

FULL ARCH REHABILITATION OF POST-MUCORMYCOSIS EDENTULOUS MAXILLA USING QUAD ZYGOMATIC IMPLANTS: A CLINICAL CASE REPORT

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Abstract: Rehabilitating the maxilla in the patient who has had surgical resection for mucormycosis poses a distinctive set of anatomical, surgical, and prosthetic challenges. The extensive maxillary bone loss after aggressive debridement often makes traditional implant-supported prosthetic options impossible. In these circumstances, zygomatic implants have proven to be a predictable, graftless solution, especially in patients with extremely atrophic maxillae. Where the bone loss is severe, the quad zygoma procedure—two implants for each zygomatic arch—is possible to support full arch rehabilitation with a fixed prosthesis. This report presents the successful rehabilitation of oral function and appearance in a patient with post-mucormycosis edentulous maxilla, treated with four zygomatic implants and a screw-retained hybrid prosthesis. The article addresses preoperative evaluation, surgery protocol, prosthetic process flow, and clinical results, stressing the long-term effectiveness and clinical applicability of this method for medically compromised individuals.

Keywords: Maxilla/surgery, Mucormycosis, Zygoma/surgery, Dental Implants, Maxillofacial prosthesis, Dental implantations.

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Conflicts of interest:

The authors declare no conflicts of interest.

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RÉHABILITATION DE L'ARCADE COMPLÈTE DU MAXILLAIRE ÉDENTÉ POST-MUCORMYCOSE À L'AIDED'IMPLANTS QUAD ZYGOMATIQUES: CAS CLINIQUE

Résumé: La réhabilitation du maxillaire chez un patient ayant subi une résection chirurgicale pour mucormycose pose un ensemble particulier de défis anatomiques, chirurgicaux et prothétiques. La perte osseuse maxillaire importante après un débridement agressif rend souvent impossibles les options prothétiques implanto-portées traditionnelles. Dans ces circonstances, les implants zygomatiques se sont avérés une solution prévisible et sans greffe, notamment chez les patients présentant une atrophie maxillaire importante. En cas de perte osseuse importante, la procédure du quad zygoma (deux implants pour chaque arcade zygomatique) permet une réhabilitation complète de l'arcade avec une prothèse fixe. Ce rapport présente la réussite de la réhabilitation de la fonction et de l'esthétique orales chez un patient présentant un maxillaire édenté post-mucormycose, traité par quatre implants zygomatiques et une prothèse hybride transvissée. L'article aborde l'évaluation préopératoire, le protocole chirurgical, le déroulement du processus prothétique et les résultats cliniques, soulignant l'efficacité à long terme et l'applicabilité clinique de cette méthode chez les personnes médicalement compromises.

Mots-clés: Maxillaire/chirurgie, Mucormycose, Os zygomatique/chirurgie, Implants dentaires, Prothèses maxillofaciales.

Introduction

Mucormycosis is a life-threatening, rapidly progressive fungal infection caused mainly by *Rhizopus oryzae*, which is a member of the Mucorales order. It mainly occurs in immunocompromised patients—especially those with uncontrolled diabetes mellitus, recent corticosteroid treatment, hematologic malignancies, or post-COVID-19. During the COVID-19 pandemic, there was a significant increase in mucormycosis cases, many of which needed extensive surgery to stop the infection [1-5].

The rhino-maxillary and rhino-orbito-cerebral types of mucormycosis are particularly destructive, tending to require maxillectomy surgery that creates extensive loss of alveolar and basal bone, palatal morphology, and in some cases, orbital contents. This loss compromises mastication, speech, deglutition, and facial harmony, reducing the patient's quality of life [6]. Conventional endosseous implants are not feasible in such cases because of the absence of residual alveolar bone. In addition, grafting operations are often contraindicated because of systemic comorbidities or the fear of reactivating latent infections.

Zygomatic implants provide a biomechanically stable, graftless solution by anchoring into the zygomatic bone, avoiding diseased alveolar areas. Adapted for use in severe maxillary atrophy and maxillectomy since their initial introduction by Brånemark in the 1990s, the quad zygoma technique, where two implants per zygoma are placed one anteriorly and one posteriorly provides a broad prosthetic base and better force distribution. This method enables early or immediate loading, restoring oral function and facial esthetics in a relatively minimal treatment time. The current case emphasizes the use of this method in a patient with a totally edentulous maxilla due to mucormycosis surgery, with

evidence of both functional and psychological benefits [7-10].

