The Evolution of Complex Microsurgical Midface Reconstruction

A Classification Scheme and Reconstructive Algorithm

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KEYWORDS

• Midface • Microvascular • Free flap • Reconstruction • Orbit • Malar • Maxilla

KEY POINTS

- Complex midface reconstruction has evolved from prosthesis-based rehabilitation to surgical reconstruction.
- The authors present a new surgically based classification scheme for complex midface ablative surgical defects.
- Three-dimensional modeling of both bony and soft tissue elements is critical to achieving good outcomes.

INTRODUCTION

The orbito-malar framework is one of the most difficult regions to reconstruct if there is significant tissue loss. The complexity of the 3-dimensional (3D) interplay of bone, soft tissue, vital neuromuscular structures, and skin makes this area such a challenge. Beyond the anatomy, the region is a critical part of the face where aesthetic outcomes become paramount. Observers can identify a few millimeters of malposition of anatomic landmarks (eg, the lower lid margin) because of the robustness of our facial recognition systems. This ability places a unique reconstructive burden on the surgeon. The combination of anatomic complexity and the psychological and functional importance of the region have made its reconstruction a high-stakes affair.

HISTORICAL CLASSIFICATION SCHEMES

As the first step in approaching any reconstructive procedure is developing an understanding of the missing normal anatomy, the initial efforts to establish a management scheme were aimed at defining the anatomic aspects of the region. In an attempt to achieve a unified classification system of the midface after maxillectomy, at least 15 individual classification systems have been proposed in the past half-century. However, there remains no surgical or prosthodontic consensus on which one to use. Concurrent with the advent of numerous classification schemes has been the evolution of the surgical techniques to manage them. As we progressed from purely prosthetic-based approaches to fully surgically based reconstructions, the schemes were constantly revised to

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account for the ever-changing playing field of maxillary reconstruction. As each new classification has emerged, new parameters have been included. Aramany[1] designed a system from a purely prosthodontic angle, discussing mainly the palate and maxillary alveolar ridge. McGregor and McGregor[2] chose to use a simple 3-class system, based on interruption (or not) of the orbital floor. Others then extended their systems to include midfacial skin.[3–5] Spiro and colleagues[6] defined maxillectomy defects based on the removal of specific antral walls: limited maxillectomy as removal of only one (unspecified) antral wall, subtotal maxillectomy as removal of 2 (unspecified) antral walls, and total maxillectomy as removal of the entirety of the maxilla. Davison and colleagues[7] discuss maxillectomy defects and advocate their "filling," if obturator use is impossible or intolerable.

In this era of classification schemes, the defects were characterized simply on anatomic characteristics and landmarks with little focus given to reconstructive options. Surgical reconstruction remained a last resort for volumetric reduction of defects as maxillary prosthodontics remained the mainstay for rehabilitation.

SURGICAL RECONSTRUCTION OF COMPLEX MIDFACE DEFECTS

Although microsurgical reconstruction became commonplace after its initial introduction in the early 1980s, it is important here to note that microvascular reconstructions of the midface were not attempted until the 1990s and complex osseocutaneous free flaps did not make an appearance until the twenty-first century. Better understanding of flap anatomy, increasing comfort level with flap modification and inset geometry, and improved flap survival rates all contributed to this evolving clinical path. As the mode of reconstruction has changed, the classifications before this have limited value in directing the complex microvascular free flap reconstructions performed today.

At the turn of the century, the paradigm began to shift as the free flaps used for midface reconstruction began to increase in complexity and provide better functional outcomes. Comparative studies measuring quality-of-life metrics offered evidence of better self-esteem and psychosocial outcomes in patients who had surgical reconstruction when compared with their prosthesis-based rehabilitation counterparts.[8,9] As the pendulum shifted to surgery, the surgical approaches continued to improve. Instead of using solely large soft tissue flaps to obliterate defects, the goals changed to better osseous reconstructive methods to improve functional outcomes.

Techniques to rebuild midface buttresses and provide a framework of alveolus for dental implantation began to become more commonplace in the literature with investigators advocating specific reconstructive constructs (C shaped, Omega shaped, stacked, and so forth) and different donor flaps (fibula, iliac crest, scapula). Umino and colleagues,[10] Davison and colleagues,[7] Brown and colleagues,[11] Triana and colleagues,[12] Cordiero and Santamaria,[13] Okay and colleagues,[14] Yamamoto and colleagues,[15] Futran and Mendez,[16] and Rodriguez and colleagues[17–19] have all entered their individual classification schemes and surgical algorithms into the reconstructive arena.

The Evolution of the Classification Systems

If the classification schemes of old were lacking in appropriate algorithms for reconstruction, the newer literature became focused on individual techniques for specific defects. In doing so, the individual reports became less universal as guidelines for management. Also, most, if not all, of the work has been directed at bony reconstruction with little technical guidance as to how to establish an appropriate volumetric reconstruction. There is often discussion of what bone is missing but little emphasis on which specific structures need replacing and to what end. For example, the widely accepted schema of Cordeiro and Santamaria's[13] classification system describes 4 groups, depending on the lost maxillary bony borders. The classification is used to guide the choice of osseocutaneous free flap. Bone is the tissue to be addressed first; the soft tissues are mentioned, though not with regard to restoring normal architecture.

A commonly used classification system comes from Brown and Shaw.[20] They describe the defect by its vertical and horizontal extensions, in terms of numbers and letters, respectively. Their intentions are (1) to provide a framework for nonsurgical health care workers to plan their input (eg, the prosthodontist), (2) to predict future outcomes (eg, midfacial collapse following resection of the orbital floor), and (3) to guide reconstruction of the defect. In 2010, this system was revised to include orbito-maxillary and nasomaxillary defects. New recommendations are made with regard to reconstructive approach, depending on the descriptor given to a defect. (There is no mention of volume replacement to counteract enophthalmos in class III or replacing the inferior orbital rim with bone/implant. They also advocate 3 distinct bone flaps for the same defect, each