Dental Traumatology 2007; doi: 10.1111/j.1600-9657.2005.00372.x

DENTAL TRAUMATOLOGY

Case Report

Segmental osteotomy to reposition multiple osseointegrated dental implants in the anterior maxilla in a trauma patient

Kao S-Y, Fong J-HJ, Chou S-J, Wu J-H, Tu H-F, Yeung T-C. Segmental osteotomy to reposition multiple osseointegrated dental implants in the anterior maxilla in a trauma patient. © Blackwell Munksgaard, 2006.

Abstract – A 16-year-old young man had severe loss of alveolar bone and lost four teeth in the anterior maxilla because of traumatic injury in a traffic accident. To overcome the surgically compromised condition for implant rehabilitation, the deficient ridge was augmented by autogenous bone graft from the mandibular symphysis. The augmented ridge had much improvement in width but less in vertical height. Four implants were placed to gain initial osseointegration. Segmental osteotomy was performed to occlusally reposition the implants and bone for 5-mm in the anterior maxilla. After 2 years of clinical follow-up, the rehabilitation outcome is satisfactory and stable.

Shou-Yen Kao[1,2,3], Jenny Hwai-Jen Fong[2], Shen-Ju Chou[1], Jen-Hsien Wu[1], Hsi-Fen Tu[4], Tze-Cheung Yeung[1]

[1]Department of Dentistry, Taipei Veterans General Hospital (VGH); [2]School of Dentistry, National Yang-Ming University (NYMU); [3]Central Clinic Hospital; [4]Department of Dentistry, I-Lan Hospital, Taiwan, Republic of China

Key words: bone graft; implant; maxilla; segmental osteotomy; trauma; vestibuloplasty

Dr Shou-Yen Kao DDS DMSc, No 201, Sec II, Shih-Pai Rd., Oral and Maxillofacial Surgery, Department of Dentistry, Taipei-Veterans General Hospital, Taipei, Taiwan, Republic of China
Tel.: 886 2 287 57572
Fax: 886 2 287 42375
e-mail: sykao@vghtpe.gov.tw

Accepted 29 March, 2005

Excessive loss of teeth and bone are frequently seen in the traumatized anterior maxilla. The traumatized area often requires bone augmentation to provide appropriate dental implant support (1). Difficulties have been encountered to simultaneously augment the width and height of the deficient ridge. Crestal split technique is efficient in lateral widening but not vertical augmentation (2). Onlay bone graft or guided bone regeneration (GBR) technique is especially useful for augmenting the ridge width but, to some extent, has limited advantages in increasing the ridge height (3–6). The interpositional bone graft procedure also has technical difficulty in a limited edentulous ridge (7, 8). The various above bone graft techniques can lead to wound dehiscence, infection, and possibly total failure of bone graft because of lack of appropriate soft tissue coverage in those traumatized areas (2–9). While seeking for methods to increase the success rate of these technique-sensitive procedures, the success rate differs in various follow-up studies to estimate the benefits of the various bone augmentation procedures (1). Distraction osteogenesis (DOG) is another recently proposed principle with significant advantage to increase the bone height but occasional complications and expensiveness of commercial devices sometimes hinder the general acceptance of its clinical use (10–12).

Soft tissue management is equally as important as bone augmentation. The morphology of the augmented area needs to be improved by vestibuloplasty with skin or mucosa graft. Among the various donor sites, keratinized palatal mucosa (KPM) is the best choice as peri-implant tissue grafting in terms of quality and cosmetics (13–15). Here we describe a case of narrow traumatized edentulous ridge in the anterior maxilla which sequentially received bone graft, implant surgery, vestibuloplasty and segmental osteotomy in a comprehensive oral rehabilitation procedure.

Case report

A 16-year-old boy involved in a motorcycle accident presented facial laceration, mandibular

