

CMF SURGERY SOLUTIONS

3D PLANNING, PATIENT-SPECIFIC ANATOMICAL MODELS, SURGICAL GUIDES AND PATIENT-SPECIFIC IMPLANTS



www.insightsurgery.com

Case Summary

This patient presented with severe facial asymmetry (of both the mandible and maxilla) and a class III occlusion. The patient had a yaw, with their mandible swinging to the left, and the mandibular midline was off to the left by 4mm.

The surgeon requested two patient-specific anatomical models to assist with the pre-surgical planning and simulation ahead of the orthognathic surgery.

Description

Insight Surgery received the patient's CT scan in DICOM format and proceeded to segment the full skull.

Two anatomical models were provided to the surgeon. The first was printed in clear resin with magenta incorporated to highlight the roots of the teeth and mental nerves. This would be used for careful planning of the osteotomies.

The second model was printed in a wood-like material to allow for full procedural simulation as well as pre-bending of implant plates ahead of live surgery.

INSIGHT SURGERY CASE STUDY



ORTHOGNATHIC PRE-SURGICAL PLANNING, SIMULATION, PLATE BENDING

SPECIALITY: ORTHOGNATHIC **PROCEDURE:** LE FORT I, BSSO **DEVICE:** 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODELS







OUTCOME / BENEFITS

These models facilitated careful pre-operative planning of the surgeon's cuts, with the model highlighting the nerves and teeth roots providing particular guidance.

Simulation on the wood-like model led to time saved in theatre, as the surgeon was able to practise their approach with a tactile medium. This provided the clinician with a deeper understanding of what they would face in theatre and enabled them to operate with greater confidence in their surgical approach.







CASE SUMMARY

Cancer treatment had resulted in osteoradionecrosis (bone death due to radiation) in a patient and complex mandible reconstruction was necessary. Fibula free flap surgical reconstruction was required whereby the patient's fibula is removed and reshaped before being implanted to recreate the anatomy of a healthy jaw.

Surgeons requested 3D printed cutting guides to be designed and manufactured for both fibula and mandible bones.

DESCRIPTION

3D segmentation and reconstruction were used to create patient-specific anatomical models. These models were in turn used to:

- Virtually plan the surgery, allowing surgeons to determine the resection of the mandible and the reshaping of the fibula to fill the defect.
- As templates to design the patient-specific cutting guides and reconstruction plate which secured the bone segments in place.

The patient-specific guides were printed using medical-grade nylon polyamide while the mandible plate was produced using titanium. All were sterilized using autoclaving.

INSIGHT SURGERY CASE STUDY



CRANIO-MAXILLOFACIAL RECONSTRUCTION

SPECIALITY: CRANIO-MAXILLOFACIAL **PROCEDURE:** FIBULA FREE FLAP RECONSTRUCTION **DEVICES:** 3D PRINTED PATIENT-SPECIFIC GUIDES AND IMPLANT





OUTCOME / BENEFITS

With the use of 3D technologies, the surgeons were able to avoid the typical, time-consuming procedure in which a straight metal plate is bent to fit the reconstruction.

The use of pre-designed and manufactured patient-specific plates meant the risk of compromised surgery, caused by prolonged disruption of blood supply to the fibula bone while the plate is being shaped in traditional surgery was avoided.

The surgery was a success, with both guides and implant fitting perfectly, and no further adaptation was required during the procedure.

CASE SUMMARY

The failure of a previous mandible reconstruction meant that this patient needed revision surgery. The old flap had to be removed and only the old plate remained for support. A second reconstructive attempt was vital. However, effective surgery would be challenging, as the quality of the remaining mandible bone was extremely poor. Securing the implant's plate screws would be difficult.

The surgeon requested assistance from Insight Surgery for the pre-surgical planning, the creation of an anatomical model, surgical cutting guides and a custom plate for the patient's unique anatomy.

DESCRIPTION

Insight Surgery segmented the patient's CT scan and created the virtual model for the surgeon to identify the ideal cutting planes at each location. From these, 3D printed surgical guides and a titanium reconstruction plate were designed and manufactured, as were the anatomical models for reference purposes.

