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Augmented Reality and Telenavigation in Cranio Maxillofacial and Oral Surgery*

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Abstract. Selected workflows combining computer-assisted teleplanning and navigation (including 3D-stereolithography) are presented. It is shown how interactive teleplanning of dental implants or optimization of a surgical treatment of large bone defects is done.

Keywords. augmented reality, telenavigation, cranio maxillofacial and oral surgery

Augmented reality and computer-assisted intraoperative navigation of the "first generation" in the course of cranio-maxillofacial interventions supply the surgeon solely with visual "information", i.e., the two- and three-dimensional images representing the real anatomical situation are superimposed with additional computer generated graphical structures [1, 2].

Nevertheless this technology does not provide any kind of haptic feedback. Technical progress led to the integration of rapid prototyping techniques (3D-stereolithography) in image guided surgery workflows and therefore can add "haptic" information. We call such approaches "the second generation of navigation". Preoperative treatment planning and precise interaoperative transfer of the plan to the patient becomes possible.

In this lecture selected workflows combining computerassisted teleplanning and navigation (also including 3D-stereolithography) are presented. They allow for example the interactive teleplanning of dental implants or optimizing the surgical treatment of large bone defects. Clinical applications are e.g., patients after hemimandibulectomy who are supplied with a microvascular bone transplant from the iliac crest and free rib cartilage graft.

Sterilized stereolithographic bone models (manufactured according to -.stl-files that are generated in the course of an interactive teleplanning process) are available at the OR-site and therefore enable an easy "haptic" guidance by direct comparison of the model with the bone graft [3, 4]. Achievement of an optimum shape of the reconstructed mandible can be facilitated and accelerated by intraoperative computer assisted navigation and additionally supported by the use of the stereolithographic models.

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Recent research activities at our clinic focus on the development of methods to simulate the postoperative view of the patient and the fabrication of 3D-customized facial implants according to the parameters defined in an interactive teleplanning setting. Quantitative evaluation of the results is accomplished by means of stereophotogrammetry.

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