CASE REPORT

Comprehensive Rehabilitation After Severe Maxillofacial Injury in a Cleft Patient

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We present here a complex oral rehabilitation procedure for a 19-year-old male patient with an operated cleft lip and palate who suffered motorcycle accident injuries including facial lacerations, and a severe mandible fracture with loss of teeth, gingiva and alveolar bone. His initial skeletal and occlusal relationship made the emergent surgical management extremely difficult. Emergent soft tissue repair and open reduction surgery for the comminuted fracture at the mandible were performed during the intensive care period. A 2-year period of comprehensive procedures including surgical/orthodontic treatment, implant surgery and bone graft and prosthetic restoration for oral and maxillofacial rehabilitation to treat the severely compromised soft and hard tissue status, intermaxillary jaw discrepancy, and severe malocclusion, were sequentially performed. Satisfactory results were observed after a 5-year follow-up. [*J Chin Med Assoc* 2010;73(10):543–548]

Key Words: bone graft, cleft, implant, mandible fracture, orthodontic, trauma

Introduction

Teeth avulsion with alveolar bone loss is commonly seen in patients with maxillofacial injury. In Taiwan, maxillofacial injuries are one of the leading complications associated with motorcycle accidents. Post-traumatic conditions such as a focal scar, shallow or floating vestibule, lack of adequate keratinized gingiva, and loss of alveolar bone and teeth that mimic a severely atrophic alveolar ridge greatly compromise the ease of oral rehabilitation.[1] Various restorative procedures have been reported using different types of alveolar ridge augmentation, soft tissue management, and dental implant-assisted oral rehabilitation.[1–8] Another set of compromised soft and hard tissue conditions in the oral cavity comes from congenital craniofacial deformities such as Crouzon syndrome, Apert syndrome, and cleft lip/palate patients. A cleft patient may present a severe malocclusion with focal congenital missing of teeth, scarring of the vestibule, lack of alveolar bone and, most importantly, mid-face underdevelopment accompanied by an acquired angle class III malocclusion and mandible prognathism.[9,10] This can be corrected by a well-planned sequence of surgical/orthodontic treatments assisted by other subspecialties in dentistry and medicine.

We present a case with operated congenital cleft lip and palate with mandible prognathism who suffered from severe facial lacerations and compound comminuted fractures of the mandible in a motorcycle accident. After careful clinical evaluation, we suggested that he receive comprehensive and staged soft and hard tissue management for oral rehabilitation after his recovery from emergent open reduction surgery. We describe a logical sequence of treatments including orthognathic surgery, bone grafts, implant surgery, vestibuloplasty, orthodontic treatment, and prosthetic rehabilitation.

Case Report

A 19-year-old male patient with disturbed consciousness was sent to Taipei Veterans General Hospital, Taiwan in 2001 after a motorcycle accident. Immediate physical

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examination demonstrated multiple skin abrasions in the craniomaxillofacial area, trunk, and extremities. The maxillofacial injury involved severe facial soft tissue lacerations and a compound comminuted fracture of the mandible. The mandible was separated into 3 pieces with 2 proximal fragments and 1 suspended fragment attached to soft tissue of the lower lip. The patient had complete avulsion of 6 teeth, including 2 mandibular premolars on the right side, 4 posterior teeth on the left side and loss of alveolar bone of the anterior mandible (Figures 1A and 1B). Computed tomography of the face and brain revealed mild swelling over the left side of the cerebrum and subarachnoid hemorrhage in the left parieto-occipital region, and a compatible clinical pattern of mandible fractures (Figure 2A and 2B).

