Case Report

Clinical outcomes of bizygomatic with anterior implants for restoring atrophic maxilla and all-on-four implants for restoring mandible: A case report

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ABSTRACT

Atrophic jaws present significant challenges for rehabilitation due to limited bone availability, which complicates traditional implant placement. This case report presents the clinical outcomes of using zygomatic implants for the maxilla and the all-on-four concept for the mandible in a 57-year-old male with severe atrophy of maxillary and mandibular ridges. Two zygomatic implants were placed in the maxilla, along with four anterior conventional implants, while the all-on-four technique was utilized in the mandible. The surgical procedure and prosthetic rehabilitation are described. Follow-up at 1 year showed excellent prosthetic stability, rapid osseointegration, and improved quality of life. This combined approach demonstrated successful rehabilitation without extensive bone grafting, offering immediate functionality and esthetic improvement. This case highlights the efficacy of zygomatic implants and the all-on-four concept in managing atrophic jaws, providing an alternative to traditional bone augmentation procedures. However, long-term studies are needed to establish these techniques as standard treatment protocols.

Key words: All-on-four implants, Atrophic maxilla and mandible, Edentulous jaws, Full mouth rehabilitation, Zygoma implants

Implant placement in atrophic maxilla is challenging due to bone loss and maxillary sinus pneumatization, resulting in poor bone quality and reduced density, which compromise long-term implant success [1]. Historically, total maxillary edentulism was treated with removable prostheses [2,3] but the advent of osseointegrated implants has expanded treatment options [4]. An almost typical dental rehabilitation has a strong base due to implants of the right size positioned in high-quality bone with optimal angulation [5]. However, such ideal conditions are rare. Depending on the available quantity of bone, the viable options for addressing these challenges are either augmenting the existing bone structure or selecting an alternative site. Engaging implants in the pterygoids, zygoma, or maxillary tuberosity is an alternative to bone grafting [6].

Branemark first presented zygomatic implants in 1988, which were intended for patients with significant maxillary defects brought on by trauma, tumors, and congenital issues. Their use has since expanded to include treating severely atrophic edentulous patients and cases where maxillary sinus augmentation has failed [7]. Zygoma implants are anchored in the zygomatic bone, eliminating the need for bone grafts and achieving success rates of 95.8–99.9%. They offer various configurations for full-arch maxillary rehabilitation [8].

This case report highlights the efficacy of zygomatic and all-on-four implants in managing atrophic jaws by implementing virtual surgical planning, a viable alternative without the need for extensive bone grafting.

CASE REPORT

A 57-year-old male patient visited the Department of Oral and Maxillofacial Surgery due to loose teeth. The patient requested the extraction of the teeth, as well, as the placement of a fixed dental prosthesis. The patient reported functional, as well as, esthetic difficulties, including impaired speech, mastication, and compromised facial appearance. Extraoral examination revealed a sunken appearance of the lower and midface, with sagging facial muscles and soft tissues. Intraoral examination revealed teeth with grade II mobility in 11, 21 and grade III mobility in 12, 13, 14, 23, 24, 45, 43, 33, 34, 35 along with significant mandibular and maxillary ridge resorption (Fig. 1).

Following extraction of the twelve periodontally compromised teeth in the maxillary and mandibular region and a 6-month

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healing period, a cone-beam computed tomography (CBCT) scan was taken to evaluate the edentulous atrophied regions. CBCT findings revealed a scarcity of bone height and density (Fig. 2). As per the treatment plan, the atrophied posterior maxilla received two zygomatic implants, the anterior maxilla received conventional implants, and the mandible received all-on-four implants for complete oral rehabilitation.

Pre-operative assessment and virtual surgical planning were carried out, allowing prediction of implant dimensions and optimal placement (Fig. 3). The virtual placement of the implants provides an accurate estimation of the diameter and length of each implant, facilitating optimal positioning of each implant based on the specific area of bone density. Moreover, this tool is crucial for assessing anatomical landmarks to track implant paths and ensure a safe distance from vital structures for example the inferior alveolar nerve canal, orbit, infraorbital foramen, as well as lacrimal canal.

After creating a virtual plan, a stereolithographic model of the middle third of the face, including the maxilla, had been manufactured. This model served as a precise guide for performing the surgical approach. In addition, surgical guides were also fabricated for accurate implant placement.

