



Understanding
ZYGOMA
Implants

BIOMECHANICAL, SURGICAL,
AND PROSTHETIC PRINCIPLES

Edmond Bedrossian, DDS | **E. Armand Bedrossian, DDS, MSD**

Understanding Zygoma Implants
Biomechanical, Surgical, and Prosthetic Principles





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PREFACE

This book is dedicated posthumously to Professor Per-Ingvar Brånemark in honor of his vision for developing surgical protocols and armamentaria that allow for the predictable rehabilitation of patients with maxillary defects, whether congenital or acquired. His lifetime dedication to patient care not only helped to restore form and function to this group of patients but, more importantly, improved their quality of life and reintroduced them to society. I therefore wish to remind my colleagues, as well as current and future residents, of the fundamental principles that Brånemark lived by:

- Interdisciplinary management to allow for enlightened treatment planning.
- Simplification and identification of adequate versus optimal treatment concepts.
- Predictability achieved via documentation and evidence-based treatment concepts.
- The patient is paramount—listen to the needs and demands of your patient.

Brånemark lived by these principles and mentored all who were fortunate enough to have known him. Each chapter in this book is written to honor him by upholding these principles.

Treating maxillectomy patients and patients with severe maxillary resorption is one of the most challenging maxillofacial reconstruction procedures. The introduction of the zygoma implant allowed practitioners to reconstruct these difficult defects without extensive grafting, a treatment dubbed the “graftless concept.” Over the past 25 years, clinicians using zygoma implants have followed the ad modum Brånemark technique, which has resulted in clinical success rivaling conventional axial implants, with multiple systematic reviews reporting long-term success rates of 98%.

The popularity and acceptance of the zygoma implant for the treatment of the completely edentulous maxilla is both exciting and worrisome. Preserving the technique described by Brånemark is critical for the continuance of predictable long-term outcomes with zygoma implants. To emphasize the need for maintaining the technique as described by Brånemark, I have recruited leading clinicians experienced in the treatment of patients with advanced maxillary resorption to contribute to this textbook. I have asked them to share their thoughts and their contemporary approach to executing the Brånemark technique.

The title of this book emphasizes the need to fully understand zygoma implants, including the biomechanical, surgical, and prosthetic principles that have made the use of this implant in maxillary reconstructions extremely predictable. It has been a great joy to coauthor this textbook with my son and prosthodontist, Armand, who led the team of contributors in emphasizing the role of the digital workflow (DWF) in maxillary reconstruction.

The DWF is governed by a complete understanding of the fundamental surgical and prosthetic principles. The digilog concept of implementing fundamental, evidence-based principles while using contemporary DWFs is discussed in depth, both for planning and implementing extensive maxillary reconstructions using the zygoma concept.

When navigating modern surgical education, we must always rely on the fundamental principles that have advanced the predictability of restoration using the zygoma implant—the best interests of the patient come first.

ACKNOWLEDGMENTS

I want to express my great appreciation to my wife, Jasmine, whose support enabled me to write and organize this textbook immediately following completion of my other Quintessence book, *The Immediacy Concept*. I also want to recognize all the contributors to this textbook, as well as the corporate support from Quintessence Publishing and Straumann, who have facilitated communication of the principles described in this text to all our colleagues. Without their dedication, this book would not have been possible.



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1 /

History of Zygoma Implants and Their Indications

EDMOND BEDROSSIAN

Rehabilitating patients who have suffered traumatic events or undergone oncologic resections that resulted in total or partial loss of the maxilla is one of the most challenging reconstructive dental procedures to perform. The lack of bone volume to support a conventional removable prosthesis is a major obstacle, and even in cases where obturators can be fabricated using the residual undercuts in the patient's anatomy, the results are generally less than optimal. Placing conventional dental implants is impossible in these patients due to the severe damage or resection of the maxillary alveolar bone. To stabilize prostheses in these patients, P-I Brånemark instead considered a distant implant anchorage site—the zygoma (Fig 1-1).

This chapter reviews the history of the zygoma implant according to its indications, from its original purpose to treat patients suffering from traumatic maxillary bone defects or resections to its contemporary uses in patients with severely resorbed maxillae.



Fig 1-1 / The zygoma (*blue shading*) forms a portion of the roof of the maxillary sinus and the lateral border of the orbit.

