Department of Otorhinolaryngology
Lab for Computer-Assisted Surgery and Electrode Development (CAS)

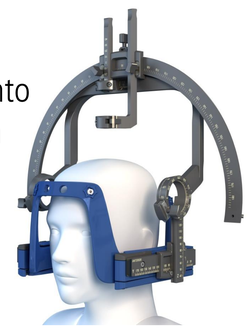
Medizinische Hochschule Hannover

GluingJig – A Customized Micro-Stereotactic System

Dr.-Ing. Thomas Rau

Problem

Continuous improvements in modern therapies lead to surgical interventions which show growing demands on reliable accuracy - much more than manually possible. That's why assistance systems gain importance. They can be used to implement smallest drillings for minimally-invasive approaches (e.g. to the inner ear) or to place instruments and probes exactly at a predefined position (e.g. during deep brain stimulation).
However, most of those assistance systems are either huge, and bulky stereotactic frames, which have to be mounted onto the skull of the patient, or very expensive robotic systems. In contrast, there are a lot of interventions for which neither bulky frames nor expensive medical robots are necessary.



The Aim of the Project

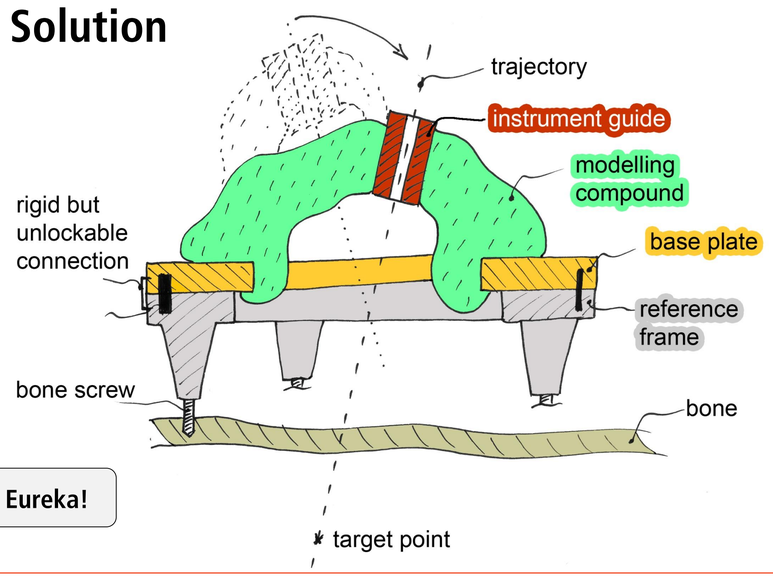
Thus, the aim of the project was to develop a small, lightweight and cost-efficient drill and instrument guide, which also allows for enable highly accurate positioning of surgical tools. That micro-stereotactic surgical targeting system, called „GluingJig", can be individually fabricated

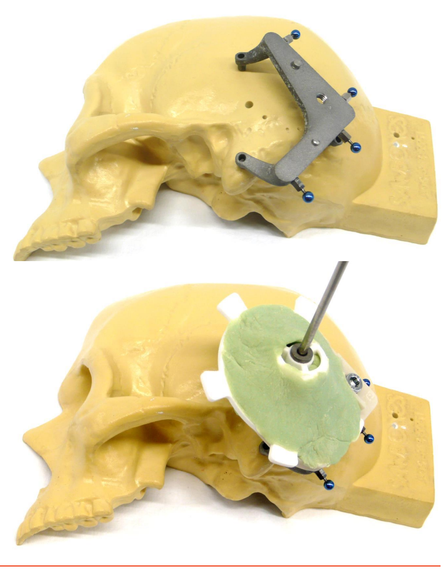
- directly in the OR
- in a short time
- out of only few, sterile components
- with simple, easy to learn manual steps

for each patient.