Emergent management included endotracheal intubation, body fluid resuscitation and intensive monitoring of vital signs. Since a seizure attack was noted in the emergency room, phenytoin was immediately administered via the intravenous route. Medical and personal history revealed that the patient had a cleft lip and palate and was missing the upper lateral incisors. The patient had received early repair of the cleft at another hospital during childhood. Because of the severely obstructed upper airway that resulted from the comminuted mandible fracture, a tracheotomy was performed under general anesthesia after his conscious status became clear 24 hours from the time that he was brought to the emergency room. Emergent open reduction for the mandible fracture and primary repair of the lacerations were carried out at the same time. A long titanium reconstructive plate and 2 miniplates were used to maintain the continuity and contour of the mandible (Figures 1C and 3A). Based on a statement from the patient's family and our clinical evaluation, the correct occlusion should be established at an Angle class III relation. The course of recovery was smooth and the patient was discharged 3 weeks later.

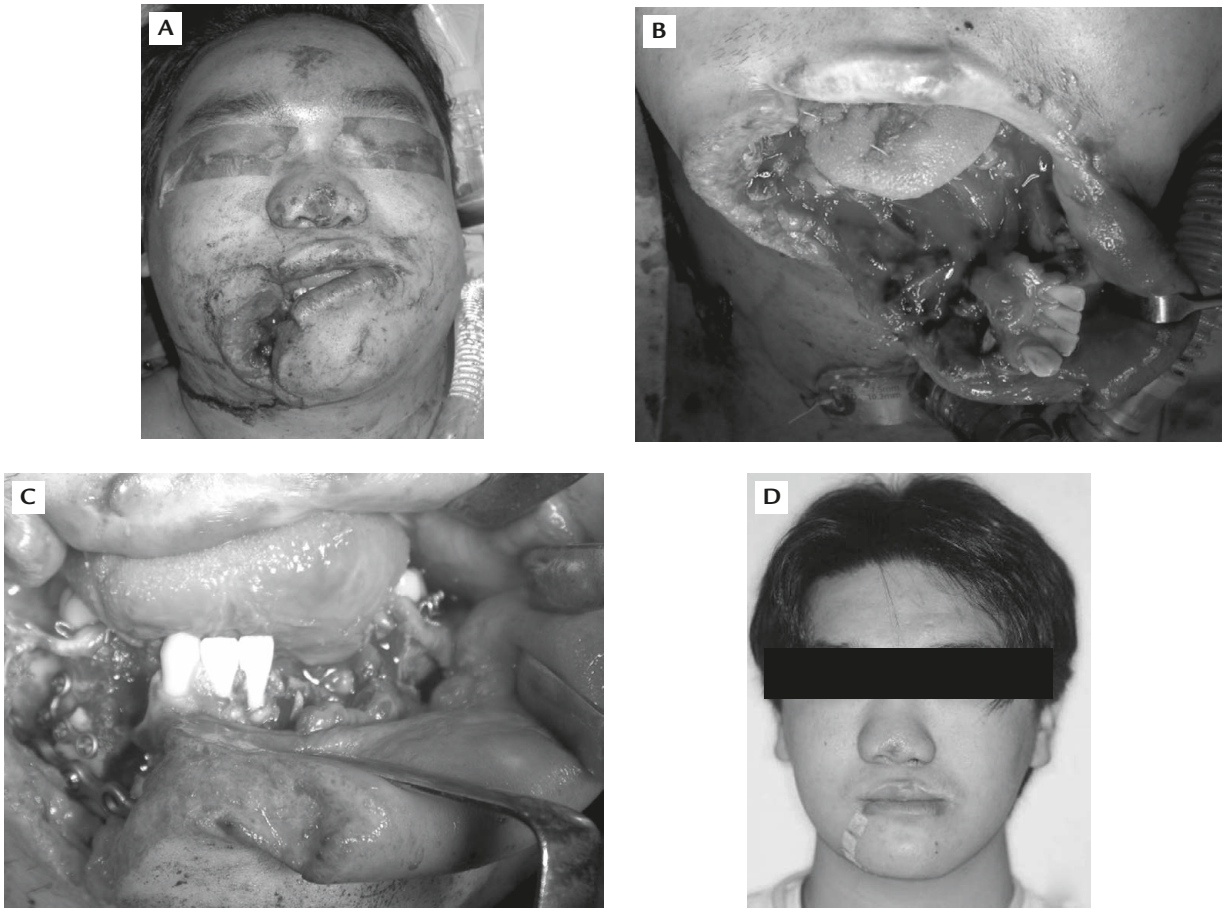

