Customized 3D-Printed Titanium Mesh for Alveolar and Jaw Rehabilitation : Case Series

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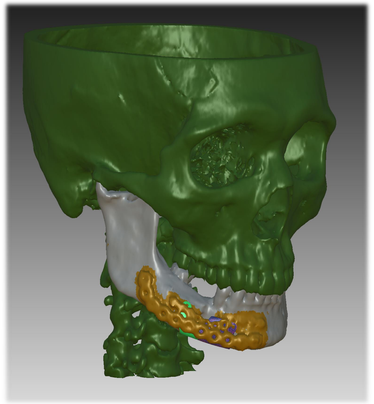
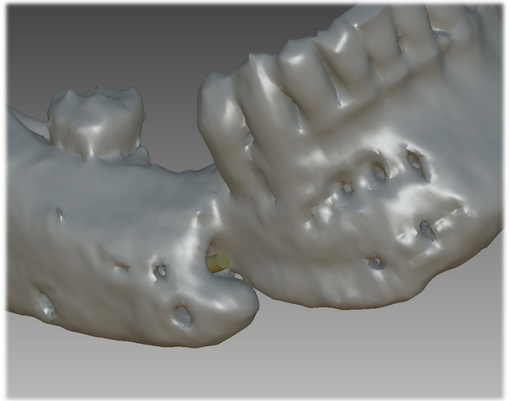
Introduction

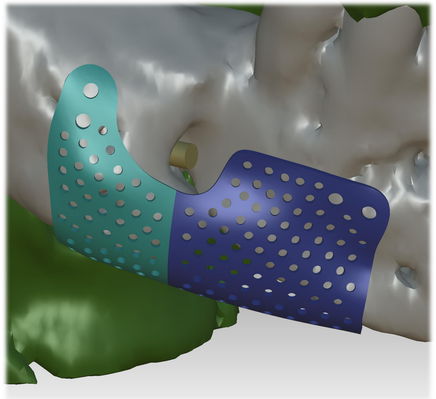
◆In the rehabilitation of alveolar and jaw bones, the use of traditional titanium and metal mesh has been limited due to issues such as infection, dehiscence, and fit limitation, In contrast, the medical field has seen revolutionary advancements in 3D printing technology has led to improved surgical outcomes and reduced complications. This study investigates 3 cases of rehabilitation in the alveolar and jaw bones using 3D-printed titanium mesh, demonstrating the potential benefits of this approach.

Methods

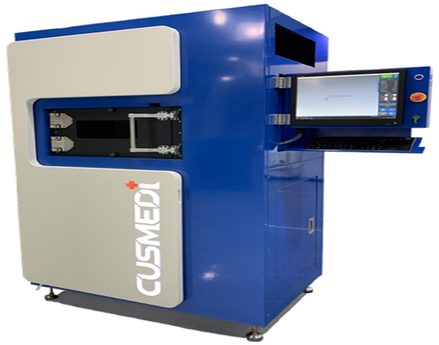
◆This study involved patients who underwent alveolar and jaw bones rehabilitation surgery at the department of oral and maxillofacial surgery of Ewha Womans University Mokdong Hospital and Seoul Hospital. Each patient underwent a preoperative **CT scan**, and custom-made 3D titanium prints were produced using ***Ondemand***® **CAD/CAM softwar**e (Cybermed Co., Seoul, Korea) and ***Doctor Check***® **software** (Cusmedi Co., Seoul, Korea). The fabricated ***3D-printed titanium mesh*** was fitted onto a ***Rapid Prototype(RP)*** model before surgery to check for compatibility, and rehabilitation was performed with bone grafting materials during surgery.