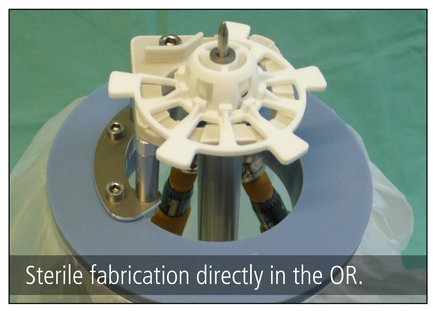
The achievable accuracy and the extent of intuitive handling were analyzed using the new system.

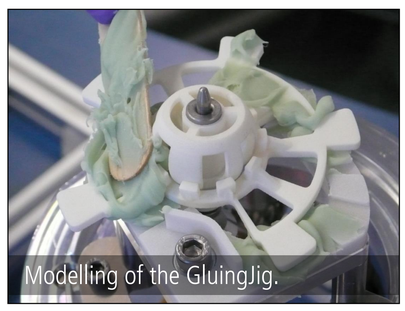
The Solution





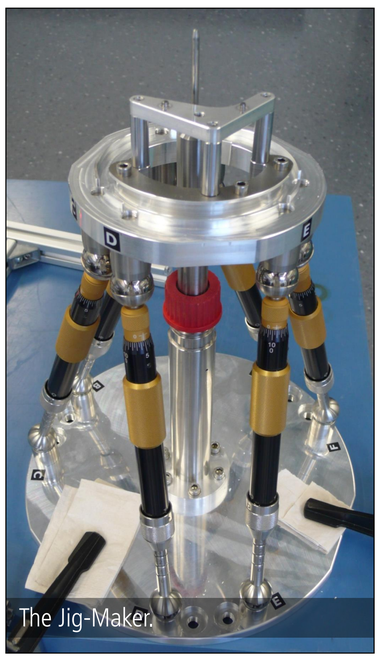
An adjustment system (called „Jig-Maker") was developed for intra-operative fabrication. The sterile components are adjusted within that system according to the planed axis to be glued together using bone cement. After hardening of the cement the custom-made micro-stereotactic frame is ready to use.

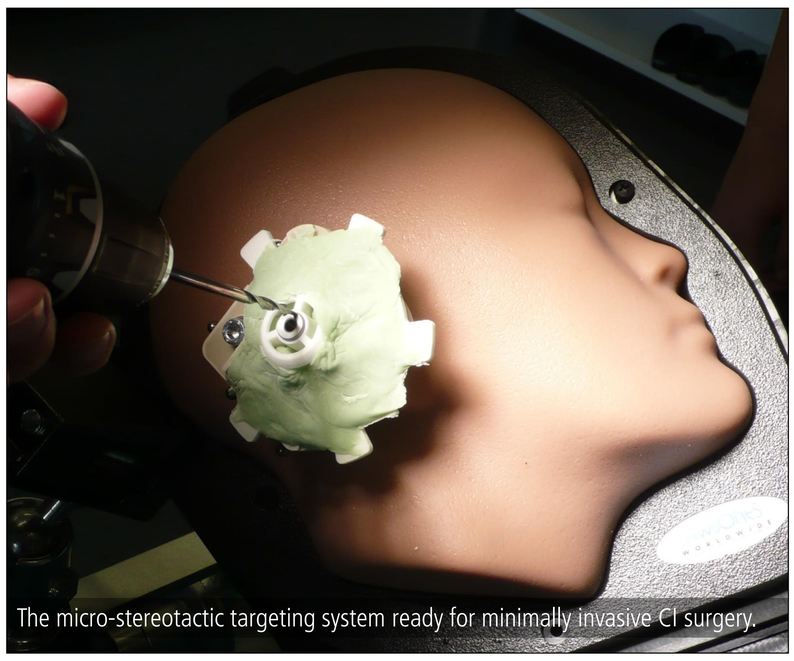

Sterile fabrication directly in the OR.