Figure 1. (A) Multiple facial skin abrasions with severe tissue lacerations observed on the lower lip. (B) Compound comminuted fractures of the mandible leading to an avulsed anterior fragment with 4 retained teeth suspended on the facial tissue. (C) Open reduction surgery with a long titanium reconstructive plate for immobilizing fractured pieces of bone fragments to maintain the continuity of the mandible was carried out. (D) Facial appearance showing an old surgical scar on the left upper lip and a surgical scar from this accident on the right lower lip.

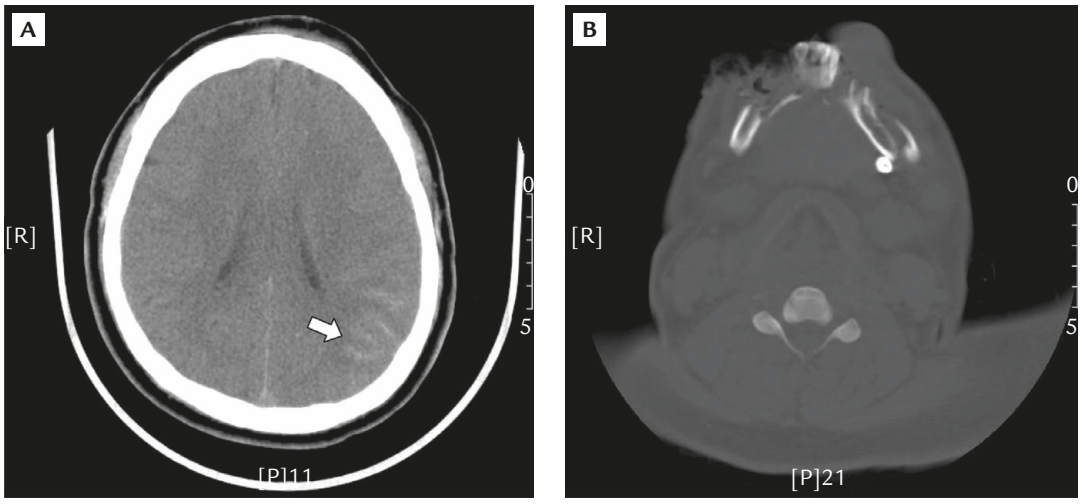

Figure 2. Computed tomography showed: (A) mild swelling of the brain and limited subarachnoid hemorrhage at the left parieto-occipital lobes (white arrow), and slight compression of the left lateral ventricle by brain edema; (B) compound comminuted mandible fracture with severe facial tissue lacerations.

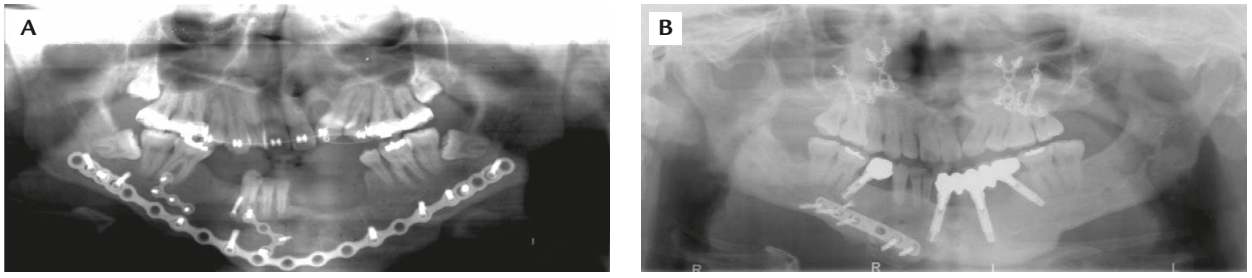

Figure 3. Radiographical images at different phases of treatment. (A) Panoramic radiograph after emergent open reduction surgery. A long titanium reconstructive plate was used to immobilize and maintain the continuity of the fractured mandible. (B) Panoramic radiograph after comprehensive and didactic surgical procedures. Miniplates with screws for LeFort I osteotomy, a compression plate with screws for the bone graft of the mandible and prostheses supported by 4 implant fixtures are shown.