Fig 1-2 / 3D reconstruction of a patient with significant right midfacial trauma and failed bone grafting.

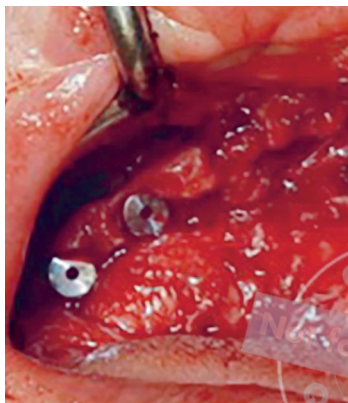
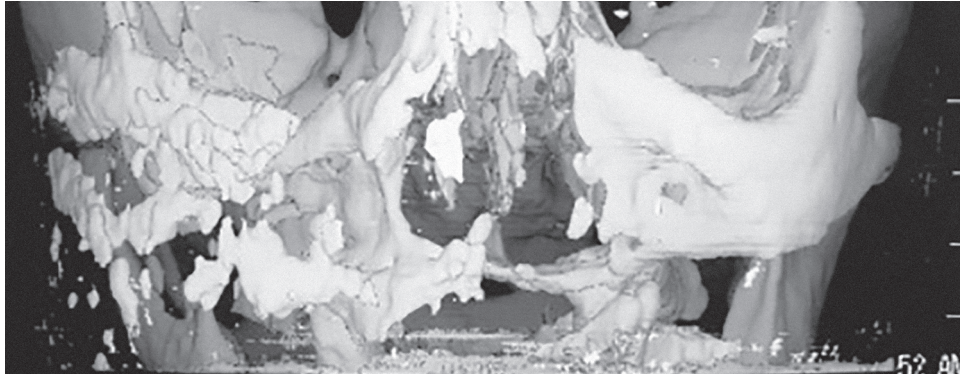


Fig 1-3 / Placement of two endosteal implants with cover screws in the remaining portion of the right zygoma.

TRAUMATIC DEFECTS

At one time, a tissue-supported removable prosthesis was the only treatment option for the dental rehabilitation of many patients who had undergone significant midfacial trauma (Fig 1-2). However, due to the difficulty of establishing an adequate peripheral seal, the reliable retention of these prostheses was often not possible, resulting in compromised function and esthetics. To enhance prosthesis retention, P-I Brånemark began exploring the possibility of anchoring endosteal implants in the surrounding stable maxillofacial skeletal bones. For this group of patients, the zygoma was the distant anchorage site of choice for endosseous implants.

Initially, conventional 3.75-mm machined titanium implants 8 to 10 mm in length were placed in the zygoma according to a two-stage surgical protocol (Fig 1-3). A waiting period of 6 months was allowed for implant osseointegration prior to uncovering the implants to begin the prosthetic phase of rehabilitation. Long, custom abutments were fabricated to allow maxillofacial prosthodontists to bring the implant platform closer to the occlusal plane.