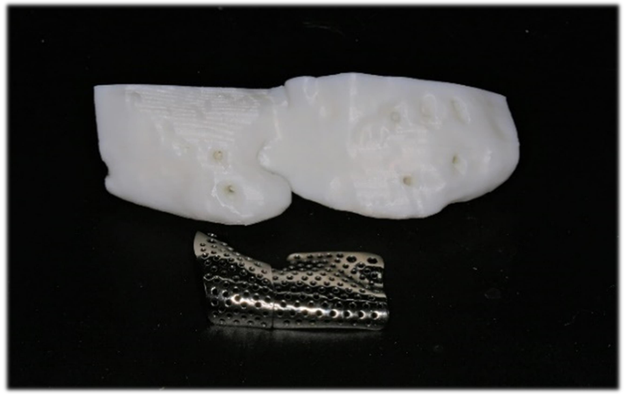




▶**3D design by Doctor Check** ® **software** (Cusmedi Co., Seoul, Korea)



▶ ***3D-printer*** **(CM150,Cusmedi Co.; Laser power 200w)**

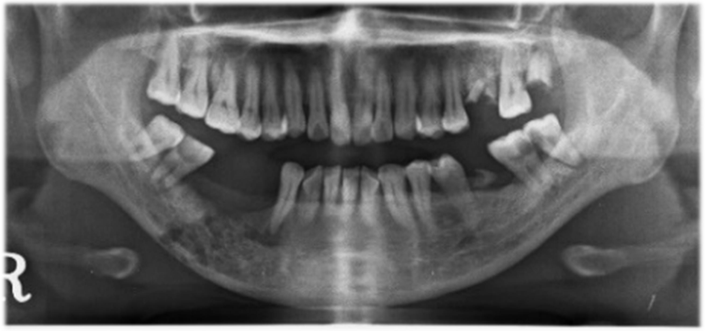


▶***3D-printed titanium mesh & RP model***

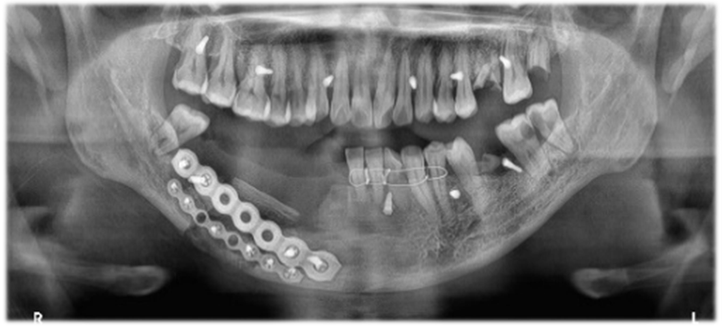
Case presentation

Case 1 ▶ *53Y / Female – Medication Related OsteoNecrosis of Jaw on Rt.Mn.Post area*

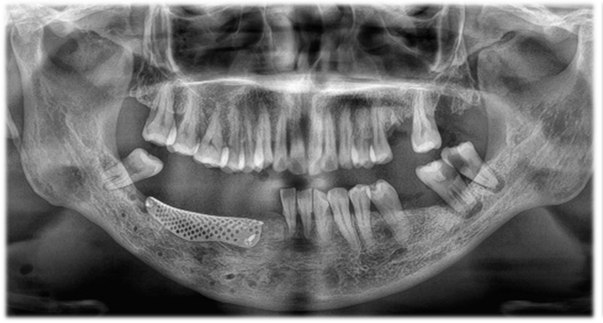
◆In the case of patient 1, a 53-year-old female who underwent alveolar bone rehabilitation using 3D-printed titanium mesh and xenograft bone transplantation after segmental osteotomy of the mandible due to medication related osteonecrosis of jaw, it was observed that 8 months post-operation, the 3D-printed titanium was difficult to remove due to complete integration and ossification with the rehabilitation bone.



