Preoperative planning on a PC with modiCAS-Planning as a first step of computer assisted surgery

Motivation / Background
Computer-based preoperative planning of surgical interventions will gain increasing importance due to the following trends.
+ Digitalization of x-ray equipment and installation of PACS in hospitals for electronic distribution and archiving of diagnostic images.
+ Corresponding need of planning procedures which directly process the digital images on a computer.
+ Forensic aspects in the context of growing demands on documentation and quality assurance.

Embedded in hospital IT networks
modiCAS-Planning can be connected to existing PACS - systems
+ Start the modiCAS-Planning out of the PACS
+ Import of patient and image data from PACS
+ Export of planning results to PACS

Features of the orthopeadic module
+ Use of 3D implant models, even if standard 2D x-ray pictures are used
+ High flexibility for data input (2D and 3D formats)
+ Compatible with Windows and Linux operating systems
+ Support specific hardware like touch displays
+ Possible to create user specific workflows
+ Profiles to define different preselections of implant families and implant sizes
+ Planning results will be transferable to navigation and robotic assistant systems

Benefits
+ Better documentation without needing more time
+ Integrated in hospital-wide computer network
+ Steps towards better reproducibility and higher accuracy
+ Requirements on quality management and quality assurance are met
+ Link to navigation and robotics will be available in future versions
+ Attractive for patients

Design Objectives
+ Development of a PC-based software to meet these trends
+ User interface which is fast and easy to handle
+ Time consumption will not exceed conventional planning
+ Modular design
  - Various modalities for input data (x-ray, CT, US)
  - Adaptable to various surgical procedures

Example: Planning of a total hip replacement procedure

Positioning of the cup
Positioning of the stem

Features
- Inclination and anteversion can be adjusted
- Implant components

Combining both parts
- Predefined workflows and profiles facilitate reproducible, time-efficient planning
- Workflow buttons

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Semiautomatic assistance functions

Semiautomatic femur detection and implant selection
+ Automatic detection of the femur contours
+ Recommendation for femur axis and neck axis
+ Suggested parameters can be optimised by the surgeon
+ Selection of the best fitting implant from the tool database

Impingement detection and motion simulation
+ Impingement detection based on three steps of collision detection
+ Motion simulation calculates the range of motion of a hip joint
+ Collision detection between other 3D-Planning objects like CT-Data or endoscope

Contact: Dr. Jürgen Wahrburg · Paul-Bonatz-Str. 9-11 · D-57076 Siegen · Tel. +49 (271) 740 4442 · wahrburg@zess.uni-siegen.de