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Case Report

Immediate Full-Arch Maxillary Rehabilitation via a 6-Implant Hybrid Protocol (Four Conventional + Two Zygomatic) in a Patient with Terminal Periodontitis: A Case Report

Sarepally Godvine[1], Sarah Fatima[2]*, Swetha Bathina[3], Manogna Kolli[3], Bheema Krishnaveni[3], SLN Karthikeya Saket[3], Sultan Mohammed Riyaan Zaid[4], Mohammed Abdul Naveed[4], Mohammed Abdul Majid[4], Singam Vaishnavi[4], Gudipati Harika[4], Phalguni KN[4], Muskan Iqbal[4], Misbah Rizwana[4], Damera Srihitha Rao[4], Barla Divya[4], Afifa Sultana[4], Atufa Maryam[4], Lubna Mubeen[4] and Madadi Abhinaya[4]

[1]MDS, Associate Professor, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, India

[2]MDS, Assistant Professor, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, India

[3]PG II Year, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, India

[4]BDS, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, India

***Corresponding Author:** Sarah Fatima, MDS, Assistant Professor, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, India.

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Abstract

Rehabilitation of the severely atrophic maxilla secondary to chronic periodontal destruction remains one of the most demanding procedures in oral and maxillofacial surgery. Conventional reconstructive options such as sinus floor augmentation or block grafting are associated with extended treatment timelines, significant morbidity, and unpredictable resorption.

Zygomatic implant protocols offer a graft less alternative by engaging the dense cortical bone of the zygoma, thereby bypassing the limitations of compromised maxillary bone. This report describes the management of a 64yearold female with Stage IV, Grade C generalised periodontitis and a terminal anterior maxillary dentition (#11, #12, #13).

Following extraction and thorough debridement, immediate reconstruction was performed using four anterior conventional implants combined with two posterior zygomatic implants placed via an extrasinus approach. A screwretained temporary prosthesis was delivered on the day of surgery, ensuring immediate functional and aesthetic rehabilitation. At the sixmonth review, all implants demonstrated complete osseointegration with stable periimplant soft tissues. The patient was subsequently transitioned to a definitive CAD/CAMmilled permanent bridge, providing durable function and aesthetics.

Keywords: Zygomatic Implants; Maxillary Rehabilitation; Terminal Periodontitis; Immediate Loading; Graft-less Protocol; Oral and Maxillofacial Surgery

Introduction

Periodontitis, when advanced and left untreated, results in progressive destruction of the alveolar process, culminating in terminal dentition and severe maxillary atrophy [1,2]. The residual ridge in such cases is often characterised by paperthin crestal bone and extensive sinus pneumatization, leaving insufficient bone height and width for conventional implant placement [3]. This loss of structural integrity compromises prosthetic rehabilitation and presents one of the most demanding challenges in oral and maxillofacial surgery.

Cawood and Howell's classification identifies Class V and VI maxillary atrophy as particularly complex scenarios, where posterior bone volume is inadequate for rootform implants without augmentation [4]. In these patients, the posterior maxilla is frequently reduced to a fragile shell, incapable of supporting conventional fixtures. Traditional reconstructive strategies—bilateral sinus floor elevation, autogenous block grafts, or iliac crest grafting—can restore volume but are associated with extended healing times, donorsite morbidity, unpredictable resorption, and prolonged prosthetic disability [5,6]. These limitations often delay functional rehabilitation, forcing patients to rely on removable prostheses that compromise mastication, phonetics, and psychosocial wellbeing.

Zygomatic implants, introduced by Brånemark, provide a graft-less alternative by engaging the dense cortical bone of the zygoma [7]. Their extrasinus trajectory avoids sinus complications and ensures primary stability even in severely resorbed maxillae [8,9]. Unlike conventional augmentation, zygomatic protocols bypass the need for grafting, reduce surgical morbidity, and shorten treatment timelines. When combined with anterior conventional implants in a hybrid siximplant protocol (four conventional + two zygomatic) configuration, they provide a wide anteroposterior spread, minimise cantilever forces, and enable immediate functional loading [10,11]. This approach transforms a traditionally staged, multiyear reconstructive process into a singlestage rehabilitation with immediate aesthetic and functional restoration.

