

Graftless complete arch rehabilitation using a facial approach for enhanced bone anchorage and prosthetic outcomes: A clinical report

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CLINICAL REPORT

Graftless complete-arch rehabilitation with a facial approach for enhanced bone anchorage and prosthetic outcomes: A clinical report

ABSTRACT

This clinical report introduces a novel approach for the placement of anterior implants in maxillae with severe atrophy, with the objective of reducing anterior cantilever length and enhancing bone anchorage. By sagittally tilting the anterior implants to emerge facially rather than palatally, the procedure enhances prosthetic screw position and decreases the risk of a bulky prosthesis. Two zygomatic implants were placed posteriorly for additional support, and bilateral paranasal prostheses helped restore midfacial contours. Early follow-up showed stable implants and good soft tissue health. Longer-term studies and clear patient selection criteria are needed to confirm the effectiveness of the technique.

Graftless treatment options for complete arch rehabilitation have been shown to be predictable and effective,¹⁻⁴ as an alternative to more invasive approaches.^{5,6} Posterior support has been successfully addressed through the tilting of posterior implants,⁷⁻¹³ the placement of

pterygoid implants,¹⁴ or the use of zygomatic anchorage,^{3,15–20} effectively reducing or eliminating unfavorable posterior cantilevers.

Anterior anchorage in the maxillae has traditionally been achieved by utilizing the residual bone through a standard implant placed via a palatal approach²¹ or by employing zygomatic implants.^{14,15,19} More recently, transnasal implants, though still under development, have also been explored.^{22,23} However, the complete arch rehabilitation are, in some clinical scenarios, associated with significant prosthetic drawbacks.^{24,25}

Since maxillary resorption in the anterior region progresses from anterior to posterior,²⁶ it is common to encounter a Class III or pseudo-Class III intermaxillary relationship.^{27,28} This tends to lead to an anterior cantilever can be associated with a prosthesis with increased bulk, leading to screw access holes being positioned too far posteriorly relative to the prosthetic teeth. This unfavorable positioning may adversely affect speech, complicate hygiene, and compromise biomechanics.^{24,25,29}

Addressing the effects of facial aging is also essential for achieving comprehensive therapeutic outcomes in edentulous patients. A variety of techniques, materials, and adjunctive solutions have been documented, which can be strategically implemented to optimize treatment results.^{30–40} This clinical report describes a novel surgical approach aimed at achieving optimal prosthetic outcomes in complex situations, while secondarily enhancing facial esthetics through adjunctive treatment.

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A 78-year-old female on levothyroxine and losartan presented with an atrophic maxilla. The lower arch had well-conditioned anterior teeth and implant-supported prostheses from the left

first premolar to the left first molar and the right canine to the right first molar. A well-fitting maxillary denture, along with the well-aligned occlusal plane, ensured stable occlusion, serving as a reference for treatment planning (Fig. 1). Reverse treatment planning was performed using the digitized denture as a prosthetic reference in a software program (BlueSkyPlan; BlueSkyBio, LLC). Two 3.8×8-mm Morse taper conical-connection implants (EpikutCM; SIN Implant System) were simulated in the anterior region using a palatal approach. However, the evaluation revealed that the prosthetic screw emergence would be too far from the anterior dental axis (Fig. 2). To optimize the prosthetic outcome, the anterior implants were simulated in a transpalatal position, with the implant head emerging facially. This improved bone anchorage and allowed for a longer (3.8×11.5 mm) implant. A 30-degree angled mini-abutment enhanced the prosthetic screw's emergence profile (Fig. 3). Two zygomatic implants were simulated for posterior support.

To evaluate the effect of omitting the flange in a fixed dentogingival prosthesis, a diagnostic trial prosthesis was created by digitally removing the flange from the left hemi-arch and 3D printing it in biocompatible resin (PriZma 3D Bio Prov; Makertechlabs). The evaluation revealed reduced dental exposure and a depression in the left labial region. Preoperative discussions confirmed the need for bilateral paranasal prostheses.

