A Comprehensive Strategy for Reconstruction of a Missing Midface

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Summary: The loss of midface structures always leads to significant functional and cosmetic deficits, and the reconstruction work remains a challenge for surgeons. We report a rare case with severe midfacial defects involving the maxilla, nasal bone, and zygoma. This patient was treated with a comprehensive approach that included distraction osteogenesis, computer-aided surgery, a fibula bone graft, dental implantation, orthognathic surgery, and rhinoplasty. The treatment procedures required 4 years to complete, and a dramatically improved facial contour and stable occlusion were achieved. The results demonstrated the importance of a multidisciplinary approach and computer-aided design when treating severe maxillofacial deformities. Other important elements of the treatment process were the meticulous physical examination, the selection of an optimal treatment sequence, the skill of the surgeons, and more importantly, the patient-oriented mindset. (Plast Reconstr Surg Glob Open 2015;3:e446; doi: 10.1097/GOX.0000000000000376; Published online 6 July 2015.)

The loss of key midface structures leads to significant functional and cosmetic deficits, and the reconstruction work remains a challenge for surgeons.¹,² Several techniques have been developed for the treatment of such cases, such as maxillary prostheses, vascularized composite flap grafts, distraction osteogenesis (DO), computer-aided surgery (CAS), and facial transplantation (FT).²⁻⁴ The majority of physicians prefer a comprehensive approach that combines different techniques to treat complex midface defects.³,⁵,⁶ We report a rare case with severe midfacial defects.

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CASE REPORT

An 18-year-old Chinese girl was referred to us with a severe facial deformity that had been present since her birth. The deformity was associated with poor speech intelligibility and feeding disturbances. Clinical examination demonstrated a severe maxillary defect and bilateral zygoma hypoplasia accompanied by nose and mandible deformities. Her mouth opening was normal, and no obvious deviation of the mandible was observed. No teeth presented in her upper jaw, and the teeth in the lower jaw were intact but lingually inclined. A three-dimensional computed tomography scan clearly revealed the patient’s skeletal deformity (Fig. 1). The patient’s health and social life were greatly affected, and she had a high motivation to undertake any procedure that would improve her oral–facial function and appearance. In addition, the patient’s family history could not be traced because she had been abandoned as a baby.

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We adopted a comprehensive strategy to reconstruct a new midface for the patient. After an extensive multidisciplinary discussion among the maxillofacial surgeons, orthodontists, and prosthetic teams, we began the treatment with the correction of her hypoplastic zygoma and nasal bone by performing a Le Fort III osteotomy and external DO. The distraction distance was 1.6 cm, and the girl acquired a fronted zygoma and nasal bone, and her orbital shape was also improved greatly (Fig. 2).

Because of the severe deficiency in the midface, we decided to use a fibula osteomyocutaneous flap to rebuild a new maxilla. We manufactured resin models of a facial skeleton and a fibula bone according to computed tomography data and performed model surgery. The miniplates were prebent to facilitate shaping the fibula graft and to ensure its proper placement during surgery. Then, a 19.5-cm long fibular bone with a 3 × 8-cm² skin paddle was harvested and shaped to form a U-shaped maxillary arch that was connected to the bilateral zygoma and the remnant thin maxilla (Fig. 2). The skin island and muscle were placed into the mouth to separate the nasal and oral cavities. After surgery, the patient’s facial contour was dramatically improved.

To rebuild an appropriate occlusion and further improve the facial contour, we performed implantation in the reconstructed maxilla and mandible osteotomy (bilateral sagittal split ramus osteotomy). We designed and produced an implant guide and a special splint, which was composed of the implant guide and a mandible occlusal guide, using the computer-aided design/computer-aided manufacturing technique. Five implants were placed, and the mandible was moved backward (Fig. 3). Three months later, vestibuloplasty was performed, and the rhinoplasty was then conducted with a costal cartilage graft to improve the patient’s nasal profile. The final dental prosthesis was attached with implants.

It took 3½ years to complete the entire treatment process. The patient recovered very well, and no obvious complications were referred to us (Fig. 4). She married and gave birth to a healthy boy during the follow-up period.

**DISCUSSION**

The maxilla composes the main portion of the midface, and its restoration plays a central role in
midface reconstructive procedures. Elimination of the defect, restoration of the essential functions, the provision of adequate support for the midfacial units, and restoration of the esthetics of the facial features are the goals of maxillary reconstruction.7 Prosthesis can repair small maxillary defects,7,8 but large defects normally call for reconstruction using compound tissue flaps.8,9 DO has been used to repair maxillary bony defects,10 and it has been used in the zygoma to restore the low projection of the maxilla, so that prosthetic rehabilitation can be accomplished.11,12 Recently, FT has also been regarded as an innovation for treating a severely damaged face.1,13 However, considering the complicated surgical procedures, the need for life-long immunosuppression, the meticulous selection of the patient and the donor body, the unsatisfactory mortality rate, and the ethical controversy,4,13,14 FT still must overcome many hurdles before it will gain widespread acceptance. In our case, we proposed a comprehensive strategy that involved DO, a free composite tissue graft, orthodontic treatment, orthognathic surgery, implanted prostheses, and rhinoplasty. To the best of our knowledge, this is the first case in the English literature that combined these techniques to accomplish midface reconstruction in a single patient.

To carry out this comprehensive strategy, the first issue was to determine the correct treatment sequence. Generally, bony reconstruction should be performed before soft-tissue reconstruction, followed by the esthetic repair and dental rehabilitation.15,16 We followed this principle and divided the treatment procedure into 4 successive steps. It should be noted that the sequence was determined based on the philosophy that the comprehensive procedure is an integrated whole, and each step should solve a main problem and lay the foundation for the next step. The incorrect sequence would prolong the therapeutic process, impair the surgical outcomes, and might result in treatment failure. To avoid this, an extensive preoperative discussion among the treatment team is particularly important.

With the development of computer technology in medicine, CAS has become a new paradigm for the treatment of craniomaxillofacial malformations, and its distinct superiority to other approaches has been demonstrated.17,18 For our patient, the absent maxilla, the hypoplastic zygoma, and the protruding mandible made it very difficult to properly rebuild
the maxilla. However, computer modeling was used to calculate the vectors for the augmentation of the zygoma and nasal bone, simulate the maxilla reconstruction with a virtual fibula bone graft, and manufacture a digitally designed splint for orthognathic surgery and implantation using the computer-aided design/computer-aided manufacturing technique. CAS was a key element in the achievement of a good surgical outcome in this case.

We report a comprehensive strategy for midfacial reconstruction, which restored the esthetic appearance and function of the oromandible in a patient suffering from severe maxillary loss. The excellent results reveal the importance of multidisciplinary teamwork and the use of CAS. Other elements that are important for the successful treatment of complex facial defects include meticulous physical examination, the correct treatment sequence, the skill of the surgeon, and more importantly, a patient-oriented mindset.

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PATIENT CONSENT

Parents provided written consent for the use of the patient’s image.

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