Two guides were provided; for the mandible and chin, and for the scapula to raise the flap for the reconstruction. They were printed in Polyamide/PA 12. The custom plate used to secure the flap was printed in titanium.

INSIGHT SURGERY CASE STUDY



CRANIO-MAXILLOFACIAL PRE-SURGICAL PLANNING, SURGICAL GUIDES, AND IMPLANT

SPECIALITY: CRANIO-MAXILLOFACIAL **PROCEDURE:** RECONSTRUCTION WITH SCAPULA FREE FLAP **DEVICES:** 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODELS, SURGICAL GUIDES AND IMPLANT



OUTCOME / BENEFITS

Thanks to digital planning, it was possible to determine the areas of the mandible and chin which had the greatest integrity for the placement of the screws. The surgical guides used in theatre enabled the successful avoidance of holes drilled previously, maintaining the patient's bone integrity and securing the new 3D printed reconstruction plate in position.

A 3D printed model of the patient's anatomy was also used intra-operatively as a reference guide for the surgeon. The reconstruction and the implantation of the custom implant were carried out without complication and dental rehabilitation is being planned for the patient's future without complication.

CASE SUMMARY

In this case, Insight Surgery worked with the surgeon to assist in the design and manufacture of a customised 3D-printed titanium plate for a surgical procedure to restore the patient's malar (cheek) symmetry.

Insight Surgery received the CT scans of the patient's head and using advanced medical segmentation software, reconstructed in 3D the anatomical regions of interest for the upcoming malar surgery. The segmentation process involves the selection of the Hounsfield units corresponding to the appropriate bone areas of interest.

DESCRIPTION

The 3D reconstruction / segmentation of the patient's anatomy from the CT scan was used to virtually plan the surgery in order to aid with the surgeon's pre-surgical planning process.

The implant is designed based on the surgeon's requirements, the virtual simulation of the mirror and the types of screws used in order to accurately match the patient's anatomy. It was then 3D printed in titanium, sterilised by the hospital and then surgically implanted into the patient.

INSIGHT SURGERY



CRANIO-MAXILLOFACIAL VIRTUAL PLANNING & IMPLANT

SPECIALTY: CRANIO-MAXILLOFACIAL **PROCEDURE:** MALAR SYMMETRISATION USING PATIENT-SPECIFIC ONLAY IMPLANT **DEVICES:** 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND IMPLANT





OUTCOME / BENEFITS

It is estimated that using traditional techniques for the creation of malar implants, 10% are removed or replaced because of improper implant size, shape or position. The use of 3D technologies and the virtual planning simulation process enabled a highly accurate implant to be created and implanted that required no further adaptation. The shape of the implant enabled the surgeon to easily position it through a transoral approach.

Post-operatively, the surgeon commented - "It went really well. Fitted perfectly!"

Case Summary

This patient had been allegedly assaulted, suffering complex orbital fractures along with globe injury leading to severe visual deficit and atrophy of the eye. Additionally, the patient suffered from severe social anxiety due to the appearance of the enophthalmos/atrophied globe.

The Oral and Maxillofacial Surgeon was required to perform a complex orbital floor and medial wall reconstruction. Insight Surgery was commissioned to provide two patient-specific devices to support both planning and the actual reconstruction.

Description

Insight Surgery provided a replica of the patient's orbital floor and the patient-specific implant used in the reconstructive surgery.

The orbital model was printed in PA 12 and sterilised for reference use during the operation to help position the 3D printed titanium implant, which had been custom designed for the patient.

INSIGHT SURGERY CASE STUDY



CRANIO-MAXILLOFACIAL PRE-SURGICAL PLANNING AND SURGICAL IMPLANT

SPECIALITY: CRANIO-MAXILLOFACIAL **PROCEDURE:** COMPLEX ORBITAL FLOOR & MEDIAL WALL RECONSTRUCTION **DEVICES:** 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND IMPLANT









OUTCOME / BENEFITS

The surgeon was able to reconstruct the orbital floor and part of the medial wall to provide a base for the globe.

Furthermore, a buccal fat pad graft was harvested and placed inferior to the globe to restore the volume with excellent preliminary results.