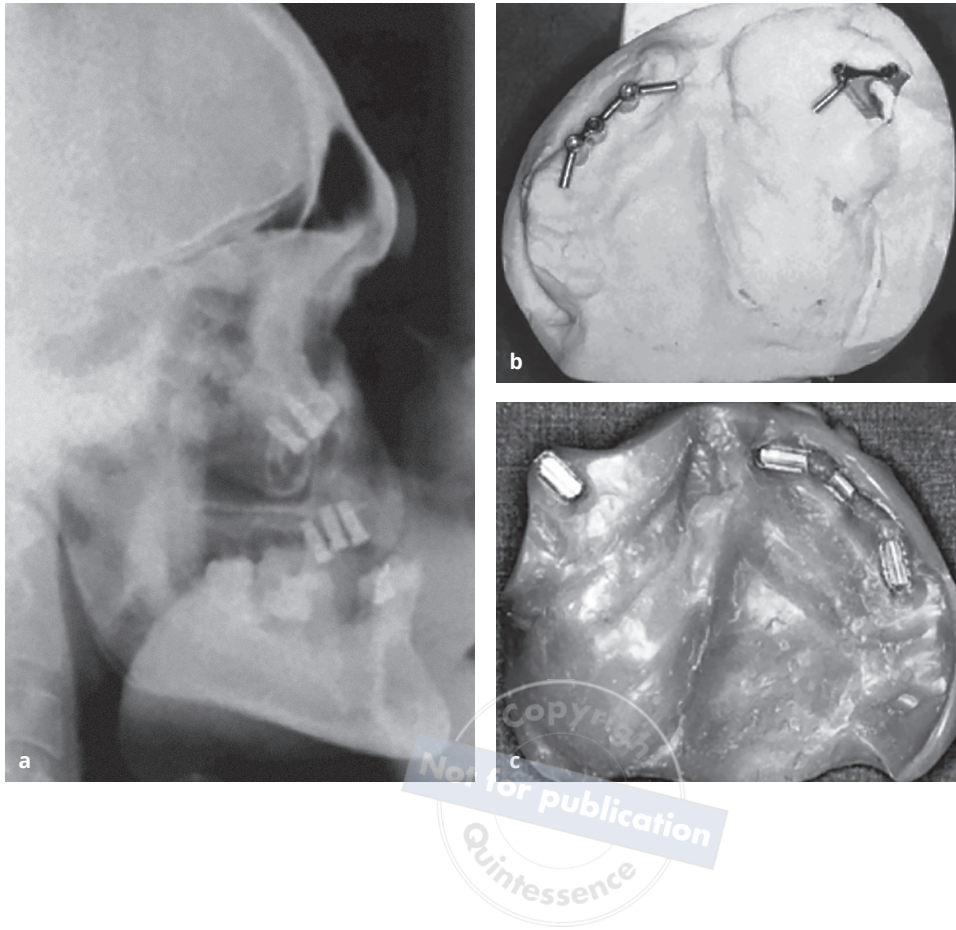


Fig 1-4 / (a) A patient with a left maxillectomy. Two endosseous implants were placed in the left zygoma. (b and c) Splinted implants were used to retain the overlying removable prosthesis.

The placement of conventional machined titanium implants in maxillectomy patients was also reported by Thomas Weischer et al in 1997.¹ As seen in Fig 1-4a, three endosteal implants were placed in the patient's right maxillary alveolar bone, along with two endosseous implants in the left zygoma. After osseointegration of all implants, the implants in the left zygoma were connected with a titanium bar and used to retain the overlying prosthesis (Figs 1-4b and 1-4c).

In many patients treated according to these methods, however, the outcome was that the implant-abutment junction was too far from the abutment-prosthesis junction, creating a long cantilever. Although the prostheses were tissue supported and only implant retained, in general the clinical outcomes were associated with frequent loosening and fracturing of the prosthesis and the custom-made abutment screws. The difficulty of replacing the fractured abutment screws made this treatment unpredictable, and a very high level of maintenance was also required.

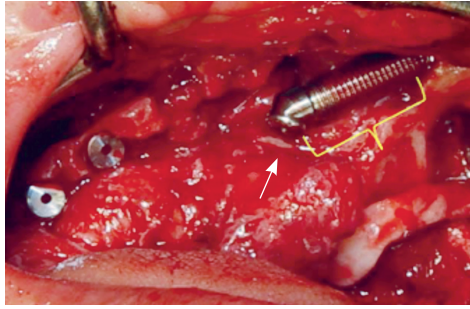


Fig 1-5 / The extended length of the zygoma implant eliminates the need for long, custom-made abutments.

The logical solution to this type of complication was exchanging the conventional implants with long, custom-made abutments for single-piece implants—hence, the birth of the zygoma implant. Figure 1-5 shows the use of conventional implants in the patient's right zygoma as well as experimentation with a zygoma implant in the patient's left zygoma. The extended length of the zygoma implant replaces the need for a long custom abutment and brings the restorative platform of the implant into the proper occlusal plane. Eliminating long custom abutments resulted in fewer mechanical complications and more predictable restorations with easier maintenance for this group of patients.

Brånemark did not report the use of the new zygoma implant until 10 years after treating the first patient in 1989; the first publication on the use of the zygoma implant was not until 2000.² This study reported the predictable treatment outcomes found with zygoma implants, both in the patient who received the newly designed zygoma implant and in patients treated earlier according to a zygoma concept. The first course to introduce the zygoma concept to North America was held in 1996, and the technique was quickly adopted by a select group of maxillofacial surgeons, who found the same positive outcomes as reported in the 2000 paper.