Case Presentation

A 35-year-old male presented to the Department of Prosthodontics with concerns about compromised chewing ability, unclear speech, and dissatisfaction with facial appearance. He reported undergoing multiple surgical procedures for rhino-maxillary mucormycosis eight months prior, following a severe COVID-19 infection. His medical history included a 2-year history of poorly controlled Type II Diabetes Mellitus, which had contributed to the development and rapid progression of the fungal infection.

As part of his treatment, the patient had undergone subtotal maxillectomy involving the removal of the alveolar process, palatal vault, anterior maxillary wall, and bilateral sinus linings. He had completed a full course of intravenous liposomal amphotericin B and had been medically stable for the past three months. He expressed a strong desire for fixed dental rehabilitation, citing significant difficulties with removable prostheses.

Extraoral examination revealed midfacial depression and a collapsed nasolabial angle due to the absence of underlying bony support. Intraoral examination showed a completely edentulous and scarred maxillary arch, with minimal soft tissue resilience and obliterated anatomical landmarks. Palpation indicated dense fibrous scar tissue over the palatal region. The mandibular arch had complete set of teeth with favorable periodontal support and acceptable occlusal alignment.

Panoramic radiography and CBCT imaging revealed severely resorbed maxillary ridges with residual bone height averaging less than 2 mm, rendering traditional implants impractical. However, both zygomatic complexes were found to be well preserved, offering sufficient volume and density for

implant anchorage. The maxillary sinuses were patent with no signs of residual infection or mucosal thickening.

A multidisciplinary team—including maxillofacial surgeons, prosthodontists, and radiologists planned a rehabilitation strategy involving four zygomatic implants: two on each side. This quad zygoma approach would allow for optimal prosthetic support without the need for grafting. After a detailed explanation of the procedure, potential complications, and the importance of maintenance, the patient provided informed consent.

The surgical phase was conducted under general anesthesia. A mid-crestal incision was made extending from first molar to first molar. Full-thickness mucoperiosteal flaps were elevated to expose the maxillary remnants and the lateral wall of the maxilla. Care was taken to identify the infraorbital neurovascular bundle and zygomatic buttress.

Anterior implants were placed via an extra-sinus trajectory, engaging the body of the zygoma through the canine region. Posterior implants were placed using an intrasinus pathway through a lateral antrostomy, following the trajectory outlined during preoperative CBCT planning. Four Norris Zygoma® implants, ranging from 45 mm to 50 mm in length, were inserted with high primary stability (torque values: 45–60 Ncm). Multi-unit abutments, including angulated ones for appropriate prosthetic alignment, were torqued into place. After copious saline irrigation, soft tissues were approximated with resorbable sutures (Figure 1).

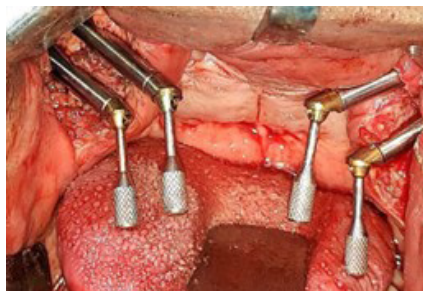


Figure 1. Intra oral view post implant placement

Postoperatively, the patient was maintained on intravenous antibiotics and analgesics, with chlorhexidine rinses and dietary restrictions. Healing proceeded uneventfully, with no signs of inflammation, dehiscence, or implant-related complications at the one-week and three-week follow-ups.

At three weeks, the prosthetic phase commenced. Open-tray impressions were taken with a custom tray and polyether material (Figure 2). Jaw relations were recorded with occlusal rims, and a trial was performed to evaluate esthetics, phonetics, and functional parameters (Figure 3). A CAD-CAM fabricated metal-reinforced acrylic hybrid prosthesis was designed and tried in first (Figure 4) and later delivered using screw-retained access channels. Occlusion was adjusted to ensure even centric contact and smooth excursive movements.

Over follow-up visits at one, three, and six months, the patient exhibited excellent adaptation to the prosthesis (Figure 5). Clinical assessments showed healthy peri-implant tissues with no signs of mobility, inflammation, or mechanical issues. Radiographs confirmed stable osseointegration, and sinus evaluations showed no postoperative complications (Figure 6). The patient reported significant improvement in mastication, speech clarity, and overall self-esteem. Oral hygiene was maintained with water flossers, custom interdental brushes, and regular professional maintenance.