Under general anesthesia, a mucosa-supported surgical guide was employed for flapless initial demarcation of the osteotomy sites. Subsequently, a supracrestal incision was made along the maxillary ridge, complemented by 2 vertical incisions over the zygomatic buttress. In the anterior region, the incision was made palatal to the initial implant perforations. A full-thickness mucoperiosteal flap was elevated, followed by osteotomies for placing 4 implants: 2 anterior implants and 2 posterior 4.0×40 mm zygomatic implants (ZygomaticPlus; SIN Implant

System) (Fig. 4,5).

All implants achieved insertion torque values around 45 Ncm. Forty-five-degree angled abutments (Indexed 45-Angled Multi-Unit Abutment; SIN Implant System) were placed on the zygomatic implants and 30-degree angled abutments (Indexed 30-Angled Multi-Unit Abutment; SIN Implant System) were installed on from anterior implants. As planned, 2 paranasal prostheses were intraoperatively fabricated using polymethyl methacrylate (PMMA) surgical cement (C-MAXX; Cimtech), following a previously published protocol³⁸ and secured with 2 titanium screws on each side in the paranasal area (Fig. 6). To enhance the anterior ridge volume and improve lip support, 0.5 g of hydroxyapatite (Osteogen; Intra-Lock) was applied.

The flap was closed using 4-0 polyglactin 910 sutures (Vicryl; Ethicon) (Fig. 7). Impressions were made, and a complete acrylic resin prosthesis with a metal infrastructure was delivered 3 days after surgery.

Recovery was uneventful. At 3.5 months, all implants had been successfully osseointegrated with healthy soft tissues (Fig. 8). A cone beam computed tomography (CBCT) scan confirmed accurate positioning of the bilateral zygomatic implants within the zygomatic bone and proper sagittal and facial emergence of anterior implants. The bilateral PMMA prostheses extended to the infraorbital nerve limits (Fig. 9) for enhanced facial esthetics (Fig. 10), and the definitive restoration showed optimal implant distribution, cantilever design, and tooth-screw distance (Fig. 11).

DISCUSSION

The palatal approach, a well-established graftless technique for anterior implant placement

within the All-on-4 concept, utilizes the residual bone for anchorage^{11,13}; However, in cases like this, it may lead to excessive anterior cantilevering, bulky prostheses, and posteriorly positioned anterior screw access channels, potentially compromising speech, hygiene, and biomechanical stability.^{24,25,29} Furthermore, this approach fails to adequately address the challenges associated with lip support and the correction of deficiencies in the paranasal area.³²

The combination of Le Fort I osteotomy and iliac bone graft effectively enhances facial esthetics and prosthetic outcomes in atrophic maxillae but requires extensive grafting.^{5,6} Using Le Fort I osteotomy with zygomatic implants offers a less graft-dependent alternative but is highly invasive and complex.⁴¹

Less invasive techniques, such as the utilization of particulate xenografts in conjunction with collagen membranes,¹⁹ or a pedicled fat pad,⁴² have been proposed to enhance the sagittal support of the superior lip. The primary effects of these interventions could improve the lip support, but do not adequately address the anterior cantilever challenges associated with the palatal positioning of the implant and the prosthetic outcomes.^{24,25} Similarly, challenges persist with transnasal implants and zygomatic anchorage.

The facial approach, as described in this clinical report, presents some potential advantages. By placing the implants in a more horizontally or tilted position, with the implant head emerging from the facial aspect of the residual ridge, the anterior cantilever length is minimized, leading to a more favorable prosthetic outcome. This technique allows the use of longer implants, thereby increasing bone anchorage. The utilization of angled abutments facilitates precise adjustment and optimal positioning relative to the definitive restoration. In the current patient, a 30-degree abutment provided adequate correction.

Despite the unconventional nature of this approach, the biomechanical principles

governing implant dentistry remain consistent. Critical implant techniques that involve the placement of implants in a tilted fashion in posterior regions, subject to high occlusal forces,⁴³ and the extension of some implants beyond the bone envelope, such as tilted transsinus or extramaxillary zygomatic implants, deviate from conventional intraosseous approaches. However, they still adhere to the principles of osseointegration and demonstrate a high success rate.^{3,10,12} The All-on-4 concept demonstrates a high success rate, even when the implant insertion torque is low.¹¹

In the facial approach, the biomechanics are comparable to those of distally tilted implants, which are well-supported by evidence⁷⁻¹⁰; however, the implant remains entirely within the bone envelope and is tilted facially, positioning it in a region subjected to relatively lower occlusal forces compared to the molar area.⁴³ In contrast to the zygomatic externalized technique,³ where implant threads are exposed in the buccal region, this novel approach ensures that no implant threads are exposed.