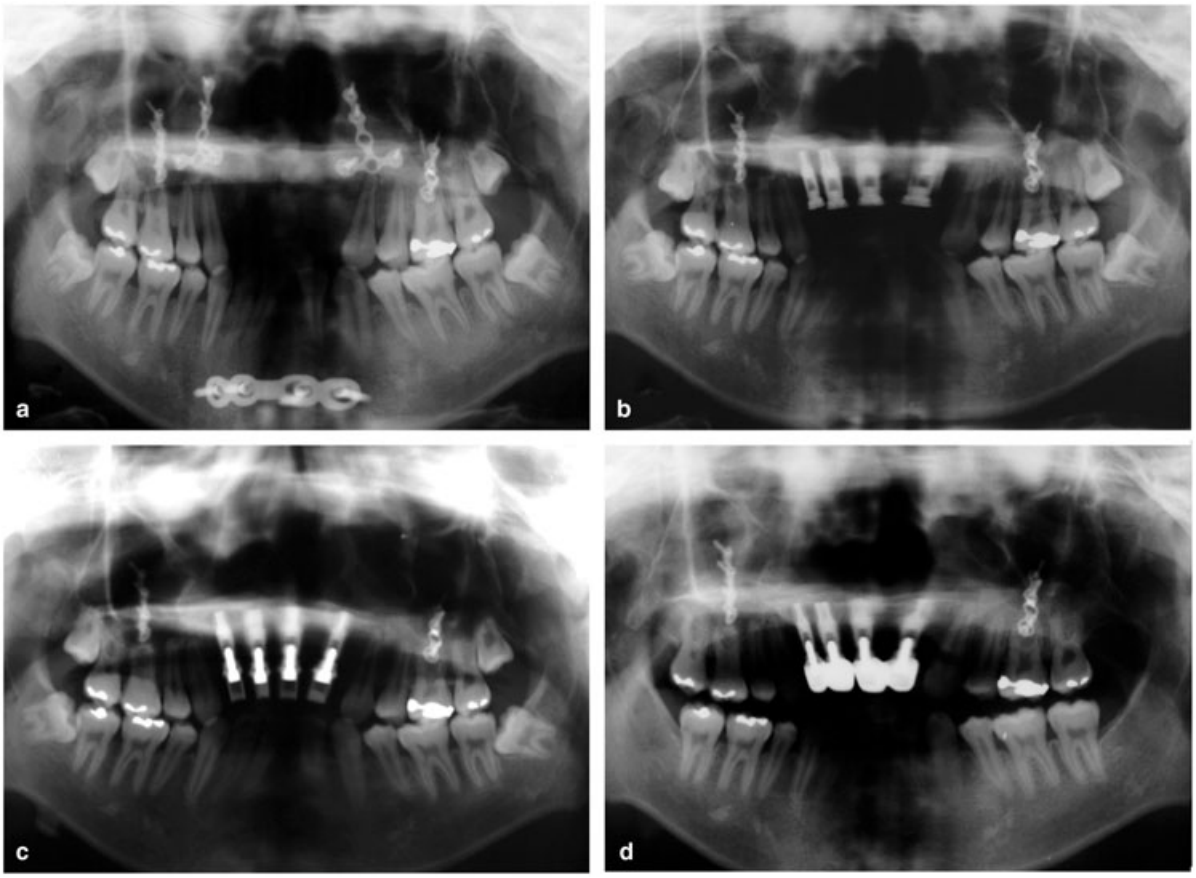

Fig. 1. Panoramic radiographs at different stages of rehabilitation. (a) Four months after open reduction for maxillo-mandibular fractures, bone plates were retained at both jaws. Four anterior teeth in the maxilla were missing. (b) A vague shadow at the symphysis of the mandible represents the donor site of bone graft. The implant is obviously located far above the cervical line of the adjacent teeth. (c) The prosthetic cylinders on the implants show a vertical space longer than needed for the clinical crowns. (d) The implants are repositioned more occlusally when comparing the preoperative level of both apex and top of each implant with postoperative level.

symphysis and Lefort I fracture, and loss of alveolar bone with avulsion of four anterior teeth in the maxilla. Four months after open reduction surgery, he was evaluated for dental rehabilitation. Intra-orally, he had acceptable occlusion but showed severely deficient alveolar bone, lack of keratinized gingiva, shallow vestibule with scar, and loss of four anterior teeth in the maxilla. Radiographic examination showed bone plates left from previous open reduction surgery (Fig. 1a). Different treatment plans including necessary surgical procedures, potential outcomes or complications were explained to the patient and his family. They agreed to take the comprehensive approach for implant rehabilitation.

Bone graft

The anterior maxilla was estimated by tomography and model study. Under general anesthesia, a 1.2×3-cm sized fragment of cortico-cancellous bone was harvested from mandibular symphysis via a vestibular approach. In the maxilla, the miniplates at previous fractured sites were removed bilaterally via two separate vestibular approaches. A sub-periosteal tunnel between right and left maxillary canines was prepared to provide the recipient site for the grafted symphysis bone, which was immobilized by a 10-mm-long mini-screw. The wound was tightly closed and covered by a COE-PAK^{TM} periodontal dressing material (GC America Inc., ALSIP, IL, USA) for 1 week. A compromised shallow vestibule was seen at this stage.

