Application of Digital Workflow to Maxillofacial Reconstruction: A clinical Report

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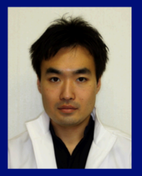

Purpose

The application of oral implants to the reconstructive treatment for jawbone defects caused by cancer, tumors, and trauma has been increasing in recent years. However, it is considerablyy difficult to reconstruct both the jawbone and surrounding soft tissues, compared to the general implant treatment. And highly advanced techniques are required to accomplish the satisfactory result.

Conventional workflow

On the other hand, preoperative virtual simulation has become a common practice in conventional oral implant treatment, and various applications of CAD/CAM technology have been reported in the reconstruction of the maxillofacial region. We reported a case in which an intraoral scanner and CAD/CAM technology were successfully applied to a patient who underwent jaw reconstruction and functional restoration with implants.

Prosthetically Driven Maxillofacial Reconstruction

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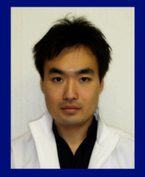
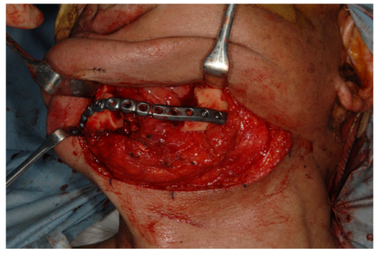


Methods

1. Patient profile

The patient, a 70-year-old male, underwent a mandibulectomy due to mandibular gingival cancer in April 2016.
The patient's postoperative course was good, and he was referred to the Department of Oral Implantology for implant prosthetic treatment after mandibular reconstruction in November 2017.



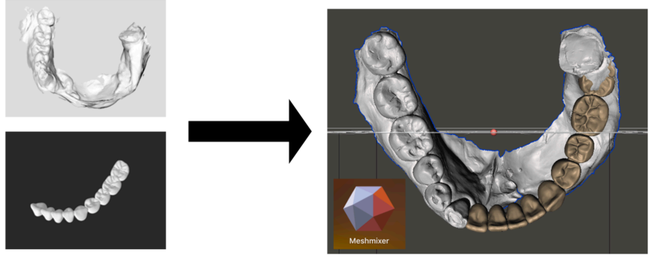
Mandibulectomy and Mandible reconstruction using Ti plate.

Postoperative panoramic X-ray image.

2. Design of virtual teeth

Before treatment, an intraoral scanner (TRIOS3, 3Shape) was used to scan the maxilla and mandible, and occlusal scans were performed to design the final superstructure. The obtained data was transfered to CAD software (Dental System 2017, 3Shape) for the arrangemnt of virtual teeth.

Mandibular scan data and designed teeth.



Combined virtual teeth and mandibular STL data.

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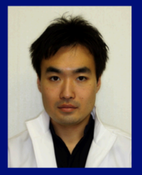
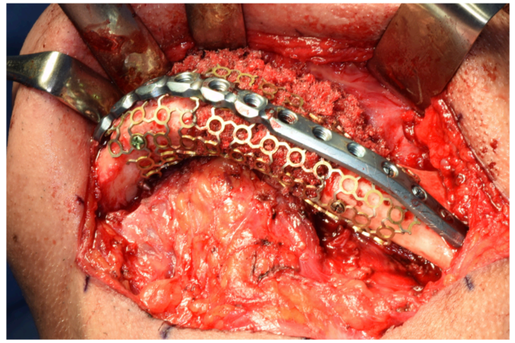


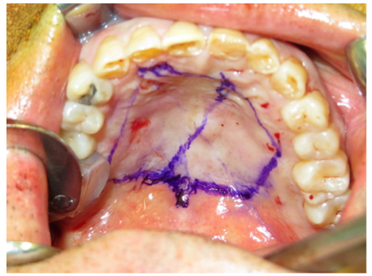
5. 3D printed bone model, Ti mesh production ,and mandibular reconstruction

