VAKA RAPORU / CASE REPORT
Balıkesir Sağlık Bilimleri Dergisi / BAUN Sağ Bil Derg
Balıkesir Health Sciences Journal / BAUN Health Sci J
ISSN: 2146-9601- e ISSN: 2147-2238
Doi: https://doi.org/10.53424/balikesirsbd.1525601

Management of a Zygomatic Implant Complication Using Custom-Made Subperiosteal Implants: A Case Report

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***Geliş Tarihi / Received**: 31.07.2024, **Kabul Tarihi / Accepted:** 02.01.2025*

ABSTRACT
Introduction: Zygomatic implants are effective for treating edentulism when conventional implants are unsuitable due to insufficient bone volume. Despite high success rates, complications such as sinusitis and osseointegration failure may occur. This report presents a case in which a custom subperiosteal implant was successfully used to manage a zygomatic implant complication. **Case Presentation:** A 52-year-old female with severe maxillary bone loss underwent zygomatic implant placement. Four months later, a complication with the right posterior zygomatic implant was identified, leading to its removal and the subsequent repair of an oroantral fistula. A custom subperiosteal implant was then successfully placed. **Discussion:** Complications with zygomatic implants require innovative solutions. Subperiosteal implants provide an effective management option, especially in cases involving severe bone loss. **Conclusion:** This case demonstrates the successful use of subperiosteal implants to manage zygomatic implant complications, underscoring the need for further research in this field.
Keywords: Zygomatic Implants, Subperiosteal Implants, Implant Complications, Maxillary Bone Loss.

Özel Yapım Subperiostal İmplantlarla Zigomatik İmplant Komplikasyonunun Yönetimi: Bir Olgu Sunumu

ÖZ
Giriş: Zigomatik implantlar, yetersiz kemik hacmi nedeniyle geleneksel implantların uygun olmadığı durumlarda dişsizliği tedavi etmek için etkilidir. Yüksek başarı oranlarına rağmen sinüzit ve osseointegrasyon başarısızlığı gibi komplikasyonlar meydana gelebilir. Bu rapor, zigomatik implant komplikasyonunu yönetmek için özel bir subperiosteal implantın başarıyla kullanıldığı bir vakayı sunmaktadır. **Olgu Sunumu:** Şiddetli maksiller kemik kaybı olan 52 yaşında bir kadına zigomatik implant yerleştirildi. Dört ay sonra, sağ posterior zigomatik implantta bir komplikasyon tespit edildi ve bu da implantın çıkarılmasına ve ardından oroantral fistülün onarılmasına yol açtı. Daha sonra özel bir subperiosteal implant başarıyla yerleştirildi. **Tartışma:** Zigomatik implantlardaki komplikasyonlar yenilikçi çözümler gerektirir. Subperiosteal implantlar, özellikle şiddetli kemik kaybının olduğu vakalarda etkili bir yönetim seçeneği sunar. **Sonuç:** Bu vaka, zigomatik implant komplikasyonlarını yönetmek için subperiosteal implantların başarılı bir şekilde kullanıldığını göstererek bu alanda daha fazla araştırma yapılması gerektiğini vurgulamaktadır.
Anahtar Kelimeler: Zigomatik İmplantlar, Subperiostal İmplantlar, İmplant Komplikasyonları, Maksiller Kemik Kaybı.

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Bu makaleye atıf yapmak için / Cite this article: Kundakcioglu, A., Gedik, B. (2025). Management of a zygomatic implant complication using custom-made subperiosteal implants: a case report. *BAUN Health Sci J, 14*(1), 238-242. https://doi.org/10.53424/balikesirsbd.1525601

INTRODUCTION

Zygomatic implants have emerged as a reliable solution for edentulism, especially in cases where conventional implant placement might be challenging due to inadequate bone volume or quality in the posterior maxilla. Traditional intraosseous implants often face significant challenges in the posterior maxillary region due to the proximity to the maxillary sinus and poor bone quality (Kämmerer et al., 2023). In such scenarios, zygomatic implants and custom subperiosteal implants offer alternative solutions. Zygomatic implants, anchored in the zygomatic bone, are particularly favored when maxillary bone height is insufficient (Brånemark et al., 2004; Wang et al., 2015).

Despite their high success rates, complications such as chronic sinusitis, lack of osseointegration, and prosthetic issues can occasionally arise, necessitating specialized approaches for resolution (Molinero-Mourelle et al., 2016). The management of these complications often poses a clinical challenge, requiring innovative strategies to ensure successful outcomes. This case report delves into the management of a complication associated with zygomatic implants through the innovative use of subperiosteal implants.