Three months later, physical and radiographic examinations revealed multiple functional and cosmetic problems. Extraorally, his mild concave facial skeletal profile and mandibular prognathism were marked by fullness of the face (Figure 1D). Intraorally, there was loss of the attached gingiva and multiple teeth in the mandible were missing. The malocclusion included a 7-mm reverse overjet, anterior open bite, crowded maxillary dentition, and class III canine/molar relationships (Figures 4A–4E). Different treatment options including conventional removable/fixed prostheses and an implant prosthesis were discussed with the patient and his parents. The indications for the surgical/orthodontic treatment were also carefully explained. They opted for a more comprehensive treatment by implant surgery, soft and hard tissue management, and advanced surgical/orthodontic treatment. Presurgical treatment included periodontal ultrasonic and hand scaling. Oral hygiene instruction was given after the completion of informed consent.

Initial orthodontic treatment

The first 6-month period of orthodontic treatment mainly focused on relieving crowded teeth, arch coordination, leveling of dentition, correction of the upper dental midline and decompensation of the retroclined lower incisors and proclined upper incisors (Figures 4F–4J). While waiting for bone healing of a severe mandible fracture (Figure 3A), orthognathic surgery to correct the intermaxillary jaw discrepancy was carefully planned. During the period of the initial teeth alignment, a 5-mm reverse overjet, 4-mm open bite, and a bilateral 5-mm class III canine/molar relationship were observed.

Surgical phase

Removal of the reconstructive plate by orthognathic surgery, bone grafting for the deficient area of the mandible, and implant surgery were primarily performed simultaneously. Vestibuloplasty could be postponed to at least 2 months after hard tissue management.