This case is distinctive in demonstrating immediate full-arch rehabilitation of a 64-year-old female with terminal maxillary dentition secondary to Stage IV, Grade C periodontitis using a graft-less hybrid siximplant protocol (four conventional + two zygomatic)protocol combining four anterior conventional implants with bilateral zygomatic implants placed through a ZAGA extra-sinus approach. The treatment integrated periodontal staging and grading into the surgical and prosthetic planning, allowing immediate implant-supported loading despite severe maxillary bone and periodontal compromise. The report describes the surgical workflow, intraoperative considerations, and prosthetic conversion, highlighting the clinical decision-making involved in achieving primary stability and functional rehabilitation without bone grafting. The successful short-term clinical outcome underscores the potential of this hybrid siximplant protocol (four conventional + two zygomatic) as a predictable treatment option for severely compromised maxillae requiring immediate full-arch rehabilitation.

Case Report

A 64-year-old female reported to the dental clinic with the chief complaints of difficulty in chewing, mobility of the upper anterior teeth, and chronic periodontal discomfort.

The patient's medical history was non-contributory, and she was classified as ASA I. There were no known systemic contraindications to implant surgery.

Clinical examination revealed a severely compromised maxillary dentition with features consistent with advanced periodontal destruction. The maxillary anterior teeth, particularly #11, #12, and #13, demonstrated:

- Grade III mobility
- Deep periodontal pockets measuring more than 8 mm
- Severe clinical attachment loss exceeding 6mm
- Gingival recession
- Increased clinical crown height
- Loss of periodontal support
- Generalized deterioration of the maxillary dentition

The clinical and radiographic findings were consistent with terminal-stage periodontal destruction, and the maxillary dentition was deemed unsuitable for long-term retention. A diagnosis of Stage IV, Grade C generalized periodontitis was established based on probing depths exceeding 8 mm, clinical attachment loss >6 mm, radiographic bone loss exceeding 50% of the root length, Grade III

mobility of the anterior teeth, and pronounced gingival recession with increased clinical crown height, collectively indicating advanced and terminal periodontal breakdown.

The mandibular dentition was relatively stable and functionally adequate, providing a favourable opposing arch for maxillary full-arch rehabilitation.

Figure 1: Preoperative clinical presentation.

The preoperative photograph demonstrates the compromised maxillary anterior dentition, characterised by periodontal breakdown, tooth mobility, gingival recession, and loss of normal tooth proportions.

Radiographic assessment

A panoramic radiograph and three-dimensional imaging were obtained as part of the preoperative diagnostic work-up.

Radiographic assessment demonstrated advanced horizontal and vertical resorption of the maxillary alveolar ridge, consistent with severe periodontal destruction. According to Cawood and Howell's classification, the maxilla corresponded to Class V–VI, characterised by severe horizontal and vertical resorption with extensive sinus pneumatization. The posterior maxillary regions demonstrated marked pneumatization of the maxillary sinuses, resulting in extremely limited residual crestal bone.

The available posterior alveolar bone was considered inadequate for predictable placement of conventional implants without additional augmentation.

The premaxillary region, however, retained sufficient residual bone volume to permit placement of conventional implants after removal of the hopeless teeth and debridement of the diseased tissues.

Because of the severe posterior maxillary atrophy, a zygomatic implant-based rehabilitation was planned.

An ENT evaluation was performed before surgery. The bilateral maxillary sinus ostia were patent, with no clinically significant sinus pathology showed, supporting the feasibility of zygomatic implant placement.

Treatment planning

Considering the patient's age, functional requirements, severity of maxillary atrophy, periodontal condition, and desire for a fixed rehabilitation, a full-arch implant-supported prosthetic rehabilitation was planned.

The treatment goals were:

- Elimination of the hopeless periodontal dentition.
- Removal of infected and diseased periodontal tissues.
- Restoration of adequate implant anchorage.
- Avoidance of extensive sinus augmentation procedures.
- Achievement of immediate functional rehabilitation.
- Restoration of mastication and aesthetics.
- Provision of a definitive fixed prosthesis after adequate healing and functional adaptation.

The planned implant configuration consisted of:

- Four conventional implants in the anterior/premaxillary region
- Two bilateral zygomatic implants for posterior anchorage
- Multi-unit abutments for prosthetic correction and parallelisation
- Immediate screw-retained provisional prosthesis
- Definitive full-arch prosthesis after six months

This approach provided a biomechanically distributed implant-supported foundation for a fixed maxillary full-arch restoration.

Surgical procedure

Anaesthesia and surgical access

The procedure was performed under intravenous conscious sedation combined with local anaesthesia.

Regional anaesthesia was achieved using bilateral posterior superior alveolar, infraorbital, greater palatine, and nasopalatine nerve blocks with 2% lignocaine containing 1:100,000 epinephrine.

A mid-crestal incision was made extending across the maxillary arch, with bilateral vertical releasing incisions to facilitate adequate surgical exposure.