Implant surgery

Six months later, the augmented ridge was ready for implant surgery. Under local anesthesia, four Osseotite^{TM} $3.75 \times 3.75 \times 13$ mm implants (3I$^{®}$ Implamt Innovations Inc., Palm Beach Gardens, FL, USA), were placed according to the guide of the surgical stent. One month later, a removable partial

denture was relined and delivered. The panoramic film showed an obvious insufficiency of the bone level at the implant site (Fig. 1b).

Design of segmental osteotomy and soft tissue management

Four months later, the second stage operation to expose implant fixtures was performed. Clinically, the insufficient vertical ridge height at the implant site led to an occlusal clearance much longer than needed when prosthetic abutments were tried (Fig. 1c). To overcome the predictable unsatisfactory cosmetics of the prosthesis, another surgery to occlusally reposition osseointegrated implants and bone for 5–7 mm was planned. Under general anesthesia, a labial flap with supra-periosteal dissection was created from the muco-gingival junction close to the ridge crest, and extended with bilateral buccal releasing incisions. Segmental osteotomy was started via bilateral vertical cuts of anterior maxilla with minimal exposure of bone between teeth and implant fixtures. Bilateral cuts were continued and connected by medial extension to the mid-palatal vault (Fig. 2a). The anterior nasal septum was separated from the palate with an osteotome. The anterior maxillary bone fragment was tracked by orthodontic ligature wires fixing at the cervical area of healing abutment of implants and immobilized to a palatal stent. The edge of the labial flap was apically sutured with the periosteum to leave a 15-mm-wide nude supra-periosteal tissue surface spanning between bilateral canines (Fig. 2b). The nude surface was covered by periodontal dressing material for 2 weeks. The vestibular contour at the anterior maxilla was then created. Six weeks later, the primary stability of the downward repositioned maxillary fragment was observed. A permanent fixed prosthesis was completed in the following 2 months with a good cosmetic result (Fig. 2c,d). The radiographic image showed a significant downward repositioning of the bone fragments (Fig. 1d). After 2 years of follow-up, the rehabilitation outcome is stable and satisfactory.

Fig. 2. Clinical pictures of surgery and prosthetic rehabilitation. (a) The vestibuloplasty was performed together with the segmental osteotomy to reposition the multiple implants retained anterior maxilla. A partial thickness apically positioned flap was prepared. (b) The bone fragment was tracked through the ligature wire of each healing abutment on the implant. A 5 mm downward movement of the bone was achieved by immobilization to a palatal stent. (c) Most of the clinical crowns of the fixed prosthesis can be seen with satisfactory cosmetics with the increase of lip strain. (d) Full exposure of prostheses shows acceptable cosmetics with the cervical line in continuation with the adjacent natural teeth.

Discussion

The implant rehabilitation at the narrow traumatized edentulous ridge often needs a stepwise improvement of both soft and hard tissue (1). Although both soft and hard tissue management is of equal importance in the full plan of reconstruction, bone graft at the deficient ridge should be considered prior to soft tissue management. The autogenous bone graft can provide the needed bone volume in severe cases. The mandibular symphysis is a reliable bone graft to serve as an accountable implant supporting tissue (9). The ridge width at the anterior maxilla had substantially provided the need for the implant. However, the insufficiency in the ridge height could still be observed. Current surgical techniques, for example, onlay bone graft, GBR, bone splitting and bone distraction, may have their respective advantages or disadvantages (1–3, 6, 10). Ridge splitting technique could have benefit of widening the deficient area, yet further increase of the ridge height because of insufficient soft tissue coverage for the bone graft (2, 4, 5). DOG theory to generate new bone has also been applied to increase the edentulous ridge by various commercial devices (10). This method succeeds in making new bone grow in the distracted bone gap through a biological process (10–12). However, it is difficult to combine bone lengthening simultaneously with bone widening. A two-directioned floating distraction device has recently been advocated. However, the long-term stability still needs to be confirmed (16).

As the management of both hard and soft tissue before implant surgery is essential, a multidisciplinary approach for the implant rehabilitation of cases with dento-alveolar trauma is necessary. Instead of using the expensive distraction device to prepare the bone for implant surgery in this case, the segmental osteotomy was selected to further reposition the osseointegrated implants in the anterior maxilla. The segmental osteotomy to immediately correct a single malposed implant has recently been reported (17). The transfer of the multiple implants in the bone has not been reported. The other unique feature for this case is the use of palatal stent for fragment immobilization. The comprehensive rehabilitation procedure of bone graft, implant surgery, segmental osteotomy and vestibuloplasty with a satisfactory and stable result warrants attention.

Acknowledgement – This article and the case were sponsored by VGH93C230 grant and NSC 93-3112B075 grant, Taipei, China. The work was administratively helped by Miss Su-Ting Tsai.

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