Conversely, the facial approach presents certain limitations. One key concern is the facial emergence of the implant head and abutment in an area lacking keratinized mucosa. Although keratinized mucosa is generally recommended⁴⁴, maintaining optimal oral hygiene, as demonstrated in this case, may help prevent soft tissue complications. However, soft tissue grafting can be considered for future cases.

Facial aging involves a clockwise rotation of the maxillae, necessitating consideration of skeletal changes for effective treatment. In maxillary complete dentures, the labial flange is crucial for lip support and esthetics. However, in cases of severe maxillary atrophy, traditional flanges often fail to restore midfacial contours, particularly in the paranasal region.³⁻³³

Paranasal prostheses address these deficiencies by supporting nasolabial and labial tissues, enhancing esthetics and patient satisfaction. Various materials can be used,^{34–37,40} but polymethyl methacrylate (PMMA) was chosen for its transsurgical molding capability and proven craniofacial safety.³⁹

SUMMARY

This clinical case demonstrates the possibility of a facial approach for anterior implant placement in graftless complete-arch rehabilitations, addressing the challenges of severe maxillary atrophy. By tilting the implant sagittally to emerge from the facial side of the maxillary ridge, this approach enhanced bone anchorage, reduced anterior cantilever, and improved prosthetic outcomes. Paranasal prostheses enhanced midfacial support and aesthetics. Further research is needed to validate the long-term efficacy of the facial approach and refine guidelines.

PATIENT CONSENT

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

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FIGURES

Fig. 1. Initial condition of the maxillary denture, antagonist arch, and occlusal plane.



Fig. 2. Virtual simulation of a 3.8×8.5 mm anterior implant using a palatal approach in the region of the right central incisor and the prosthetic emergence.

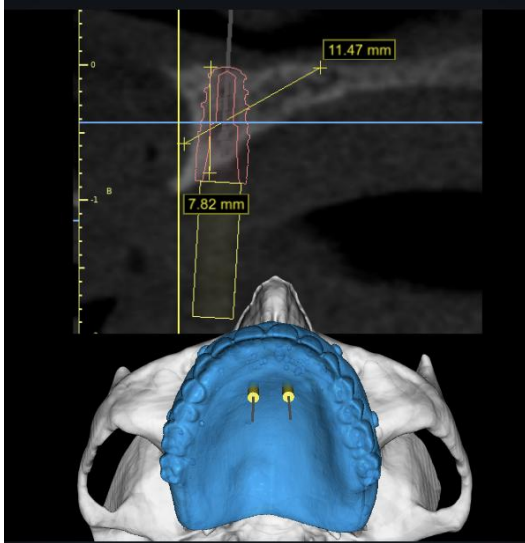


Fig. 3. Virtual simulation of a 3.8×11.5 mm anterior implant shows its head emerging facially from the residual ridge, with the 30-degree abutment enhancing prosthetic alignment.

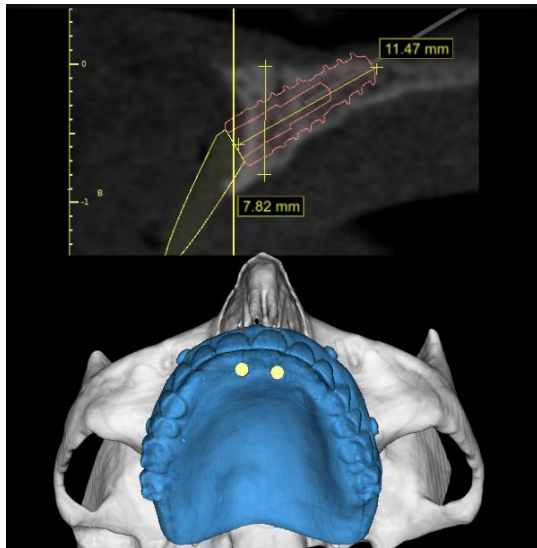


Fig. 4. Outcome of the facial approach initial osteotomy compared with the prototype.



