Smart mechatronic driver for surgical trajectory navigation

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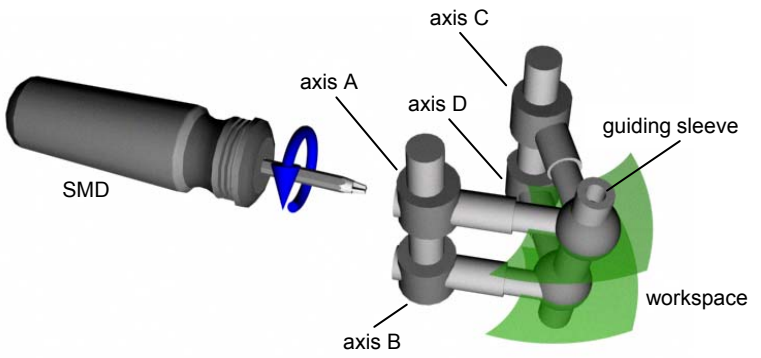
The aim of trajectory navigation is to position a surgical instrument along a planned trajectory. Computer assisted navigation systems show maximal flexibility but are limited by the costs and accuracy of the used optical tracking system and the human errors during free-hand navigation. Robotic devices can reach highest accuracy but are expensive and potentially safety critical due to active electric components being close to the patient. The novel concept of a smart mechatronic driver may reach the same accuracy as using robotic systems but without active components being attached to the patient. To achieve this, the kinematic structure of the positioning device is build from pure mechanical components and a handheld smart mechatronic driver is used to adjust the device to reach the planned position. After rigidly attaching a reference platform containing x-ray opaque markers to the anatomy an image based planning has to be done to define the desired trajectory. The system then automatically calculates the necessary adjustments of the positioning device. The surgeon can then use the smart mechatronic driver as an intelligent electric screwdriver which knows how to adjust each axis. This concept has been implemented for pedicle screw placement and drilling of the guidance pin for hip resurfacing. First evaluations show that higher accuracy can be achieved in comparison to the use of optically tracked free-hand navigation.



Concept of the smart mechatronic driver (SMD) adjusting the different axes of the mechanical positioning device to align the guiding sleeve with the planning data