Discussion

Zygomatic implants have emerged as a robust, graftless solution for the rehabilitation of patients with severely atrophic maxillae or post-surgical defects, such as those resulting from mucormycosis-related maxillectomy. The use of quad zygoma implants—placing two implants per zygomatic bone—



Figure 2. Impression Phase



Figure 3. Jaw Relation and Try in



Figure 4. Framework try in

Figure 5. Final prosthesis

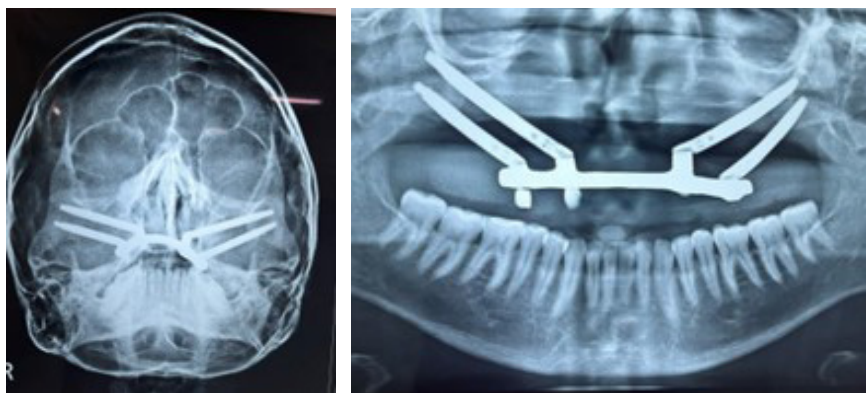


Figure 6. Post-operative Radiographs

provides enhanced prosthetic support and stability in situations where traditional endosseous implants are contraindicated due to inadequate alveolar bone [11, 12]. However, despite their efficacy, this technique is surgically demanding and requires thorough anatomical and procedural planning to avoid complications, the most critical of which is maxillary sinus perforation.

Given the implant's trajectory near or through the maxillary

sinus, the risk of Schneiderian membrane damage is significant. Sinus perforation can result in complications such as chronic sinusitis, oroantral fistula formation, or implant failure. To mitigate these risks, detailed preoperative imaging using Cone Beam Computed Tomography (CBCT) is indispensable. It allows for precise mapping of the sinus anatomy, bone volume, zygomatic arch morphology, and the angulation required for

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safe implant trajectory [13-18]. Additionally, surgical navigation tools or stereolithographic guides can enhance precision, especially in anatomically distorted or altered maxillary regions [19-24].

Surgical techniques play a pivotal role in minimizing risks. The use of depth-limiting drills, controlled sequential osteotomy preparation, and where necessary, the lateral wall approach for direct visualization of the sinus wall can help in preserving sinus integrity [25]. Avoiding thin buccal bone by planning palatal emergence profiles also reduces the risk of implant exposure or dehiscence. Furthermore, adherence to aseptic protocols and minimization of operative trauma are essential in patients with prior fungal infections, to avoid postoperative complications or reactivation of latent infection [26].

Regarding clinical outcomes, numerous studies report high survival and success rates with zygomatic implants. According to systematic reviews, cumulative survival rates for zygomatic implants range from 94% to 97% over a 5 to 10-year period, even in patients with significant comorbidities [27, 28]. Quad zygoma techniques particularly show favorable outcomes due to better force

distribution and increased prosthetic anchorage. However, it is imperative to underscore that clinical success is highly technique-sensitive and contingent on accurate preoperative diagnosis, operator experience, prosthetic planning, and meticulous surgical execution [29].

The clinical indications for quad zygoma placement include complete maxillary edentulism with severe bone resorption (Cawood and Howell Class V/VI), maxillary defects secondary to tumor resection, trauma, or invasive infections such as mucormycosis, particularly when bone grafting is contraindicated due to systemic compromise [30, 31]. Conversely, cases with active infection, uncontrolled diabetes, or inadequate zygomatic bone structure may be at increased risk of failure and must be evaluated cautiously.

In this case, the patient's systemic history, extent of resection, and absence of residual alveolar bone made traditional implants unsuitable. The use of quad zygomatic implants enabled early prosthetic loading, restored oral function, and significantly improved quality of life, including esthetics and psychological well-being. The success of this rehabilitation underlines the clinical value of this

technique in post-mucormycosis reconstructive protocols, offering a viable alternative where few others exist.

In summary, while the quad zygoma approach is highly effective, it requires judicious case selection, comprehensive surgical planning, and experience in managing anatomical complexities. Properly executed, it provides a durable and functional solution to one of the most challenging prosthodontic scenarios in medically compromised patients.

Conclusion

The application of quad zygomatic implants in post-mucormycosis edentulous maxilla rehabilitation presents a predictable, effective, and life-altering solution in otherwise treatment-constrained situations. This case illustrates the clinical viability and functional dependability of zygomatic implant-supported prostheses in patients with complex anatomical and systemic restrictions. With detailed planning, skilled execution, and vigilant follow-up, the quad zygoma method can profoundly enhance the quality of life of patients who have suffered from disabling infections and reconstructive procedures.

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