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**„Clinical Evaluation and Surgical Education with ElePhant,
the ICCAS electronic phantoms“**

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Clinical Evaluation and Surgical Education with *ElePhant*, the ICCAS electronic phantoms

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INTRODUCTION

CAS-equipment, like navigation systems, has diverse effects on patients, surgeons, and cost bearers. Thus, investigation need to be focused on more than one aspect. A complete evaluation should consider the technical quality, (surgical) efficacy, (surgical) effectiveness and (cost) efficiency. Together with project partners, ICCAS does health technology assessment including technical parameters, human factors and clinical outcome.

Therefore realistic test-phantoms have to be developed for evaluation of CAS-equipment and the simulation of surgical intervention. The reliability of innovative surgical interventions and instruments are evaluated within such standardized test-beds.

Such systems can also be used for training.

MATERIAL AND METHODS

A anatomical realistic rapid prototyping model (RPT) consisting of the target volume together with all structures at risk is created with the 3D-Printing technology (4D Concepts, Gross-Gerau, Germany) based on plaster or starch as base material (Fig. 1).



Fig. 1: Anatomical 3D rapid prototyping model

Compared with other RPT technologies, anatomical 3D models based on plaster or starch can be produced cost-efficiently. Further these models can be printed in colour.

The generated 3D models enable the surgeon to apply the same surgical instrument which will also be used during the operation on the patient (Fig. 2).



Fig. 2: Performing of the surgical milling procedure at the phantom.

Functional data are represented as electrical or optoelectronic circuits.

RESULTS

The evaluation of the systems with experienced surgeons based on questionnaires resulted in realistic anatomical and milling characteristics of a first head phantom prototype for mastoidectomy.

An accuracy study of CT images of 15 identical RPT-models compared to the patient CT-scan shows that the mean accuracy is (0.101 ± 0.077) mm with maximum and minimum values of +0.380 mm and -0.272 mm.

CONCLUSION

The technical system setup and production of *ElePhant*, the ICCAS electronic phantoms, are shown. Such systems can be used for evaluation and health technology assessment of innovative surgical procedures and instruments as well as for education and training of students and surgical residents.

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