Subperiosteal implants, historically known for their application in compromised bone situations, offer a promising alternative when dealing with complex complications (Weiss et al., 2005; Strappa et al., 2022). Their unique design and placement technique allow for the circumvention of areas with inadequate bone while providing stable support for dental prostheses. In this report, we present a detailed account of a 52-year-old female patient who experienced a complication four months after the placement of a zygomatic implant. The patient was successfully treated with a custom-made subperiosteal implant.

The case provides insights into the clinical presentation, diagnostic assessment, and successful utilization of subperiosteal implants in addressing complications associated with zygomatic implants. The intricate nature of zygomatic implant complications often requires tailored solutions, and this case demonstrates the efficacy of subperiosteal implants as an effective remedial strategy. By detailing the clinical process, complication management, and follow-up assessment, this report aims to contribute to the expanding knowledge base on managing complex scenarios related to zygomatic implantology. It offers valuable considerations for clinicians encountering similar challenges in their practice.

CASE REPORT

A 52-year-old female patient, with no known systemic diseases, presented to the Istanbul University Oral and Maxillofacial Surgery Clinic seeking implant surgery. During her detailed medical history, it was noted that she had been using a total removable prosthesis in the upper jaw since the age of 20. Radiographic examinations, including panoramic radiography and cone-beam computed tomography (CBCT), revealed significant bone resorption in the maxilla, which precluded the use of conventional implants. Consequently, a treatment plan was formulated involving the placement of zygomatic implants in the maxilla and four implants in the mandible following the all-on-four concept.

Under intravenous sedation and local anesthesia, a surgical plan was executed involving the placement of two zygomatic implants in the upper jaw. Additionally, two 3.2 mm x 10 mm (JD Evolution) implants were placed in the anterior maxillary region, and two 4.9 mm x 40 mm (JD Zygoma) zygomatic implants were placed in the posterior maxilla to maximize the anchorage and stability. In the mandible, four 3.5 mm x 12 mm (Bredent CopaSKY) implants were inserted following the all-on-four protocol, ensuring optimal support for the prosthetic superstructure.

The surgical procedure was uneventful, and the patient tolerated the procedure well. She was reviewed one week postoperatively, and clinical examination revealed a smooth recovery of the soft tissues with no signs of infection or inflammation.

After a four-month osseointegration period, the patient returned for the prosthetic phase of her treatment. During the follow-up visit, the patient reported no issues and indicated that she had an uneventful postoperative period. However, during the session aimed at placing the gingival formers for the prosthetic stage, it was observed that sufficient torque could not be achieved on the right posterior zygomatic implant. This indicated potential failure of osseointegration or mechanical stability of the implant.

To further investigate, the zygomatic implants were removed using reverse torque technique, and a comprehensive CT scan was performed to assess the condition of the surrounding bone and sinus structures (Figure 1).

The CT scan did not reveal any signs of sinusitis, fractures, or cracks. However, it became evident that the bone in the region where the right posterior zygomatic implant was removed appeared thin and compromised. This suggested that adequate anchorage for a new zygomatic implant could not be achieved due to the substantial defect area, particularly in the buttress region. Consequently, re-implantation of the zygomatic implant was deemed unfeasible. Instead, a subperiosteal implant was considered a more suitable and less invasive option for the compromised bone structure.

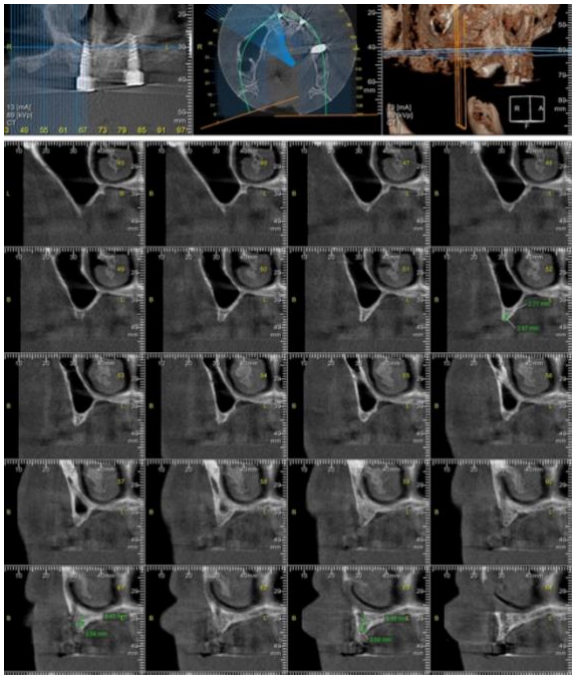

Figure 1: Three-dimensional sections of the defect area post-removal of the zygomatic implant, highlighting the compromised bone structure and defect area.