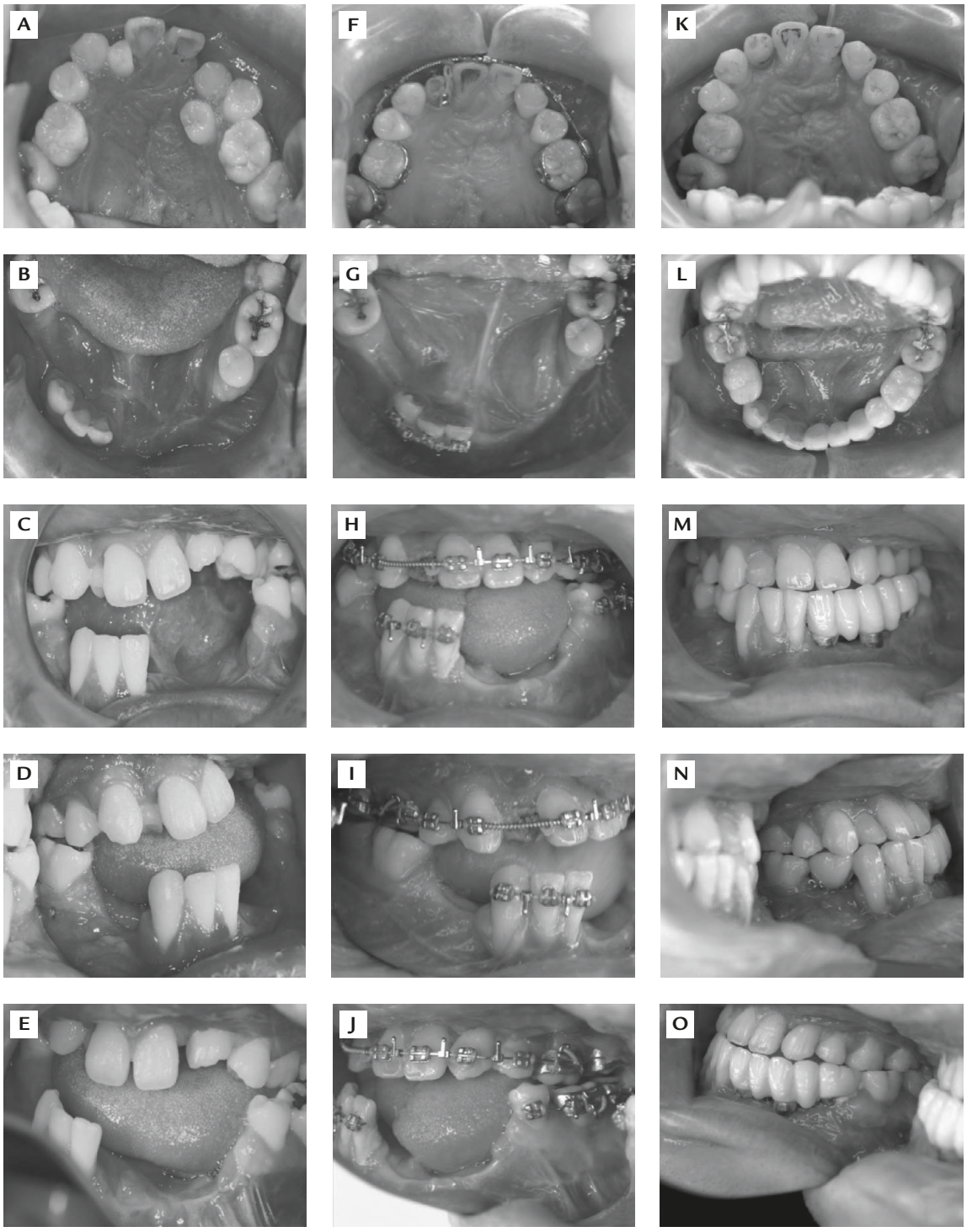

Figure 4. Intraoral photographs at different phases of treatment. (A–E) Three months after open reduction surgery. A compromised vestibule with loss of the gingiva, teeth and alveolar bone can be observed. The malocclusion included a 7-mm reverse overjet, anterior open bite, crowded dentition, and class III canine/molar relationships. (F–J) Six months after the initial orthodontic treatment. Relieving and leveling of the crowded dentition, arch coordination, and decompensation of the retroclined lower incisors and proclined upper incisors are shown. (K–O) Five-year follow-up. An edge-to-edge anterior occlusal relationship and a slight posterior buccal crossbite are shown. A 5-unit bridge from the left lower canine to the 2nd molar supported by 3 dental implants and a single implant prosthesis on the right side of the mandible are in place.

Orthognathic surgery by LeFort I osteotomy

The first goal of the orthognathic surgery was to cope with the above problems due to the cleft-related underdevelopment of the maxilla and a relative mandibular prognathism. The orthognathic surgery was performed in the maxilla. A LeFort I osteotomy was performed to achieve a 5-mm anterior movement of the whole maxilla and a 4-mm wedge-shaped downward movement of the anterior maxilla. The maxillary fragment was immobilized using an L-shaped and an X-shaped titanium miniplate on each side (Figure 3B).

Iliac bone graft

In the mandible, a whole arch molar-to-molar vestibular incision was made to remove the previously placed reconstructive plate, miniplates and screws. The right-side vestibular wound was deepened to the lower part of the mandible. A $1 \times 2 \times 3$ iliac bone block was harvested from the left side for the augmentation of the deficient basal portion of the mandible and was fixed by a compression plate and 4 miniscrews. Less than 2 mL of iliac bone chips were used for augmenting the deficient edentulous ridge in the mandible and posterior portion of the maxilla after the LeFort I advancement.