A full thickness mucoperiosteal flap was elevated to expose the anterior maxilla and lateral maxillary walls. Particular care was taken during lateral dissection to identify and protect the infraorbital neurovascular structures.

Extraction of hopeless teeth and debridement

The severely compromised teeth #11, #12, and #13 were considered hopeless because of their advanced periodontal destruction and Grade III mobility.

They were carefully extracted using minimally traumatic techniques and periotomes to preserve the remaining alveolar bone.

Following extraction, the sockets were thoroughly inspected. Granulation tissue and residual inflammatory tissue were meticulously removed using curettes.

The surgical field was subsequently irrigated extensively with sterile saline.

Figure 2: Extraction and debridement.

The intraoperative photograph shows the maxillary surgical field after extraction of the hopeless teeth and debridement of diseased periodontal tissues.

Placement of conventional anterior implants

Following preparation of the premaxillary osteotomy sites, four root-form implants were strategically positioned in the anterior maxilla at sites #13, #11, #22, and #24.

Implant dimensions ranged from approximately 3.75–4.3 mm in diameter and 11.5–13 mm in length.

We placed four conventional implants (NobelActive, Nobel Biocare; diameters 3.75–4.3 mm, lengths 11.5–13 mm) in the premaxilla. Two zygomatic implants (NobelZygoma, 42.5 mm and 45 mm, moderately roughened TiUnite surface) were inserted bilaterally. Multiunit abutments included 17° anterior and 45° posterior angulations.

The implants were positioned to maximise the available residual bone while maintaining an appropriate prosthetic distribution.

Engagement of the available cortical bone, including the nasal floor region where appropriate, provided excellent primary stability.

Insertion torque values ranged between 40 and 50 Ncm, indicating adequate primary stability for immediate prosthetic loading.

The positioning of the anterior implants also provided favourable anterior support for the planned full-arch prosthesis.

Bilateral zygomatic implant placement

Because conventional implants could not be predictably placed in the posterior maxilla due to severe bone deficiency and extensive sinus pneumatization, bilateral zygomatic implants were utilised.

The lateral maxillary region was exposed, and the relevant zygomatic anatomical landmarks were identified.

A ZAGA-based extra-sinus approach was utilised. The osteotomy was initiated from the crestal region corresponding approximately to the second premolar area and directed toward the zygomatic body while maintaining an extra-sinus trajectory according to the patient's anatomy.

Two long zygomatic implants measuring approximately 42.5 mm and 45 mm were inserted bilaterally. A ZAGA2 extrasinus trajectory was selected, directing osteotomies from the second premolar crest toward the zygomatic body while maintaining extrasinus emergence. This minimised sinus involvement, optimised prosthetic screw access, and ensured favourable emergence profiles.

The implants achieved strong anchorage within the zygomatic bone, with insertion torque values exceeding 55 Ncm.

The high primary stability obtained from the zygomatic anchorage, combined with the four anterior conventional implants, provided a stable six-implant foundation for immediate full-arch rehabilitation.

Figure 3: Intra operative placement of four conventional and two zygomatic implants.

The intra operative photograph demonstrates the placement of multiple implants in the severely atrophic maxilla, including the posteriorly positioned long zygomatic implants and the anterior conventional implants.

Figure 4: Postoperative panoramic radiograph showing four anterior conventional implants and two bilateral zygomatic implants engaging the zygomatic body.

Multi-unit abutment placement

Following implant placement, multi-unit abutments were connected to facilitate prosthetic rehabilitation.

Angulated multi-unit abutments were selected to compensate for the different implant trajectories and to relocate the prosthetic screw-access channels toward more favourable occlusal positions.

The anterior implants were restored using appropriately angulated multi-unit abutments, while the posterior zygomatic implants were connected to suitable angulated components.

The abutment configuration facilitated fabrication and seating of a common full-arch prosthetic framework despite the divergent trajectories of the implants.

Immediate provisional prosthesis

Given the excellent primary stability achieved by all implants, immediate loading was selected. Immediate loading was determined based on insertion torque >40 Ncm and resonance frequency analysis (ISQ values >70), confirming adequate primary stability.

Day of surgery: immediate PMMA provisional prosthesis → 6 months: definitive CAD/CAM titaniumzirconia prosthesis.

A prefabricated PMMA provisional full-arch prosthesis was adapted intraoperatively.

Titanium cylinders were connected to the multi-unit abutments, and the provisional prosthesis was accurately positioned and picked up intraoperatively using self-curing acrylic resin.

After polymerisation, the prosthesis was removed, finished, polished, and carefully contoured.