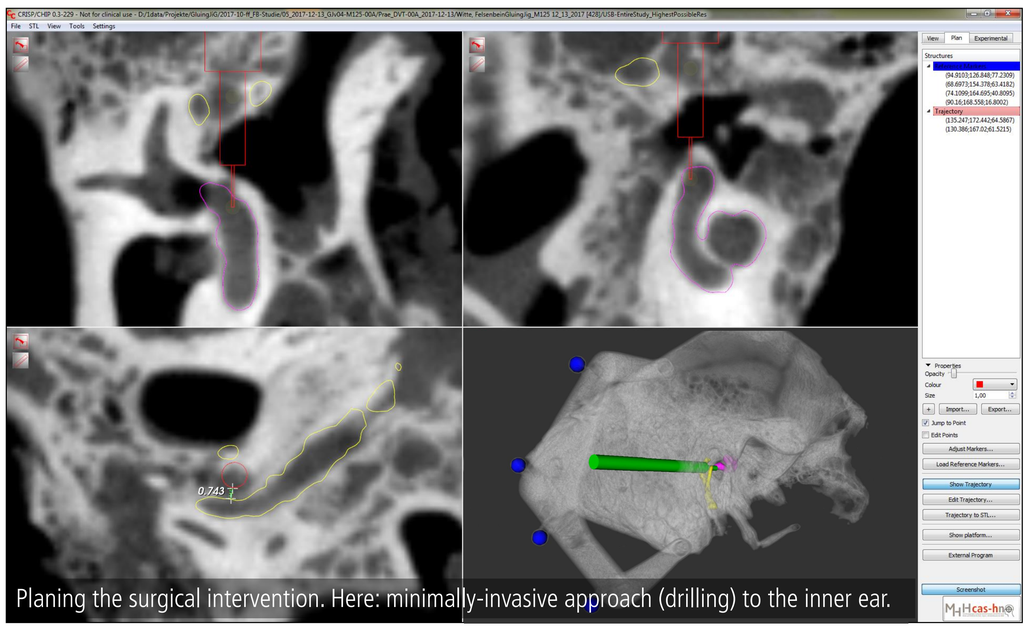

Modelling of the GluingJig.


Bone anchoring of the frame onto a model of a human skull.


Intraoperative imaging.

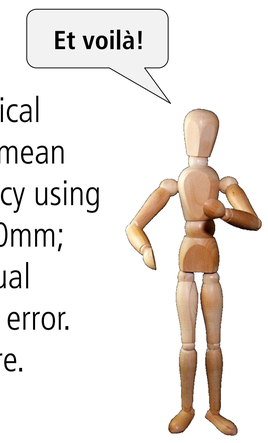

The Jig-Maker.


The micro-stereotactic targeting system ready for minimally invasive CI surgery.



Planing the surgical intervention. Here: minimally-invasive approach (drilling) to the inner ear.

The Results



The GluingJig is an entirely new concept of a micro-stereotactic surgical targeting system, which was developed and successfully tested. The mean positioning error was 0.30mm (+/- 0.25mm; n = 18). Drilling accuracy using artificial models of a human skull was found to be 0.35mm (+/- 0.30mm; n = 10). The system has proven its intuitive and easy handling. Manual adjustment of the Jig-Maker was identified as most critical source of error. Process automation is planned to avoid these user errors in the future.

Conclusion and Perspective

The preliminary results are very promising for further usage of the GluingJig system as assistance system for surgical interventions, due to its easy handling and good positioning accuracy. Although, it was originally developed for the improvement of the minimally invasive approach to the inner ear, also further applications are possible (e.g. biopsies, punctures, deep brain stimulation, stereo-tactic brachytherapy).

Please find more information under www.vianna.de/ags/cas/projects/gluingjig or see QR-Code:

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Contact
Thomas Rau, Dr.-Ing.
Medizinische Hochschule Hannover (MHH)
VIANNA - Institut für Audioneurotechnologie
der Klinik für Hals-, Nasen-, Ohrenheilkunde

Stadtfelddamm 34
30625 Hannover

Tel.: +49(0)511/532-3025
Rau.Thomas@mh-hannover.de
www.mhh-hno.de
www.vianna.de/ags/cas

MHHcas-hno
Forschungsgruppe Computer Assisted Surgery around the head
Klinik und Poliklinik für Hals-, Nasen-, Ohrenheilkunde der MHH