Implant surgery

The mucoperiosteal flap spanning from the central incisor to the premolar area was further raised to expose the bone to the edentulous ridge crest. Four 4×13-mm endosteal 3I dental implants (Implant Innovations Inc., Palm Beach Gardens, FL, USA) with 3 on the left side and 1 on the right were guided by a surgical stent and placed in the correct position of the mandible (Figure 3B).

Soft tissue management by vestibuloplasty

Three months after implant surgery and the bone graft, an operation for dental implant exposure was performed under local anesthesia. The procedure for vestibuloplasty was performed to improve the soft tissue morphology in the deficient ridge via a crestal incision with a laterally and apically positioned flap.[8] A supraperiosteal dissection with a No. 15 surgical knife was used to elevate the mucosal flap, which was further extended with an adequate length of buccal releasing incision. The covering screws of implants were replaced with healing abutments. The edges of the labial flap were repaired cervically deep to the periosteum to leave a 5-mm-wide supraperiosteal surface extending mesiodistally between the adjacent teeth. A piece of COE-PAK periodontal dressing material was placed to immobilize the flap postoperatively for 1 week.

Postsurgical orthodontic treatment

One month after soft tissue management, provisional prostheses were made on implant fixtures to provide anchorage for further orthodontic teeth movement. Another 6-month period of orthodontic treatment mainly focused on space closure, maximizing the contact of occlusion, and using the implant assisted anchorage to retract the lower anterior teeth to achieve the correct overjet. The new occlusal and jaw relationships were greatly improved. The braces were removed at the end of this stage. In the prosthetic phase, a 5-unit bridge, spanning from the left lower canine to the 2nd molar, was supported by 3 dental implants. A 1-unit molar shaped fixed crown was designed on the single implant on the right side of the mandible. After a 5-year follow-up, an edge-to-edge anterior occlusal relationship and a slight buccal crossbite in the posterior occlusion were observed. The rehabilitation outcome of the final prosthesis is stable and satisfactory (Figures 4K–4O).

Discussion

The most commonly encountered difficulty in the management of severe maxillomandibular fractures is the need to recover the "correct occlusion". An originally compromised occlusion or malocclusion, loss of teeth from trauma, and complexity of fractures may predispose to the difficulty of management. This may lead to a future need for more surgical procedures to correct the occlusion. Therefore, in the emergent management of this case, we chose an easier method by positioning major bone fragments to an acceptable intermaxillary skeletal and occlusal relationship. Thus, a titanium reconstructive bone plate was an acceptable choice to bridge the continuity of 3 major fractured pieces of the mandible. Other miniplates were used to fix minor pieces of fractured bone fragments. These bone plates or screws were removed in the well-planned 2nd surgical procedure. In addition, the congenital cleft with hard and soft tissue deficiency created an even more challenging and complex situation for the oral rehabilitation of this case.[9,10] These problems deserved a comprehensive, logical sequence of treatments after recovery from the emergent surgery. Based on our experience of surgical management for implant rehabilitation in a series of trauma patients, we considered that the management of hard tissue should be performed earlier than soft tissue preparation, because the bone graft needed full coverage by soft tissue repair.[1,5–8] We first aimed to correct the major intermaxillary disharmony of bones by a surgico-orthodontic combined treatment. In the sequential treatment procedures,

LeFort I osteotomy afforded the movement of the maxilla to improve the patient's open bite, reverse overjet and prognathism of the mandible. From traumatic injuries due to traffic accidents to surgical trauma in open reduction as well as orthognathic surgery, highly vascularized facial soft tissue provides a good blood supply for a predictable outcome of bone healing.[5,6,11,12] In conclusion, this report describes a successful sequential comprehensive rehabilitation procedure of orthognathic surgery, bone grafting, implant surgery, and vestibuloplasty with stable results.

Acknowledgments

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