

Advanced Implant Education using haptic anatomical models for surgical simulation

KERNEN, F; GASS, M; FLÜGGE, T

Translational Implantology, Department of Oral and Maxillofacial Surgery, University Medical Center Freiburg, Germany

Introduction

Teaching surgical procedures to students is a challenging assignment. They combine a thorough knowledge of anatomy with established operational techniques and require an understanding of the spatial configuration of anatomical structures.

The use of patient-specific models replicating hard and soft tissues not only allows to further develop cognitive competences but more importantly psychomotor abilities.

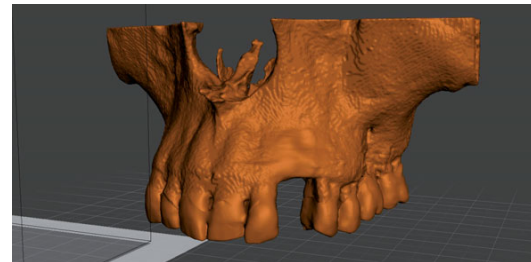
Haptic models derived from three-dimensional imaging data are used to educate students on patient-individual anatomy and to prevent intraoperative complications related to surgical technique. Additionally, they may be used to discuss and train soft tissue handling prior to a surgical intervention.

Combined hard and soft tissue models are a useful didactic instrument and might therefore increase the efficiency and success of dental implant surgeries.

The purpose of this poster is to present a protocol for dental implant education to enhance the confidence of the inexperienced student and to visualize surgical challenges to the experienced clinician.

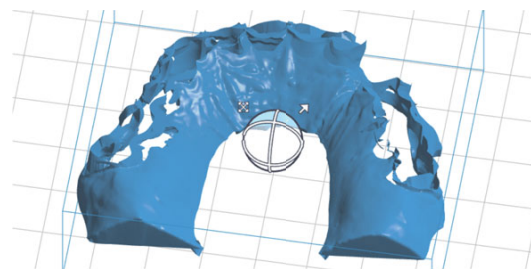
Materials and Methods

1. Segmentation of the DICOM file and export into an STL format (ITK-SNAP, Yushkevich et al., 2006)
2. Processing (Meshmixer, Autodesk, San Rafael, CA, USA)

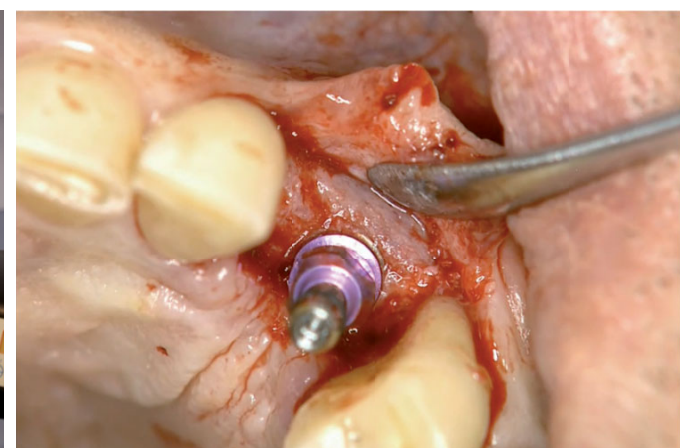
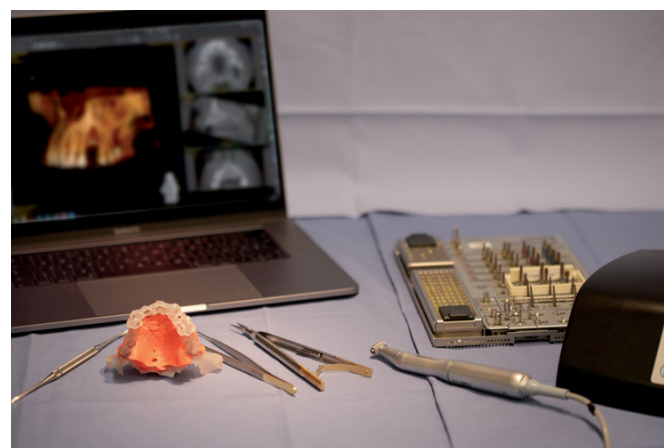


3. 3D Printing (Objet Eden260V, Stratasys, Eden Prairie, MN, USA)
4. Irreversible hydrocolloid matrix of the soft tissue
5. Molding of soft tissue anatomy using polysiloxane (Xantopren mucosa, Kulzer, Hanau, Germany)

Alternatively, the soft tissue layer can be printed after subtracting the STL segmentation of the DICOM file from an optical surface scan (Rapidform, INUS Technology, Inc., Seoul, South Korea)



Procedure



Take-Home Message

- + Haptic models based on 3D imaging data display patient-individual anatomy
- + Surgical preparation using haptic models is superior to conventional planning
- + Phantom surgery is especially valuable for teaching purposes
- + Surgical skills can be acquired before proceeding to the operatory room
- + Pitfalls can be foreseen and avoided
- + **Haptic models became an indispensable tool for students in surgical training**
- Planning and fabrication of a haptic anatomical model is time consumptive
- There is limited availability of printable materials for the soft tissue layer

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