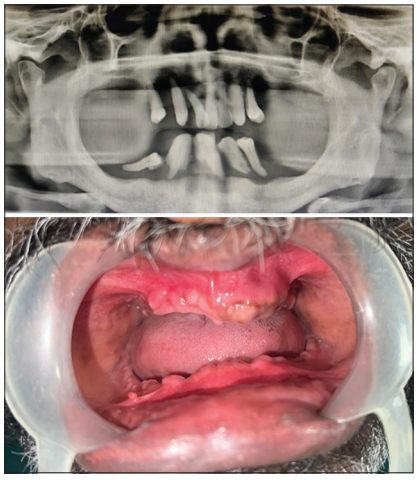

Figure 1: Pre-operative panoramic view and edentulous maxillary and mandibular ridges

The procedure had been conducted using general anesthesia with the assistance of endotracheal intubation. To minimize intraoperative bleeding, 2% lignocaine with 1:80,000 adrenaline was administered bilaterally. The surgical method consisted of executing crestal incisions, along with posterior vestibular releasing incisions. A mucoperiosteal flap had been increased, allowing for direct visualization of the alveolar crest, infraorbital nerve, the inferior rim of the zygomatic bone, along with lateral wall of the maxillary sinus. To improve visualization during osteotomy preparation, a small aperture was created in the lateral maxillary sinus wall, aiding in accurate drill placement. A surgical guide, based on prosthesis-determined osteotomy locations, was used for implant placement. Sequential osteotomies were performed using implant drills. In the first implant placement, bilateral posterior zygomatic implants (Branemark System Zygoma TiUnite Implants; Straumann) had been placed as well as emerged close to the second premolar region (15,25–4 × 42.5 mm) through the infra-zygomatic crest. Subsequently, the anterior maxillary implants (Straumann), were inserted, engaging the alveolar bone and emerging in the central incisor and canine region (11,21–3.5 × 11.5 mm) (13,23–3.75 × 13 mm). Similarly, mandibular implants (34,44–4.2 × 16 mm) were angulated in the mandible's premolar region, while traditional implants had been positioned in the anterior mandibular area (31,41–3.75 × 11.5 mm) (Straumann). Cover screws were used for conventional implants, while multiunit abutments of 45° were utilized for zygomatic and 17° for implants that are angulated in the mandible's posterior region (Fig. 4) Using resorbable 3–0 vicryl, the flaps were then meticulously re-approximated, as well as, sutured.

The prosthetic screw axis was uniformly aligned among all implants using angulated multi-unit abutments from the Branemark System Zygoma Multiunit abutments and Straumann. This helped ensure a consistent insertion direction (Fig. 5). Open tray impression copings, at abutment-level impression, were taken and healing caps had been joining the abutments. A facebow transfer as well as interocclusal recordings had been performed, and a screw-retained hybrid prosthesis had been connected to the implants (Fig. 6).

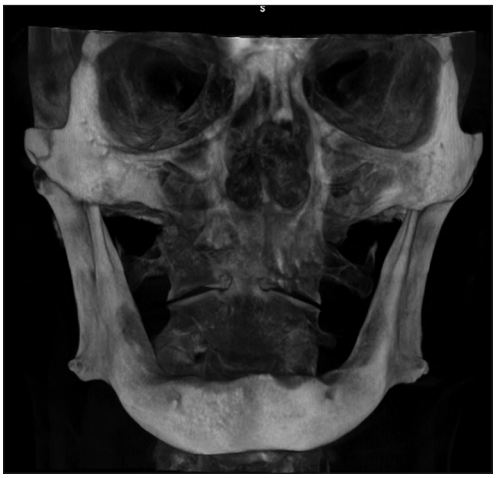

Figure 2: Pre-operative 3D cone-beam computed tomography scan

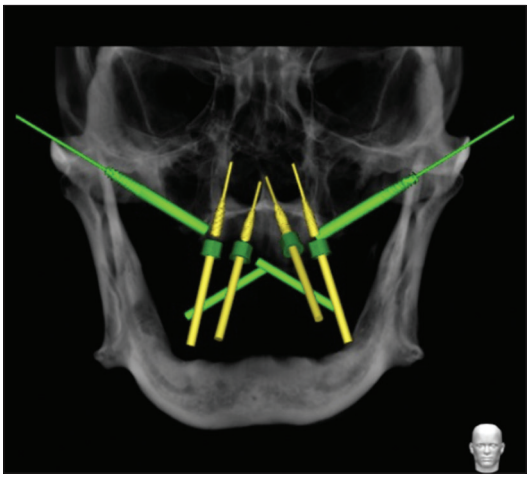

Figure 3: Virtual planning for zygomatic implants

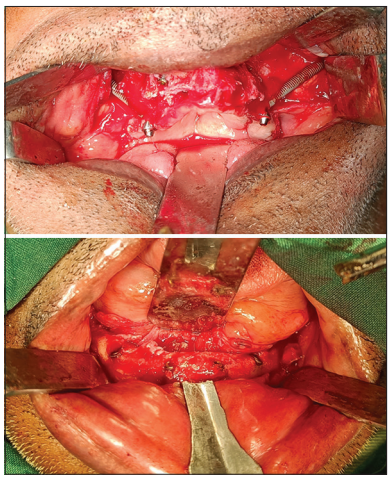

Figure 4: Intraoperative placement of zygomatic with multi-unit abutments in the maxilla and all on implants in the mandible

