TOWARDS ROBOTIC OPEN MICROSURGERY

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Introduction: Microsurgeons use a microscope with a 20-to-50 magnifying index to help them to properly visualize the operating field. However, they still use their bear hands to hold and manipulate instruments or structures and tissues with feature sizes of some microns. A surgical manipulator that can scale down the hand motion of the surgeon to the microfield would be an improvement of dexterity and precision.

Background: Some existing micro-telerobotic platforms and workstations systems have been developed for bio-medical applications, but all of them are specialized in some branch of MIS (Hunter[4]'s eye-surgery) or intravenous interventions (Dario[1,2], Hannaford[3]). Our goal is to develop a new platform that covers the largest number of open microsurgery procedures as possible, focusing on traumatological blood vessels and nerves suturing.

Methods: Our platform is based in an industrial precision robot (Staubli TX-60), an adapted laparoscopic needle holder attached to the end effector of the robot and a 3D motion capture device (Polhemus Liberty 8). With the motion sensor installed in an adapted needle holder from conventional microsurgery as master device, we can replicate the surgeon hands' moves, position and orientation, with a motion scale factor in the slave robot.

Results: Basic standardized training exercises have been performed with our platform. The surgeon can manipulate instruments with variable scaling reaching milimetric movements. After validating its effectiveness, some real suturing exercises were performed under supervision at the Experimental Surgery Lab with some rat and rabbit vessels and nerves.

Discussion/Conclusions: Although the materials used were not optimal, being adapted from another specialty, the previous theoretical analysis, backed by a full working test platform and some experiments with surgeons, indicates an improvement of skill, dexterity and performance time in all training exercises.

References

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