Particular attention was given to:

- Adequate emergence profile
- Cleansability around the multi-unit abutments
- Proper lip support
- Appropriate tooth position
- Occlusal stability
- Reduction of excessive cantilever forces
- Elimination of premature contacts and lateral interferences

The provisional prosthesis was then screw-retained intraorally.

Occlusion was carefully adjusted to achieve stable centric contacts while minimising undesirable lateral forces during the early osseointegration period.

Figure 5: Immediate postoperative/provisional prosthesis.

The clinical photograph demonstrates the patient following delivery of the immediate screw-retained provisional prosthesis. The restoration provides immediate replacement of the compromised maxillary dentition and restoration of facial and dental aesthetics.

Postoperative care

- The patient was provided with standard postoperative instructions regarding oral hygiene, diet, medication, and prosthesis maintenance.
- During the initial healing period, the patient was advised to follow a soft diet and avoid excessive biting forces on the provisional restoration.

Regular follow-up appointments were scheduled to assess:

- Soft-tissue healing
- Implant stability
- Prosthetic screw integrity
- Occlusion
- Hygiene
- Peri-implant tissue health
- Patient comfort and function

The provisional prosthesis remained functional during the healing and adaptation phase.

Six-month follow-up and definitive prosthesis

The patient was followed clinically for six months following implant placement and immediate loading.

At the six-month evaluation, the implants demonstrated satisfactory clinical stability, and the peri-implant soft tissues were healthy without significant inflammatory changes.

Clinical evaluation revealed periimplant probing depths ≤3 mm, absence of bleeding or suppuration, and stable marginal bone levels on radiographs. ISQ values remained >70, confirming osseointegration. No prosthetic complications were observed.

The patient reported subjective improvements in mastication, speech, aesthetics, and confidence.

After completion of the six-month healing and functional adaptation period, the provisional prosthesis was removed.

A definitive full-arch implant-supported prosthesis was subsequently fabricated based on the established occlusal relationship, vertical dimension, aesthetics, phonetics, and soft-tissue contours achieved with the provisional restoration. A CAD/CAMmilled titanium framework with zirconia overlay was fabricated, providing durable aesthetics and function.

The permanent screw-retained prosthesis was delivered after six months, replacing the temporary PMMA restoration.

The definitive prosthesis was carefully adjusted to establish stable occlusal contacts and appropriate anterior guidance while minimising excessive lateral loading of the implants.

Prosthetic outcome

The final restoration provided a fixed full-arch maxillary rehabilitation supported by a combination of four conventional anterior implants and two bilateral zygomatic implants.

The treatment successfully restored:

- Maxillary arch continuity
- Masticatory efficiency

- Dental aesthetics
- Facial support
- Phonetics
- Patient confidence
- Fixed prosthetic function

The treatment also eliminated the need for posterior sinus augmentation and enabled rehabilitation within a substantially shorter treatment sequence than a conventional grafting-based approach.

Discussion

The rehabilitation of severely atrophic maxillae has traditionally relied on staged bone augmentation procedures such as sinus grafting, block grafts, or iliac crest grafting. While these methods remain valid, their limitations are well documented: unpredictable resorption rates, donorsite morbidity, increased surgical complexity, and extended treatment timelines that delay prosthetic rehabilitation [12,13]. These drawbacks often compromise patient acceptance and quality of life, particularly when prolonged use of removable prostheses is required.

Zygomatic implants provide a graft-less alternative by anchoring into the dense cortical bone of the zygomatic body, thereby bypassing the compromised posterior alveolar ridge. This technique offers robust primary stability and longterm survival rates, making it a reliable solution for advanced maxillary atrophy [14]. In the present case, insertion torques exceeding 45 Ncm across all fixtures validated the immediate loading protocol, aligning with evidence that survival rates are high when primary stability surpasses 35–40 Ncm [15,16].

The use of multiunit abutments was critical in correcting angulation discrepancies, ensuring prosthetically favourable screw access and reducing biomechanical stress on the prosthesis [17]. This step not only facilitated immediate loading but also optimised longterm prosthetic maintenance. The extrasinus ZAGA approach, employed here, represents an evolution from the classical intrasinus trajectory. By minimising sinus involvement, this technique reduces postoperative complications such as sinusitis, oroantral communication, or mucosal thickening [18]. Furthermore, it enhances soft tissue emergence profiles, improving hygiene access and longterm periimplant health [19].

