

Intraoperative Implementation of X-ray image based preoperative Planning for Precise Implantation of Hip-Endoprotheses

This project is carried out in cooperation with 4 plus company for software and hardware development, Erlangen/D. It focuses on the design and development of a novel computer assisted operation procedure for total hip replacement, based on a low cost surgical navigation system. Necessary hard- and software components will be developed. A new (multiple) stereo camera system which tracks visible light marker reference bodies will be built up for this purpose. The procedure will support the surgeons in all steps from planning to implementation and execution during the surgical operation. While common commercial products currently either rely on preoperative planning without intra-operative assistance or on the support of imageless navigation systems during the intervention, we aim to benefit from both solutions. The core innovation in our approach is to combine preoperative planning, i.e. patient anatomical data acquired from 2D anterior-posterior X-ray images, with intra-operative information collected by the 3D navigation system. Since minimal invasive interventions are commonly used in total hip replacement our method promises to

give better results and patient outcome compared to conventional procedures. A key point is the exact scaling of X-ray images, which is the mandatory prerequisite for accurate pre-operative planning. Commonly applied methods like employment of calibration bodies are not sufficiently precise and reliable for our application. The 4plus company will expand their already developed surgical planning software by the functionalities which are necessary for the integration of the intra-operative acquired patient anatomical data delivered by the navigation system. Thus, the preoperative planned operation parameters can be optimized and added. Conception and development of the 3D navigation system as well as the creation of an engineering model are tasks of the ZESS team. On this basis and supported by orthopedic hospitals both project partners will prepare appropriate surgical workflows and evaluate them by means of a demonstrator setup.

The project is funded by the German Federal Ministry BMWi within the ZIM program.

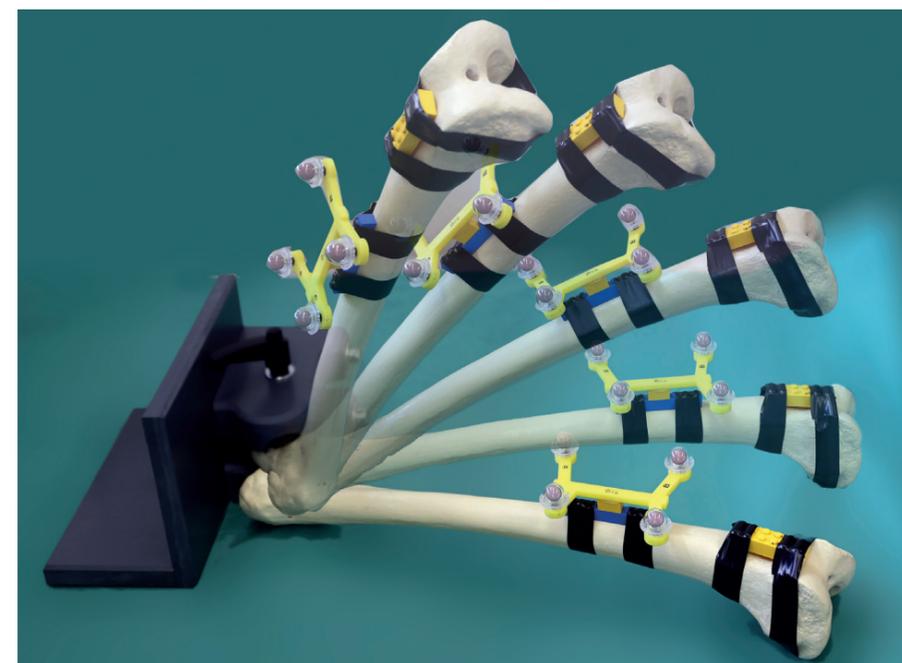
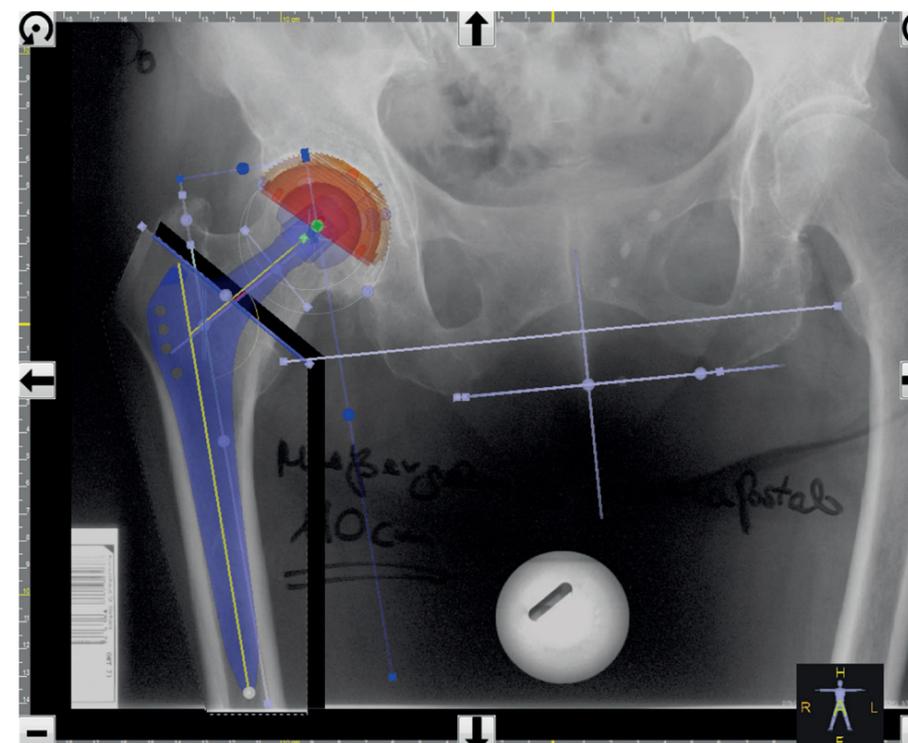


Figure 1: Test setup for determination of hip joint rotation center by means of reference bodies and movement of the femur bone

Figure 2: Pre-operative planning of a total hip replacement based on an X-ray image



I Project Management and Execution

Management:
Dr.-Ing. Jürgen Wahrburg

Contact:

Universität Siegen
Dr.-Ing. Jürgen Wahrburg
Zentrum für Sensorsysteme
Medizintechnik
Paul-Bonatz-Straße 9-11
D-57076 Siegen

E-Mail: wahrburg@zess.uni-siegen.de
web: <http://www.zess.uni-siegen.de/modicas>

Telefon: +49 (0) 271 740-4442
Fax: +49 (0) 271 740-2336