The zygoma implant proved to be invaluable for treating patients who had suffered trauma to the midface. Figure 1-6 shows an example of one of these patients. He had suffered a gunshot wound to his right midface, resulting in partial avulsion of the right hemimaxilla. The lack of hard tissue support in the maxillary right posterior quadrant created difficulty in retaining a maxillary partial denture, even with the assistance of splinted conventional implants in the anterior maxilla. To facilitate the retention and function of the partial denture, a zygoma implant was placed distal to the existing implants in the intact zygomatic bone. This allowed for the extension of the implant-retained bar for a more stable partial denture.

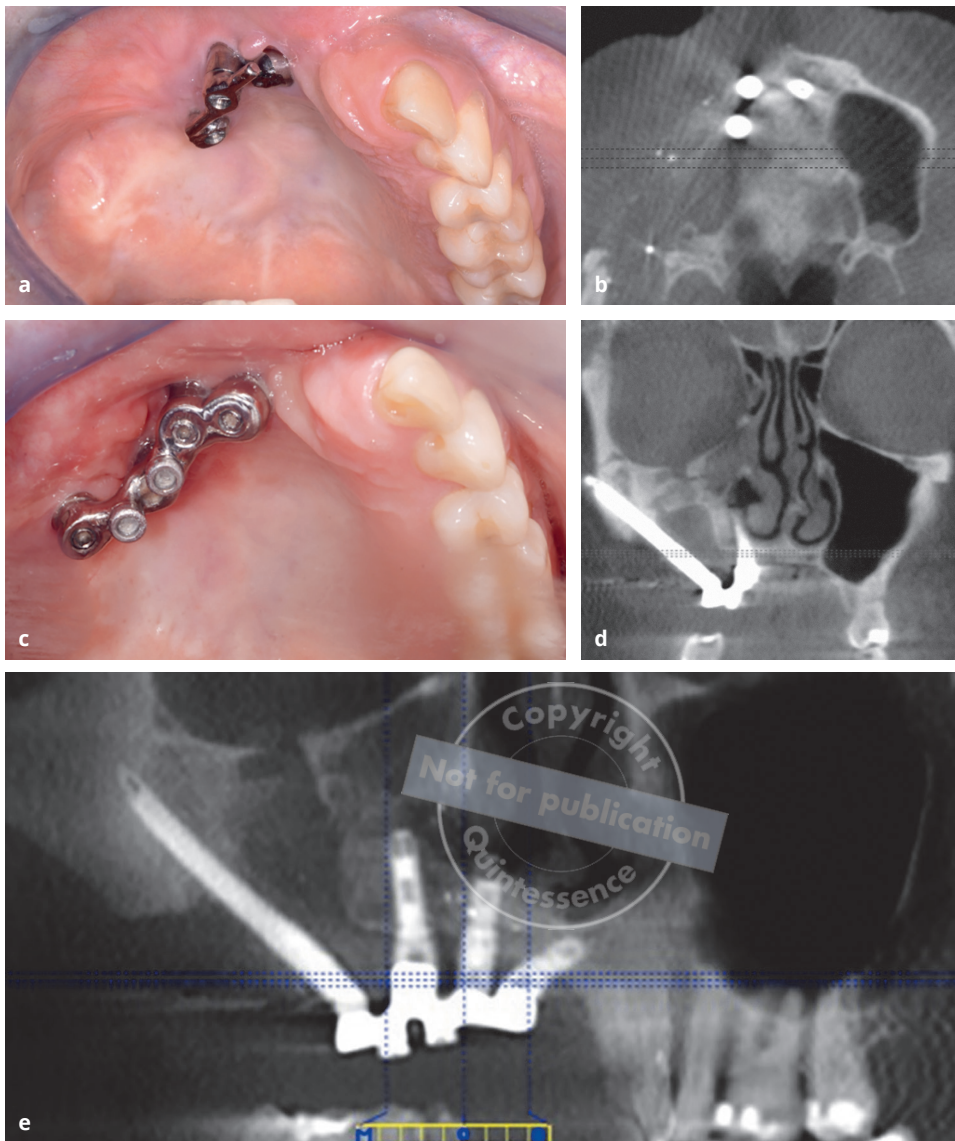


Fig 1-6 / (a and b) Loss of the right maxilla and inadequate prosthesis retention even with three conventional implants and a bar-retained partial denture. (c to e) Views at the 8-year follow-up after the placement of a zygoma implant that was used to extend the original bar for better retention of the partial denture.