With the support of computed tomography, a flap was raised to directly examine the region. During this examination, an oroantral fistula was detected at the neck of the removed zygomatic implant. The presence of this fistula was likely contributing to the implant's failure. The fistula was meticulously closed using connective tissue harvested from the palate to ensure a robust and functional closure. Following this, a subperiosteal implant was planned to provide a fixed prosthesis solution that would offer stability and durability in the existing bone structure.

Three weeks post-closure of the oroantral fistula, the patient was called for a follow-up. Complete healing of the soft tissue in the surgical area was observed, indicating successful closure of the fistula. Customized subperiosteal implants, designed using preoperative imaging and 3D modeling, were then fabricated to fit the patient's unique anatomical structure. These implants were placed under local anesthesia with precision to ensure optimal fit and integration (Figure 2).

Postoperative management included a regimen of oral amoxicillin/clavulanic acid to prevent infection and flurbiprofen to manage pain and inflammation.

The patient was reviewed 10 days post-implant placement, exhibiting uneventful recovery with no signs of infection or adverse reaction. The patient reported no discomfort or complications, indicating a successful adaptation to the new subperiosteal implants.

Impressions were taken for the fabrication of temporary fixed prostheses, which were applied within the same week. The temporary prostheses

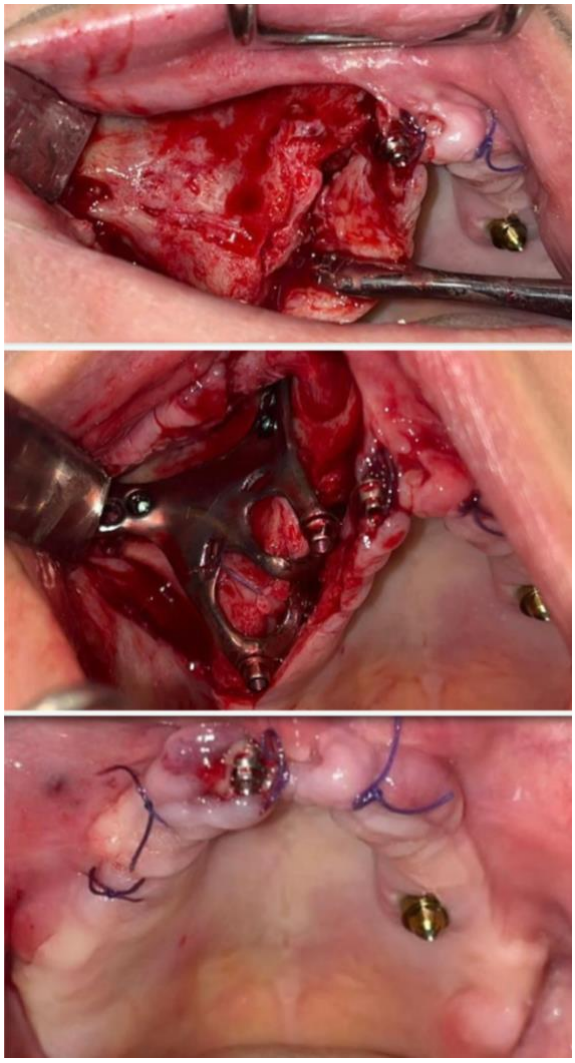

Figure 2: Placement of the customized subperiosteal implant under local anesthesia, demonstrating the tailored fit to the patient's anatomical structure and the precision of the surgical technique.

provided functional and esthetic restoration while allowing for further observation of the integration and stability of the subperiosteal implants.

DISCUSSION

Zygomatic implants are frequently used to support dental prostheses in patients with severe maxillary bone loss. However, placing these implants can be technically challenging and may lead to various complications. This review examines the complications associated with zygomatic implants and explores the management of these complications using subperiosteal implants as documented in the literature.

Zygomatic implants offer a significant solution for dental rehabilitation, especially in patients with severe maxillary atrophy. These implants stabilize by anchoring in the zygomatic bone, providing support where traditional implants are insufficient. Literature reports high success rates and longevity for

prostheses supported by zygomatic implants (Aparicio et al., 2014; Chrcanovic et al., 2016).

Various complications can arise during and after the placement of zygomatic implants, including sinus perforation, sinusitis, soft tissue infections, implant displacement, and nerve damage (Brånemark et al., 2004; Candel-Marti et al., 2012). Sinus perforation is one of the most common complications and is often associated with sinusitis (Chrcanovic et al., 2016).