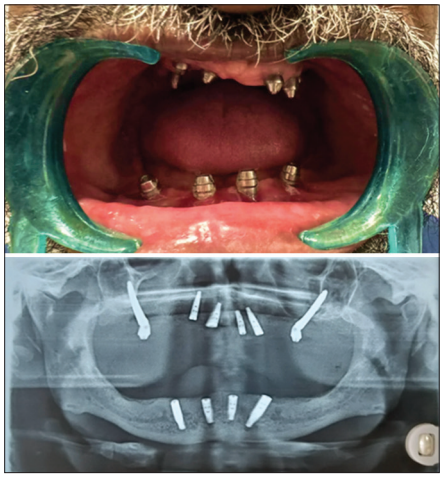

Figure 5: Multi-unit abutments connected with implants and post-operative panoramic view

Figure 6: Post-operative definite hybrid prosthesis

DISCUSSION

The restoration of the severely atrophic maxilla and mandible presents a significant challenge. Traditional implant placement often becomes unfeasible due to insufficient bone volume, necessitating extensive bone grafting procedures. Adjuvant operations, with a success rate of 60–90%, include onlay graft, sinus graft, sinus lift, as well as apposition graft with or without Le Fort I osteotomy. However, they have been frequently invasive as well as require a lengthy course of treatment.

Patients with severe maxillary atrophy now have a reliable option in zygomatic implants. Regarding zygoma implants, a comprehensive review by Chrcanovic *et al*. revealed great predictability and positive clinical outcomes [8]. When two zygomatic implants are combined with two to four anterior standard implants, the survival rates of zygomatic implants range from 98% to 100% [3,9]. The zygoma bone, which is situated distant from the occlusal level, provides a strong and long anchoring that can withstand masticatory stresses because of its thick and robust cortical layer. The width of the zygoma bone offers the potentiality of inserting two implants on either side [10].

The area around the canine and lateral incisor is where anterior implants merge, whereas the area around the second premolar as well as the first molar is where posterior implants merge. This arrangement appears to supply stable support for fixed screw prostheses. Implants' apex position in the zygomatic bone permits the distribution of axial as well as lateral loads in a structure with outstanding anatomical quality [10].

The zygomatic implant may have the benefit of eliminating donor site morbidity. Other benefits include a decrease in the duration of therapy and decreased expenses for hospitalization. The stability achieved through bicortical engagement often allows for immediate prosthetic loading. Fixed prostheses enable mastication, which enhances the quality of life of patients, thereby providing psychological benefits [11].

High success rates have been documented with immediate-functional loading protocols that employ implant-supported prostheses to restore a complete edentulous mandible [12]. Over time, it became clear that treating patients who are fully edentulous with axial implants immediately after functional placement is a reliable method [13].

The all-on-four technique, pioneered by Paulo Malo, has transformed the approach to full-arch rehabilitation in atrophic maxilla and mandible [14]. Implant placement in the posterior regions is often limited by alveolar bone loss and exposure of the inferior alveolar nerve following posterior tooth loss. Cross-arch stability in immediately loaded implants restricts micromotion to individual implants. Optimal load distribution through splinting can prevent micromotion and enhance osseointegration by avoiding overload. Malo *et al*. recommended placing posterior fixed teeth with minimal cantilevers using tilted implants to maximize the use of existing bone in areas where nerve proximity and limited bone height prevent axial implant placement [11]. Agliardi *et al*. demonstrated successful outcomes of an instantly loaded fixed complete prosthesis for the edentulous patient's treatment who had extensive bone atrophy in the posterior mandibular area [15].

To facilitate the fabrication of interim prosthesis, definitive impressions were taken 1-week post-surgery, with the final prosthesis delivered 6 months later. Clinical and radiographic assessments were performed post-surgery and 1 year after implant

placement, evaluating mobility, pain, swelling, implant quality, and occlusal contacts. No signs of infection, prosthesis instability, or implant mobility were observed.

The application of all-on-four in the mandible, as well as, bizygomatic implants in the maxilla in our case study, illustrated their respective benefits. The bizygomatic implants allowed for the successful rehabilitation of a severely atrophic maxilla without bone augmentation, while the all-on-four approach in the mandible achieved immediate functional loading. The patient experienced minimal post-operative discomfort, rapid return to function, and excellent prosthetic stability in both arches. Rapid osseointegration was observed during follow-up, corroborating the benefits reported in the literature for both techniques.

CONCLUSION

Zygoma implants and the all-on-four concept have revolutionized dental rehabilitation for severe maxillary and mandibular atrophy, representing significant progress in implant dentistry. Although promising, extensive research with more size of sample is needed to establish these techniques as gold standards in oral rehabilitation, ensuring optimal patient care and treatment efficacy.

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