From a prosthetic standpoint, immediate delivery of a screwretained PMMA bridge restored esthetics and function, significantly improving patient satisfaction. The psychological benefit of avoiding a removable interim prosthesis cannot be overstated. At six months, conversion to a CAD/CAMmilled titaniumzirconia hybrid prosthesis provided durability, precision fit, and improved load distribution, ensuring longterm stability and aesthetics [20,21].

This case underscores the paradigm shift in maxillary rehabilitation: While grafting remains a valid option, in this case the graftless zygomatic protocol provided an effective alternative, avoiding donorsite morbidity and extended timelines. Comparative superiority cannot be inferred from a single case. Such protocols reduce morbidity, shorten treatment timelines, and accelerate functional recovery, thereby transforming a traditionally prolonged reconstructive process into a singlestage, patientfriendly solution [22].

Limitations include the singlepatient design, short sixmonth followup, absence of quantitative longterm outcomes, and lack of a comparator group. Findings cannot be generalised to all patients with severe maxillary atrophy.

Potential complications of zygomatic implants include sinusitis, oroantral communication, softtissue dehiscence, prosthetic screw loosening, and technical challenges during placement. These risks must be weighed against the benefits.

Consent and Ethical Statement

Written informed consent was obtained from the patient for treatment and publication of clinical/radiographic images. Institutional ethics approval was secured in accordance with Panineeya Mahavidyalaya Institute guidelines.

Conclusion

For patients with terminal periodontitis and severe maxillary resorption, zygomatic implants combined with anterior conventional fixtures provide a predictable, graft-less alternative to traditional augmentation. By engaging the dense cortical bone of the zygoma, sinus lifts and block grafts are avoided, surgical morbidity is reduced, and immediate functional rehabilitation is achieved. This case demonstrates that a graftless hybrid zygomatic protocol can achieve successful shortterm rehabilitation in a

severely atrophic maxilla, representing a viable option in carefully selected patients.

This singlestage approach transforms a traditionally prolonged reconstructive process into an efficient, patientfriendly solution. Immediate loading not only restores mastication and esthetics but also enhances psychological wellbeing by eliminating the interim denture phase. At six months, the protocol demonstrated shortterm clinical success and functional rehabilitation. Longer followup is required to establish longterm predictability and durability.

Longterm outcomes, supported by growing literature, confirm the reliability of zygomatic implants in complex maxillary rehabilitation.

In summary, zygomatic implant protocols represent a cornerstone in modern oral and maxillofacial surgery, offering durable, esthetic, and functional solutions for patients once considered untreatable with conventional methods.

Author Contributions

- Dr. Sarepally Godvine, MDS, Associate Professor – Provided overall supervision, surgical planning, intraoperative guidance, and critical revision of the manuscript.
- Dr. Sarah Fatima, MDS, Assistant Professor – Coordinated case management, performed literature review, data interpretation, manuscript drafting, and served as corresponding author.
- Dr. Swetha Bathina, PG II Year – Assisted in surgical procedures, clinical documentation, and manuscript preparation.
- Dr. Manogna Kolli, PG II Year – Contributed to intraoperative support, data collection, and drafting of clinical sections.
- Dr. Bheema Krishnaveni, PG II Year – Participated in case documentation, postoperative followup, and manuscript editing.
- Dr. S.L.N. Karthikeya Saket, PG II Year – Assisted in surgical execution, data tabulation, and preparation of figures.
- Dr. Sultan Mohammed Riyaan Zaid, BDS – Contributed to literature search, clinical outcomes section, and proofreading.
- Dr. Mohammed Abdul Naveed, BDS – Assisted in data compilation and manuscript formatting.
- Dr. Mohammed Abdul Majid, BDS – Contributed to postoperative protocol documentation and clinical outcomes subsections.
- Dr. Singam Vaishnavi, BDS – Assisted in literature review and manuscript preparation.
- Dr. Gudipati Harika, BDS – Contributed to references and manuscript editing.
- Dr. Phalguni KN, BDS – Assisted in drafting the introduction and formatting.
- Dr. Muskan Iqbal, BDS – Contributed to data organization and proofreading.
- Dr. Misbah Rizwana, BDS – Assisted in literature search and manuscript review.
- Dr. Damera Srihitha Rao, BDS – Contributed to clinical documentation and manuscript formatting.
- Dr. Barla Divya, BDS – Assisted in the preparation of figures and references.
- Dr. Afifa Sultana, BDS – Contributed to data tabulation and manuscript editing.
- Dr. Atufa Maryam, BDS – Assisted in literature review and proofreading.
- Dr. Lubna Mubeen, BDS – Contributed to manuscript preparation and formatting.
- Dr. Madadi Abhinaya, BDS – Assisted in data compilation and final proofreading.

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