Managing complications associated with zygomatic implants poses a clinical challenge and often requires innovative approaches to ensure successful outcomes. Subperiosteal implants have proven to be an effective strategy in addressing complications encountered with zygomatic implants.

Complications in zygomatic implantology may range from prosthetic-related issues, such as prosthetic screw loosening or fracture, to more complex concerns like sinusitis, infection, or even zygomatic implant failure. In a review of 56 complications, incidences were reported as 9.53% for sinusitis, 7.5% for soft tissue infection, 10.78% for paresthesia, 4.58% for oroantral fistula formation, and 6.91% for surgery-related complications and prosthesis-related problems. A significant decrease in these incidences was observed when anatomy guidance was used, and the rate of paresthesia decreased from 10.78% to 0.55% (Kämmerer et al., 2023). The reported case exhibited an implant fracture, necessitating a meticulous approach to preserve function and aesthetics.

Only highly qualified surgeons with significant expertise should perform the placement of zygomatic implants to minimize postoperative complications. It is crucial to note that various anatomical structures adjacent to the zygomatic bone may be at risk of damage during the implantation process (Candel-Marti et al., 2012). Additionally, the loss of bone integration leading to the development of a bucco-sinus fistula results in substantial bone destruction in the surrounding area. This condition is further marked by alterations in the sinus mucosa and the functionality of the osteomeatal complex. Addressing such a situation necessitates specific treatments, including the removal of the implicated implant, curettage of the mucosa, and closure of the fistula, before considering a new reconstructive procedure. Upon the restoration of normal anatomy and sinus functionality, if there is a requirement for posterior anchorage replacement, a reconstructive approach involving bone grafting is recommended.

Subperiosteal implants are used as an alternative solution in cases of advanced bone resorption where traditional implants cannot be placed. These implants consist of a metal framework fixed under the periosteum on the bone surface. They have been shown to yield successful results in patients with severe bone loss (Weiss et al., 2005).

Subperiosteal implants offer an effective solution for managing complications arising from zygomatic implants. Literature documents successful cases where subperiosteal implants were used to treat complications such as sinus perforation and sinusitis (Misch, 1999). They are also effective in managing soft tissue infections (Weiss et al., 2005).

Brånemark and colleagues (2004) reported several cases where complications from zygomatic implants were successfully managed using subperiosteal implants. Similarly, Misch (1999) found that subperiosteal implants were effective in managing soft tissue infections.

Systematic reviews on the success of zygomatic implants contribute significantly to the literature and are essential for future surgeries. In a systematic review encompassing 25 studies with an average follow-up duration of 42.2 months (ranging from 0 to 144 months) and a collective inclusion of 1541 zygomatic implants, Goiato et al. identified a consistent survival rate of 97.86% after 36 months (Goiato et al., 2014). Another review reported similar success rates, highlighting the long-term viability of zygomatic implants when appropriately placed and managed (Chrcanovic & Abreu, 2013).

In the study by Göker, 69 zygomatic implants were placed in 25 patients and as a result of the follow-up of these patients between 65-88 months, a total of two patients had post-operative complications, one subcutaneous fistula and one oro-anal communication. However, no luxation was observed in any of the zygomatic implants (Goker, 2020).

Zygomatic implants provide an effective solution for dental prostheses in patients with severe maxillary bone loss, yet they are not without complications. Subperiosteal implants have emerged as a viable alternative for managing these complications. Literature demonstrates the success of subperiosteal implants in treating complications associated with zygomatic implants, highlighting the need for further clinical studies and case reports to expand the knowledge base and improve treatment outcomes. Future research should also explore advancements in biomaterials and implant design to enhance the efficacy and longevity of subperiosteal implants in managing complex cases.

CONCLUSION

This case highlights the effective use of subperiosteal implants in managing complications arising from zygomatic implants. The patient's successful treatment underscores the potential of subperiosteal implants as a viable alternative in scenarios where traditional approaches fail. This report contributes to the growing body of evidence supporting subperiosteal implants' role in complex dental rehabilitations, emphasizing the importance of innovative solutions in overcoming implantology challenges. Further studies and clinical evaluations are recommended to refine these techniques and improve outcomes for patients with severe maxillary bone loss.

Acknowledgement
The authors would like to extend their sincere thanks to the patient who allowed her personal data to be used for scientific publications after filling the informed consent form.

Conflict of Interest
The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions
Plan, design: BG; **Material, methods and data collection:** AK; **Data analysis and comments:** AK; **Writing and corrections:** BG.

Funding
This paper was not supported by any project.

Consent for Publication
Informed consent was obtained from the patient for the publication of this study, including the use of any accompanying images and data.

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