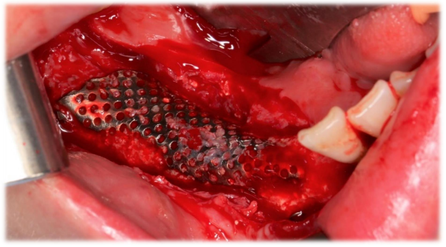
▶ **First visit**

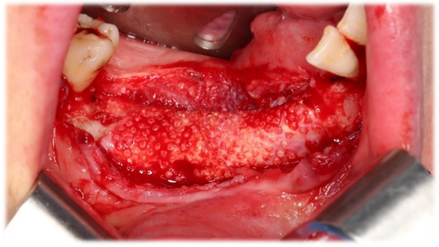


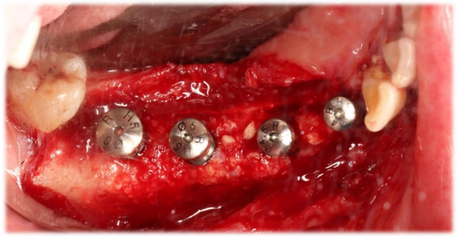
▶ ***Segmental resection & Autogenous bone graft with reconstruction plate***

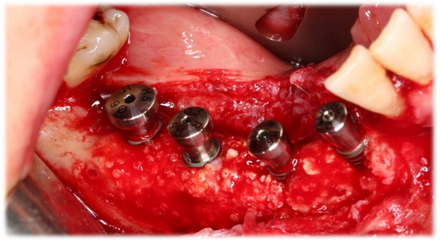


▶ ***Alveolar bone rehabilitation*** with 3d-printed titanium mesh using ***Xenograft***









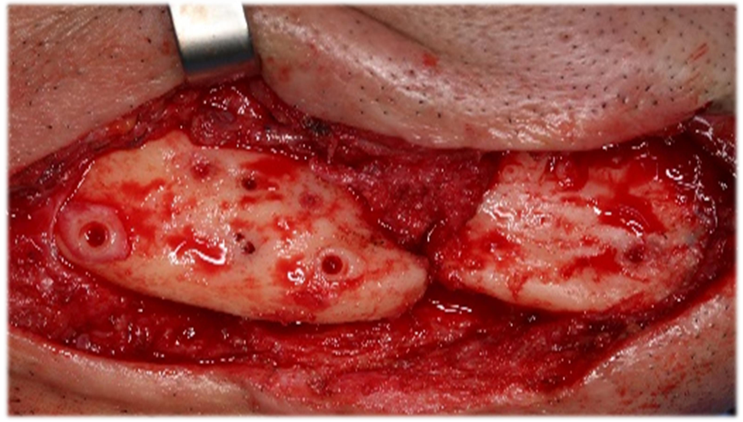
▶ ***Removal*** of 3D-printed titanium mesh was done and implantation on Rt. Mn. Post area

▶ Without the use of autogenous bone, it was possible to ***achieve a vertical bone augmentation of more than 10mm***, and implant placement was performed simultaneously with the removal of the print.

