

## **Konzept eines interaktiven mechatronischen Systems für die endoskopische Neurochirurgie**

### **Concept of an interactive mechatronic system for endoscopic neurosurgery**

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#### **OBJECTIVE**

Intracranial endoscopic approaches require a high accuracy to reach the target point. The free-hand approach combined with neuronavigation is usually used for a precise access to small ventricles or cysts. To improve the accuracy and to provide a stable holding system, an interactive mechatronic system has been developed for guiding the endoscope. We report on our preliminary preclinical experience with this system.

#### **METHODS**

The mechatronic system combines an optical navigation system and a mechatronic arm. Compared to pure navigation systems it offers additional functionality by automatic positioning of surgical instruments in preoperatively planned locations, but it does not perform any action without interaction and control of the surgeon. The mechatronic arm may thus be regarded as a controlled machine actuator of a navigation system that substitutes for manual instrument guidance. Interactive properties are provided by a versatile haptic interface and by manual control using a joystick.

Preoperatively, the approach planning with selection of entry and target point is performed. The first step of the intraoperative procedure is the registration which presently uses a paired-point algorithm based on a set of fiducial markers to align pre- and intraoperative data. The entry point is then marked on the skin and the incision is made. Once the burr hole has been made and the dura has been incised, the sheath is inserted by the navigated mechatronic arm along the planned trajectory to the target point. Thereafter, the trocar is removed and the target region is inspected with the endoscope. From that point, the endoscopic sheath with the endoscope inside is moved by the mechatronic system under joystick control while the surgeon is looking at the monitor screen. At the end of the intervention, the mechatronic arm will remove the endoscope exactly along the trajectory as it has been inserted.

## CONCLUSION

The interactive mechatronic system provides a high accuracy, enables a preoperative approach planning, is stable and can be guided safely with a joy-stick device. The preliminary results are promising, however more preclinical tests are necessary before clinical use.

