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Complex alveolar bony defect reconstruction with three dimensional printing model to assist custom-made titanium mesh for guided bone regeneration

Guided bone regeneration (GBR) represents the gold standard to reconstruct alveolar bone and peri-implant rehabilitation.[1] The key principle of GBR is the use of membrane to exclude non-osteogenic tissues from interfering with bone regeneration. Membranes must have some characteristics such as biocompatibility, tissue integration cell-occlusion properties, and space making ability.[2] Titanium mesh is a non-resorbable membrane with good space-making effect and frequently combined with grafting materials.[3] However, titanium mesh exposure is one of the common complications. Recently, three-dimensional (3D) printing model is increasingly used in oral and maxillofacial reconstruction surgery for creating custom cutting guides, fixation devices, practice models, and implanted medical devices to improve the treatment outcome. Prior to surgery, titanium mesh pre-formed on a 3D printing model could make the shape of titanium mesh more precise and accuracy for shortening the operation time.[4]

The 24-year-old male came to the Department of Oral and Maxillofacial Surgery, Changhua Christian Hospital, Changhua, Taiwan, with the chief complaint of poor chewing function at the right upper arch, which occurred after trauma for 10 months. After physical examination and cone-beam computerized tomography (CBCT) evaluation, the missing teeth 11, 12, 13, 14, and 15 and almost total destruction of the right maxillary alveolar bone were observed (Fig. 1A and B). Before surgery, 3D printing model was created by 3D printing machine (3D system, Projet CJP 660 pro, Rock Hill, SC, USA) from CBCT scans (Fig. 1C). Two pieces of titanium mesh (ACE Surgical Supply Co., Inc., Titanium Augmentation Micro Mesh, 0.1-mm thick, Brockton, MA, USA) were performed on the model and sterilization before surgery (Fig. 1D). During surgery, we carefully separated periosteum from the mucosa and cut scar band to achieve proper tension release. Particulate autogenous bone graft was harvested from right mandibular ramus region. Anorganic bovine bone mineral (Geistlich Pharma AG, Bio-Oss, Wolhusen, Switzerland) mixed with particulate autogenous bone grafts about 1:1 ratio were prepared. We fixed two titanium meshes to achieve the optimum stabilization by application with tacks (ACE, truTACK 2.5 HD 3 mm, Brockton, MA, USA) fixation (Fig. 1E). Finally, flap was suture with 5-0 nylon by horizontal mattress technique and simple interrupted suture to achieve absolute tension-free adaptation. During healing process, no membrane exposure and soft tissue healing was progressing uneventfully without alterations. Re-entry surgery was performed after 17 months. The width and height of alveolar bone were successfully augmented and the dense bone-like tissue was also demonstrated (Fig. 1F).

Titanium mesh is a useful non-resorbable membrane to treat alveolar bone deficiencies. It has good biocompatibility, space maintenance, and easily to fit the complex 3D bony defect. Furthermore, the exposure rate of titanium meshes is lower than that of polytetrafluoroethylene membrane. If the exposure occurs, it is usually not necessary to remove titanium mesh immediately with no sign of infection. Because its pore structure allows a proper

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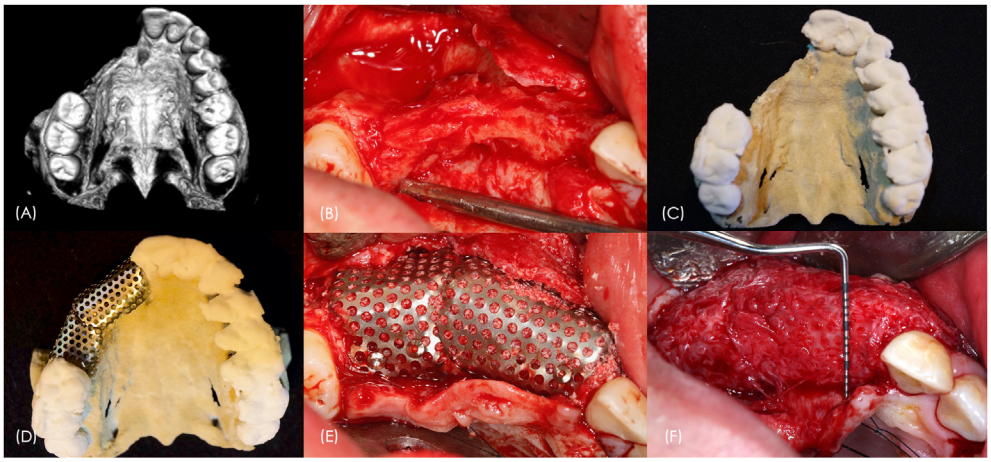

Figure 1 Radiographic and clinical photographs of this case. (A) Occlusal view of CBCT showed missing teeth 11, 12, 13, 14, 15. Almost totally maxillary alveolar bone destruction was observed. (B) Severe alveolar bone destruction and irregular bony surface were observed after flap elevation. (C) The 3D-printing bone model was fabricated. (D) The custom-made titanium meshes were pre-formed on the 3D-printing bone model. (E) Bone grafting materials and pre-form titanium mesh were precise placement over complex alveolar bony defect. (F) Re-entry after 17 months, well reconstructed ridge bone volume and the dense bone-like tissue were demonstrated.

vascular supply to underlying tissues without interfering with the blood flow.[5] This case report could offer the new option for using 3D printing model to assist titanium mesh pre-formed prior surgery. In addition, this method provides the precise placement of titanium mesh and simulates where to place the bone tacks to fix titanium mesh. It can prevent mesh displacement to reduce membrane exposure and get the better result for complex alveolar bony defect reconstruction.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

References

1. Briguglio F, Falcomata D. The use of titanium mesh in guided bone regeneration: a systematic review. *Int J Dent* 2019;1:1—8.
2. Elgali I, Omar O, Dahlin C, Thomsen P. Guided bone regeneration: materials and biological mechanisms revisited. *Eur J Oral Sci* 2017;125:315—37.
3. Jeng MD, Chiang CP. Autogenous bone grafts and titanium mesh-guided alveolar ridge augmentation for dental implantation. *J Dent Sci* 2020;15:243—8.
4. Ethan L, Ashely L. 3D-Printing technologies for craniofacial rehabilitation, reconstruction and regeneration. *Ann Biomed Eng* 2017;45:45—57.
5. Her S, Kang T, Fien J. Titanium mesh as an alternative to a membrane for ridge augmentation. *J Oral Maxillofac Surg* 2012; 70:803—10.

Jyun-Yang Su
Department of Oral and Maxillofacial Surgery, Changhua Christian Hospital, Changhua, Taiwan
School of Dentistry, Chung Shan Medical University, Taichung, Taiwan

Yu-Chao Chang*
School of Dentistry, Chung Shan Medical University, Taichung, Taiwan
Department of Dentistry, Chung Shan Medical University Hospital, Taichung, Taiwan

*Corresponding author. School of Dentistry, Chung Shan Medical University, No. 110, Section 1, Chien-Kuo N. Rd., Taichung, 40201, Taiwan.
E-mail address: cyc@csmu.edu.tw (Y.-C. Chang)

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