

## **Ein Ansatz zur markerlosen Registrierung für eine roboterassistierte Chirurgie in der Mund- Kiefer und Gesichtschirurgie**

### **An approach of markerless registration for a robot assisted craniofacial surgery**

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In this paper, we present an approach for a markerless registration of a patient for a robot assisted craniofacial surgery. To achieve this goal, our system uses a Minolta V900 3D laser scanner to evaluate the position of the robot and the patient to each other. The used robot is a Staubli RX90B and will be controlled by the RobaCKa software. The planning will be done with the KasOp. Both applications have been developed at the University Karlsruhe.

The highly complex medical discipline of craniofacial surgery has various risks for the acting surgeon and the affected patient. Our robot system assists the surgeon milling or drilling the skull-cap. To ensure that the robot keeps track onto the planned trajectory, different coordinate systems have to be registered. These are the coordinate systems of the 3D-volume resulting out of the ct-data, the coordinate system representing the patient itself and the one of the robot. To make a good registration possible, at least three titan-screws, have to be drilled into the skull-cap before the ct will be taken. The screws remain in the skull until the surgery is over. This is a "harmless" but a harassing procedure for the patient. Furthermore the necessities of this can hardly be explained to a child. Our approach shows a method to register the essential data without inserting the screws into the patients' skull.

For registering the different coordinate systems, a Minolta V900 3D Scanner could be used. Preoperatively the ct of the patient will be taken. Afterwards these data will be transformed into a 3D-vtk-volume model. Using the KasOp tool with this data, the path which the robot has to follow, will be planned. Intraoperatively, the scanner has to be placed in the near of the head of the patient at one site of the operation table. The robot has to be situated at the head of the patient. During the registration process the scanner, the patient and the robot should be fixed.

After scanning the side of the patient and the drilling-instrument of the robot the different coordinating systems can be matched as follow. The trajectory, which is described in the coordinate system of the ct-data, has to be matched with the scanned surface of the patient. The 3d-model of the tip of the drilling instrument of the robot will be matched with the scanned surface of the same instrument. Because the shape of instrument it is possible to calculate the right position and orientation of the tip. Additional the robot provides the exact position of the tip at the time where it was scanned. Thus the position of the trajectory in relation to the base of the robot can be described.

This paper describes how a 3D laser-scanner could be used in a robot system to provide a markerless registration for a craniofacial surgery. First testing will follow in the near future to evaluate the precision and the utilisability of the registration process.