

Workflow for custom-made CAD/CAM titanium plates based on virtually planned maxillofacial reconstruction**Rohner D / Kamer L / Noser H / Zizelmann C / Hammer B****Hirslanden Medical Center, Aarau (Switzerland)****Project #: C-10-22R**

Maxillofacial defects caused by trauma, tumor resection or malformation requires complex three-dimensional (3D) functional and aesthetical reconstruction. The postoperative result is dependent on the meticulous preoperative planning and its transfer to surgery. One of the latest techniques represents the prefabrication of fibula flaps, which includes reconstruction of occlusion, bone and soft tissue based on a physical 3D model planning (i.e. Rapid Prototyping models). They provide the most accurate technique allowing for complete functional reconstruction with the best fitting of drilling templates, occlusal splints, suprastructure and individual osteosynthesis plates.

Computer-assisted virtual planning could on one hand replace existing 3D planning and would on the other hand improve the adaptation and accuracy of fit of custom-made reconstruction plates. Based on our 10 year experience with prefabricated fibular flaps for the reconstruction of extended maxillofacial defects, we propose a new workflow to treat such patients. It includes preoperative image data acquisition, processing and analyzing the data and the development of surgeon driven software procedures. Then the planning procedure will then undergo Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) processes resulting in the production of a custom-made titanium plate. This plate will act as an accurate intraoperative guidance and fixation device - thus helping the surgeon to obtain a good surgical result. The following milestones will be included in the study:

- matching of skull and fibula Computed Tomography (CT) data
- virtual planning of a new occlusion
- evaluation and determination of the size, osteotomies and alignment of the fibula flap within the defect
- planning of an individually designed reconstruction plate
- transfer of the data to a production unit

In a first attempt the feasibility will be tested on a virtual patient. It will also include the evaluation of different CAD/CAM techniques. In a second attempt given clinical cases will be treated using the newly developed planning software in combination with the unit that allows for the production of custom made plates.