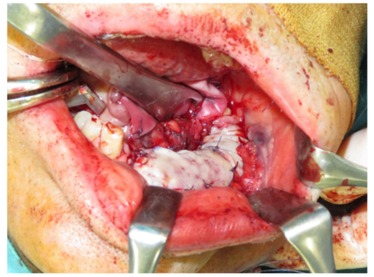
The finalized jawbone data were sent to a 3D printer, a jawbone model was printted, and a titanium mesh tray was fabricated on the 3D printed model.
Subsequently, particulate cancellous bone and marrow(PCBM) with a titanium mesh tray, palatal mucosa grafts, implant placement, and the superstructure installation were performed, in a staged apprpach manner.

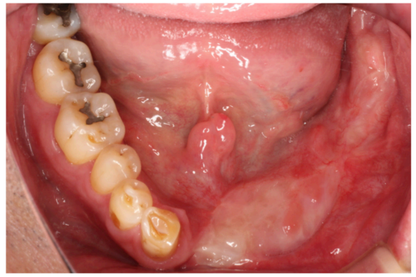
3D printed bone model and costumed Ti mesh.



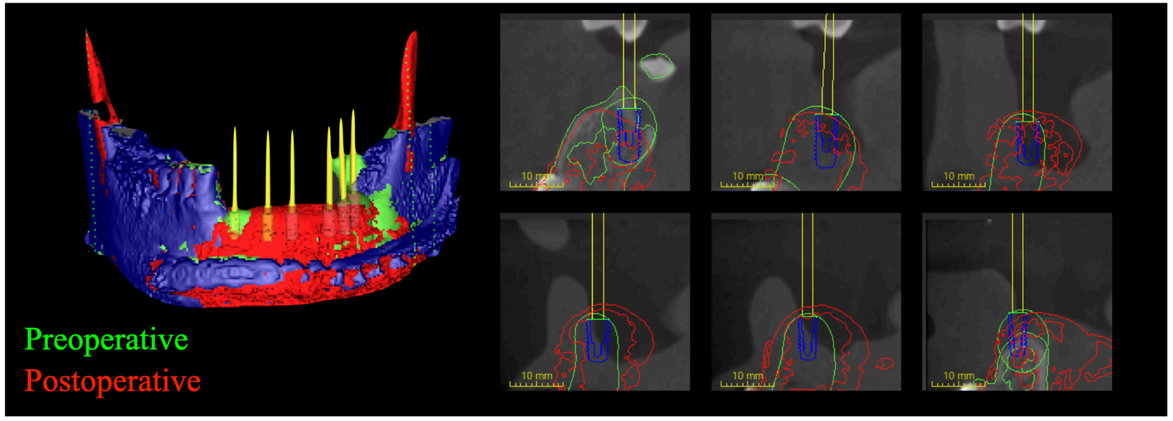
3D printed bone model and costumed Ti mesh.







The palatal mucosa grafts.



Superimposed preoperative and postoperative STL images on the implant simulation software.

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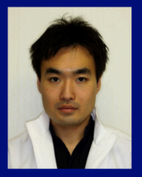