ONCOLOGIC DEFECTS

Zygoma implant therapy has also become a predictable treatment option for patients who have undergone oncologic resections involving partial or total maxillectomy (Figs 1-7 and 1-8). Clinical success with the zygoma implant concept led to the need for establishing specific protocols for treating patients with maxillofacial defects. In 2012, Bedrossian and Brånemark reported systematic treatment planning protocols for the rehabilitation of patients with various maxillofacial defects.³ The number and distribution of implants for the reconstruction of orbital defects, nasal defects, and hemifacial resections were outlined, and the authors emphasized the importance of interdisciplinary collaboration

Fig 1-7 (left) / Model showing double zygoma implants used for the reconstruction of a partial maxillectomy.

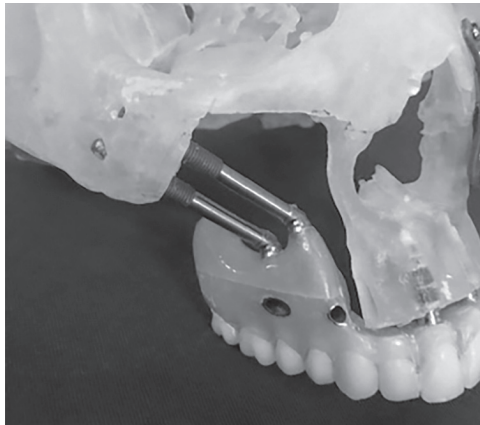


Fig 1-8 (right) / Single zygoma implant used to rehabilitate a patient with a maxillofacial defect.

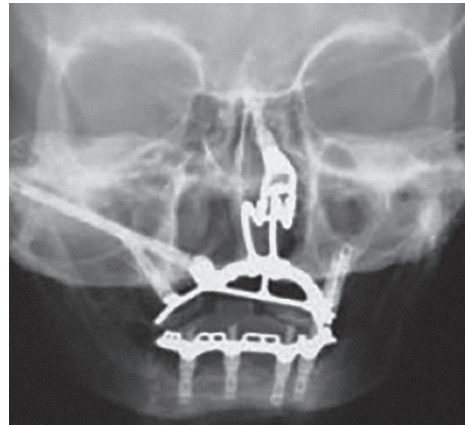
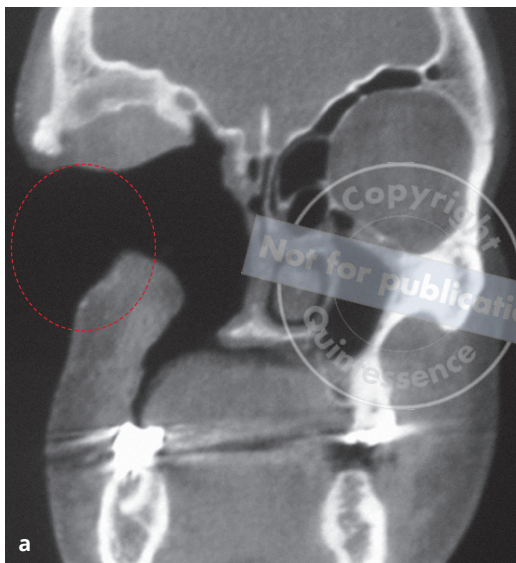


Fig 1-9 (a and b)
Resection of the right zygomatic bone limits the ability to predictably rehabilitate this patient.



between the oncologic (primary) surgeon and the reconstructive (maxillofacial) surgeon to ensure retention of the zygoma when possible.

It is important that oncologic surgeons treating patients with neoplastic midface lesions critically evaluate whether the zygomatic bone can be spared from the resection field. In cases where the zygoma is resected due to a cancerous lesion or when the rehabilitation of the patient is not adequately considered preoperatively and the uninvolved zygoma is partially or totally resected, the resultant lack of zygomatic bone prohibits the rehabilitation of the patient with any reliable retentive prosthesis, as seen in Fig 1-9.

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