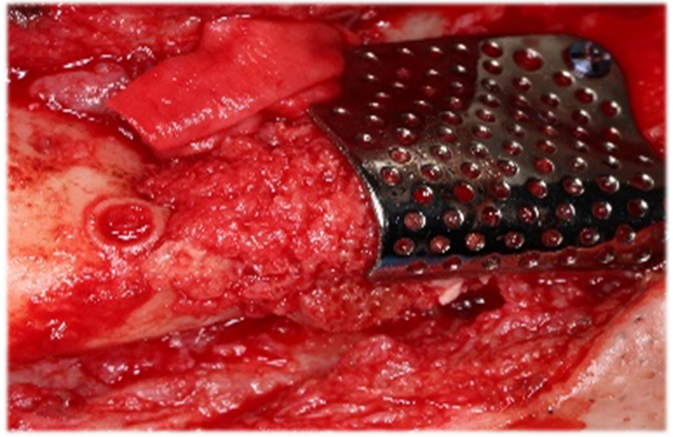
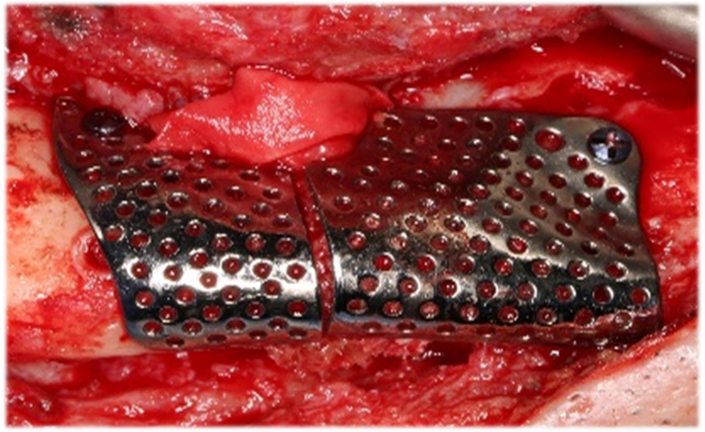
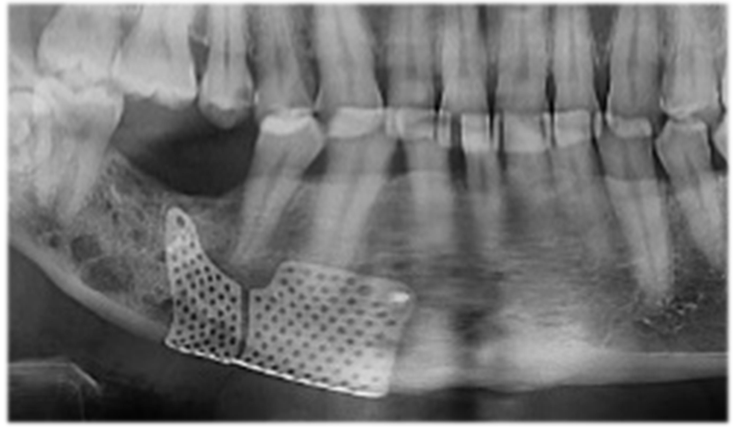
Case presentation

Case 2 ▶ *45Y / Male – Malunion of Previous fracture of the Rt.mandible*

◆In the case of patient 2, a 45-year-old male who underwent jaw rehabilitation surgery using 3D-printed titanium mesh after reduction surgery for complex comminuted fractures of the mandible. the surgery showed a stable fit that well accommodated the ***irregular contours of the fractured area***, despite the lack of standardization in the fracture's appearance.



▶ One year after reduction surgery for complex comminuted fractures of the mandible. Unfilled bone defect was observed

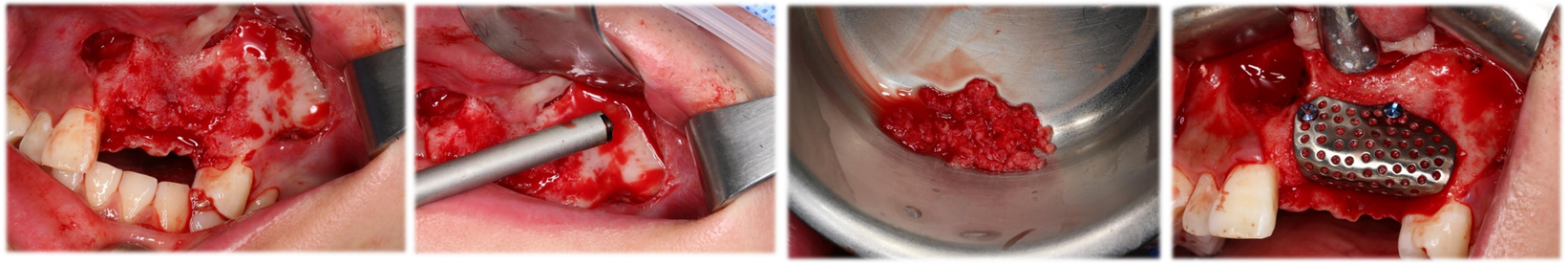
▶ ***Mandible rehabilitation*** with 3D-printed titanium mesh using ***Xenograft***

