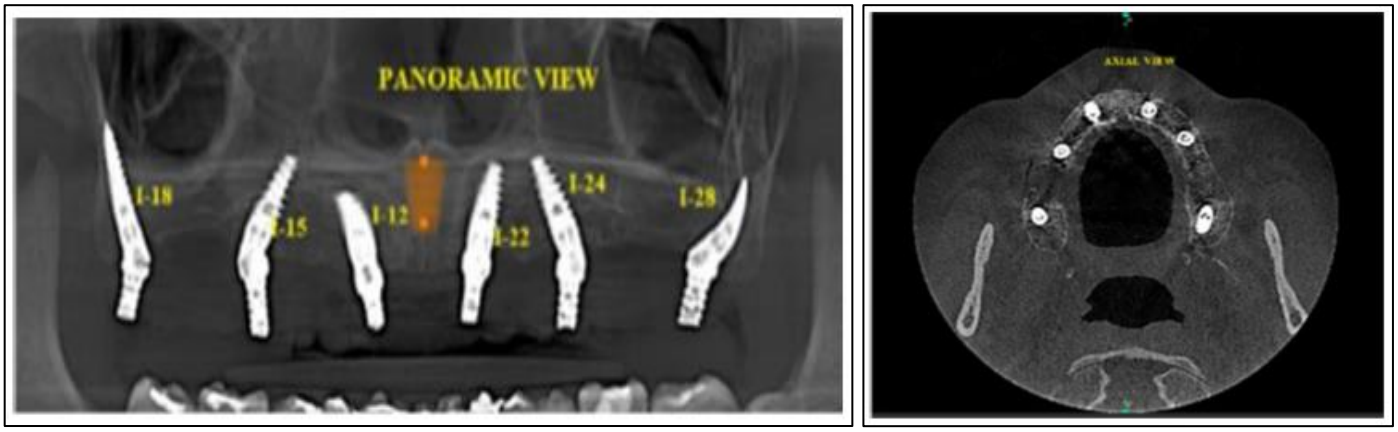

Fig 23a: Panoramic View Fig 23b: Axial View

Fig 23 Post up CBCT at 3 Months Follow up

III. DISCUSSION

It is reported that the implant-supported prosthesis had been well received by the patients because of natural tooth-like aesthetics, function and also because of the prosthesis being fixed to their jaws which is more comfortable compared to the removable prosthesis.

In a Stage IV, Grade C periodontitis patient, the main treatment issue is not only replacing missing teeth but also treating the repercussions of extensive periodontal damage, occlusal instability, and impaired prognosis of remaining teeth. The 2017 World Workshop classification emphasizes that Stage IV disease frequently necessitates complex rehabilitation due to tooth loss, masticatory dysfunction, and the need for restorative management, whereas Grade C indicates the need for strict risk control and careful long-term maintenance. Therefore, a full-arch implant solution using the All-on-X concept can be justified when remaining teeth are unsalvageable and the patient desires a fixed restoration.[20]

The biological risk in Grade C patients is significant since the disease progression is aggressive, and recurrence is possible if plaque reduction and maintenance are inadequate. The EFP guideline for Stage IV periodontitis stresses multimodal care to restore function and address the consequences of tooth loss, which is consistent with implant-prosthodontic rehabilitation following periodontal stability. Thus, this case demonstrates that implants with immediate loading can be a viable therapeutic option for maxillary arch rehabilitation in advanced periodontitis, but long-term success requires strict maintenance, risk-factor control, and prosthetic follow-up.[21,22]

Implants in the posterior maxilla have their own constraints, which include low bone quantity and quality, existence of the maxillary sinus, lack of accessibility, the need to maintain good oral hygiene, and in certain cases obvious excessive occlusal loading in the molar areas.[23] Numerous procedures, including sinus lift with augmentation (direct and indirect), bone augmentation with autogenous grafts (horizontal and vertical), tilted implants (all on 4), and zygomatic implants, have been widely reported in the literature to address these shortcomings.[24] Pterygoid implants avoid the need for sinus lifts and grafting procedures. They allow anchorage in the posterior resorbed maxilla, achieving greater stability and high rates of long-term success.

Immediate implants were first proposed in the late 1970s as a solution to the post-extraction and implant-related bone resorption issues.[25] The idea of this approach was proposed to reduce the number of surgical treatments while simultaneously limiting physiological bone loss, which would improve the aesthetic results.[26] Researchers from the University of Goteborg, Sweden demonstrated that alveolar bone resorbs independent of the timing of implant

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placement and significant dimensional changes in the buccal plate takes place 4-12 weeks following placement of immediate implants.[27] The immediate implant placement in infected tooth sockets may also lead to successful osseointegration.[28]

The All-on-six concept allows an immediate loading and temporary prosthesis of the patient on the same day. Out of six, 2 pterygoid implants in zone 3, 2 axial, and 2 distally tilted in zone 1 and zone 2 respectively were inserted. The distribution of the implants forms a prosthetic polygon enlarged by the distal inclination. Relative parallelism is required to obtain a passive adaptation of the prosthetic work: this was achieved by using multi-unit-abutments of 0°, 17°, 30º and 45° angulations with different threshold heights depending on the thickness of the mucosa.[29] In order to obtain success in oral rehabilitation with four implants in completely edentulous patient, it is necessary to consider bone quality, length and diameter of the implants. It is very important that the prosthesis is inserted in the first 48-72 hours and the abutments are tightened with the necessary torque (approx. 15 N / cm).[30] The prosthesis used in the immediate loading can be made entirely of acrylate or acrylate reinforced with metal structure. The prosthesis must rigidly and firmly join the implants and distribute the forces evenly.

Implant failure in immediate loading is caused by prosthetic causes such as lack of precision / passive adaptation, occlusal causes, decimation of prosthetic work, and prosthesis fracture. Furthermore, posterior cantilevers on implant prosthesis produce complications, such as prosthesis fracture, screw loosening, loss of osseointegration, and crestal bone loss.

Thus, pterygoid implants are an alternative to grafting solutions for posterior maxillary rehabilitation as it eliminates the cantilevering forces, increases the anteroposterior spread, allows establishment of occlusion up till the second molar especially when implant prosthesis opposes the mandibular second molar and also enables to obtain composite torque value of 120Ncm which is necessary for immediate loading.

IV. CONCLUSION

The successful treatment outcome requires correct diagnosis and accurate implant planning. Fixed implant-supported prosthesis is the best option available to the patients for rehabilitation of edentulous arches. Pterygoid implants should be considered when an inadequate bone is present in the posterior maxilla as an alternative to osseous augmentation to permit implant placement. Immediate implant placement reduces the number of surgical treatments and limits physiological bone loss. Immediate loading allows the patient to restore masticatory, physiognomic and phonetic functions in a very short time. Thus immediate implants with immediate loading for rehabilitation of atrophic maxillary arch using all-on-6 concept can be considered as a therapeutic solution.

This case highlights that advanced periodontal destruction should not automatically preclude fixed implant rehabilitation; rather, it calls for a multidisciplinary, risk-based treatment plan. With proper case selection and disciplined follow-up, the All-on-X concept followed by a definitive prosthesis can offer a stable and functional outcome in compromised patients.

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