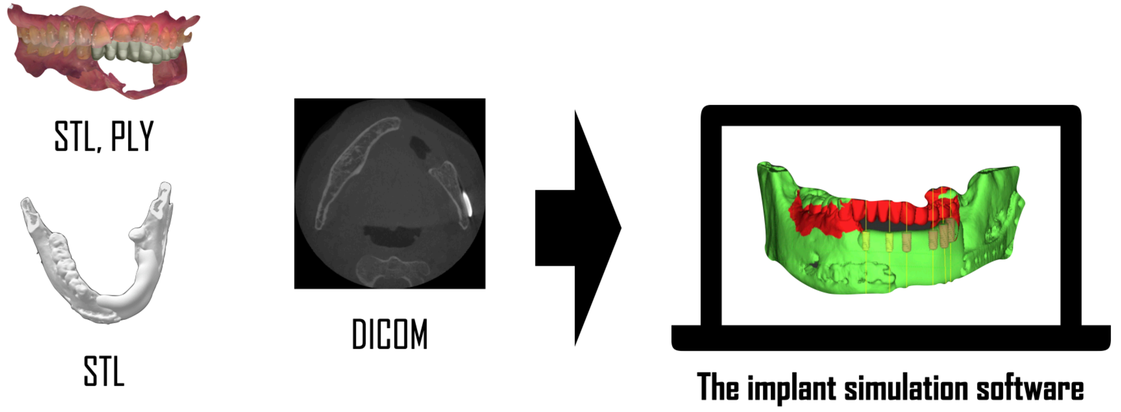
Methods

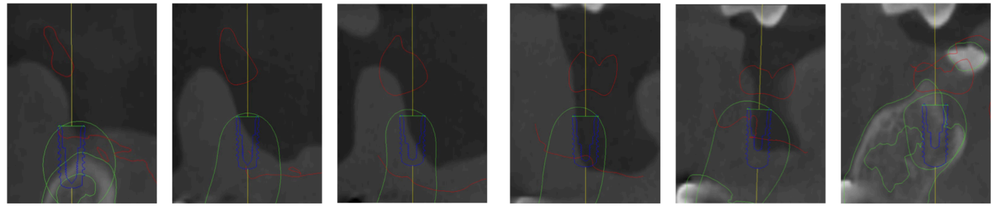
3. Design of mandible 3D model

DICOM data after preoperative CBCT imaging was converted to 3D data using specialized software to examine the mandibular bone volume and to modify the jaw bone morphology.

4. Plan of implant placement

All data were superimposed on the implant simulation software (CoDiagnostiX, Straumann) and the jawbone morphology was modified considering the implant placement position.





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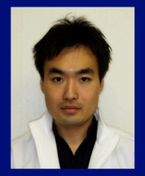
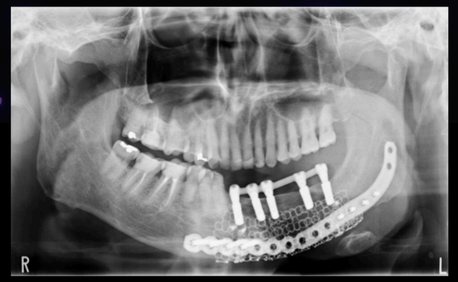


Results

The postoperative course has been in good condition. No significant bone resorption, inflammation of the mucosa, or damage to the prosthesis occurred after the prosthesis was placed.

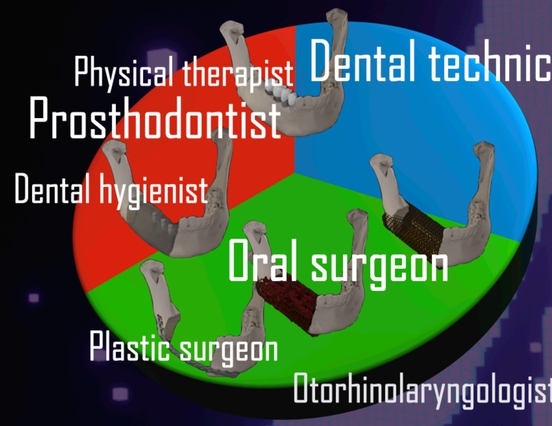
Intraoral images of the prosthesis in placement.



Postoperative panoramic X-ray image.

Conclusion

The application of digital technology made it possible to visualize the final image of the treatment result and to collaborate closely with the oral surgeon from the pre-reconstruction stage. This technique allows mandible reconstruction after considering the implant placement based on the ideal prosthesis morphology.



Digital technology is essential for collaboration among different professions in maxillofacial reconstruction.

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