Case presentation

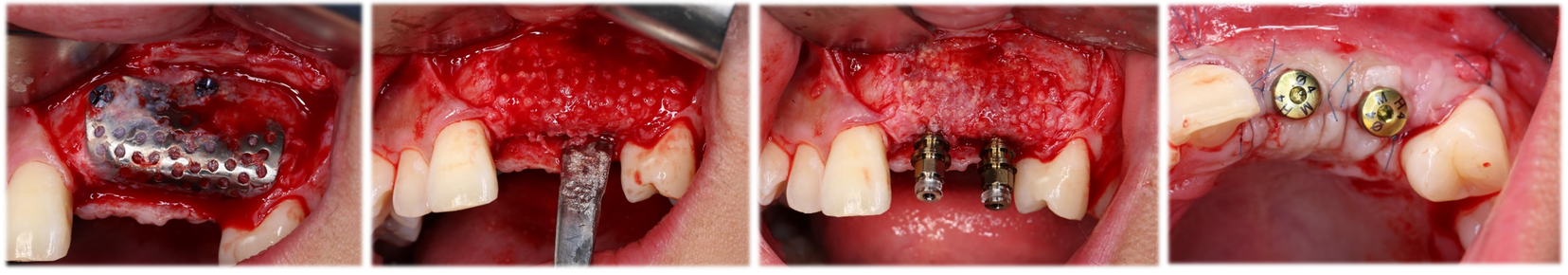
Case 3 ▶ *23Y / Male – Alveolar Atrophy of Anterior Maxilla after Traffic Accident*

◆ In the case of patient 3, a 22-year-old male who underwent alveolar bone rehabilitation using 3d-printed titanium mesh due to **Traffic Accident.** This case demonstrated that it can also be used in the aesthetically important and thin biotype gingiva of ***the maxillary anterior region***.

< Surgical procedure >



▶ Autogenous bone was harvested using a bone scraper. A well-fitted 3d-printed titanium mesh was observed



▶ 6 month after. 3d-printed titanium mesh was removed.
Simultaneously, implant placement was performed.

< Pre-OP > < Post-OP >

Discussion & Conclusions

Case 1	**53Y / Female**	**Medication Related OsteoNecrosis of Jaw on Right Mandible**	**Alveolar Bone Rehabilitation**	**3D-printed titanium mesh using Xenograft**
Case 2	**45Y / Male**	**Malunion of Previous fracture of the Right Mandible**	**Mandible Rehabilitation**	**3D-printed titanium mesh using Xenograft**
Case 3	**23Y / Male**	**Alveolar Atrophy of Anterior Maxilla after Traffic Accident**	**Alveolar Bone Rehabilitation**	**3D-printed titanium mesh using Xenograft & Autogenous bone**

◆ Customized 3D-printed titanium mesh, designed to address the shortcomings of both 3D printed PCL(polycaprolactone) and conventional titanium meshes, have demonstrated smooth, personalized fabrication and high precision. They minimized the possibilities of infection and dehiscence, offering differentiated bone formation outcomes from traditional methods. This approach also confirmed the possibility of successfully proceeding to subsequent implant placements.

References

Individualized 3D-printed Bone-Anchored Maxillary Protraction Device for Growth Modification in Skeletal Class Ⅲ Malocclusion, Jin-woo Kim, Journal of Personalized Medicine, December 2021, 1087
Reconstruction of mandible using a computer-designed 3D-printed patient-specific titanium implant: a case report, Khaldoun Darwich, Oral and Maxillofacial Surgery , July 2020, Volume 25, pages 103-111