Fig. 5. Clinical aspects of the 4 implants and their respective abutments installed.



Fig. 6. The final configuration of the bilateral PMMA paranasal prostheses and the anterior ridge volume enhanced by the addition of 0.5 g of hydroxyapatite.

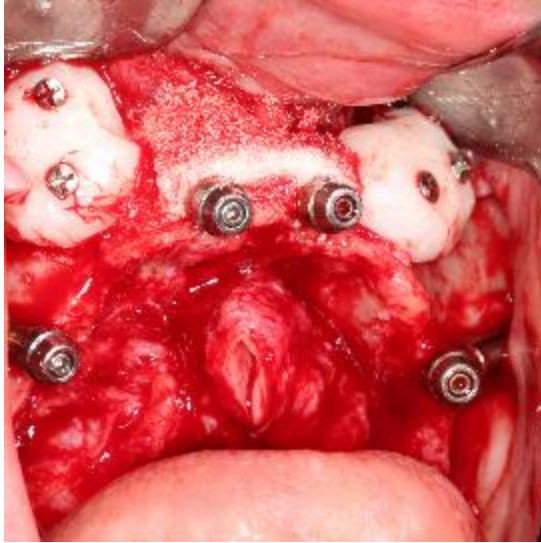


Fig. 7. Post-suturing evaluation of the soft tissue reveals a lack of keratinized mucosa surrounding the anterior implants.

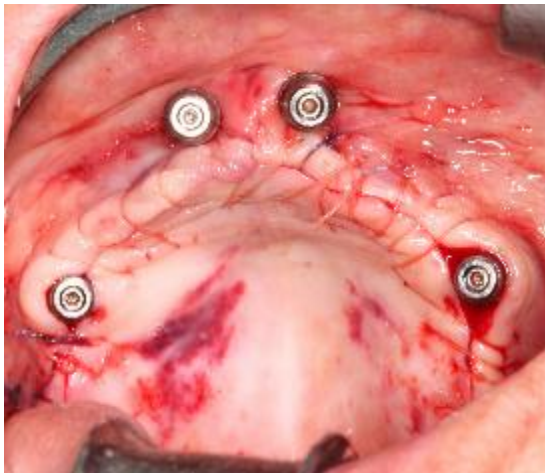


Fig. 8. Following the healing period, the gingival aspect exhibits characteristics indicative of healthy tissue.



Fig. 9. Postoperative CBCT scan illustrates the comprehensive scope of the bilateral PMMA paranasal prosthesis.

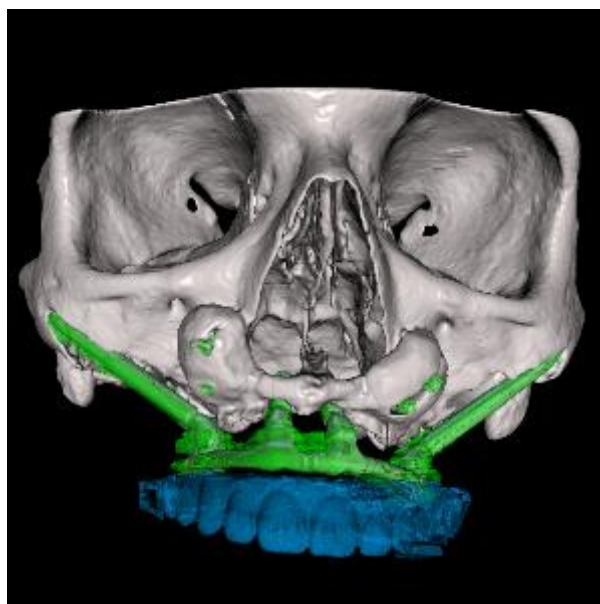


Fig. 10. Comparison of dental and facial outcomes prior to intervention and subsequent to the completion of definitive restoration.



Fig. 11. The definitive restoration illustrates the emergence of screws, the distribution of implants, and the incorporation of a short anterior and posterior cantilever.

