Microsurgical Robotic System (MM-3) for Super-micro-anastomosis: Development and experiments

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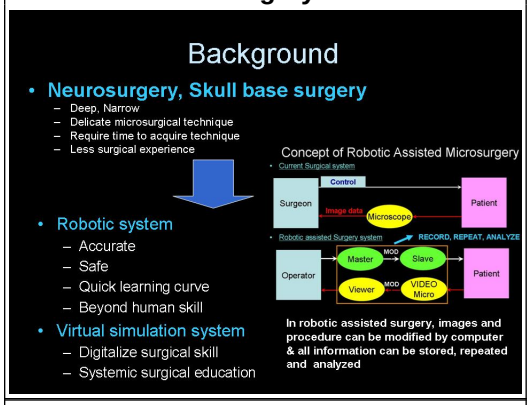
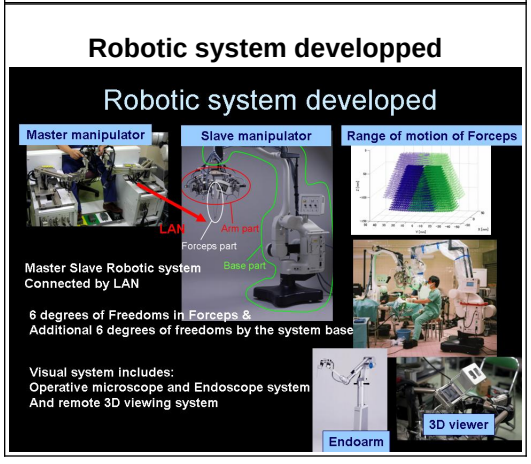
Introduction

Medical robotics and engineering have great potential in improving future medical technology. In performing super-micro-anastomosis, there are potential technical limits due to tremor and dexterity in human hands. In our laboratory, we have developed microsurgery robotic system which enabled anastomosis even smaller than 0.3mm vessels.

Background & COncept of Robotic Surgery



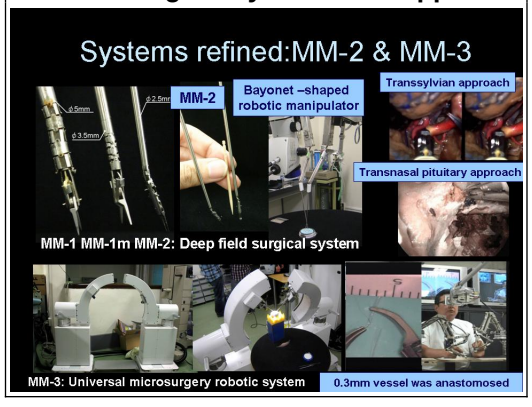
Robotic system developped



Methods

In our medic-engineering laboratory, we have developed 3rd prototype of microsurgical robotic system1). This system consists of master-slave control system. Slave system includes 2 micromanipulator 13cm long and with 6degrees of freedom. Forceps part can be sterilized and attached to the motorized portion. Surgical view is captured with high vision camera and presented in 3-dimensional viewer to the operator. Using this system, micro -anastomosis of artificial vessels 0.3~1mm was performed and the result was compared to microsurgery with 2 experienced neurosurgeons who had performed more than 50 actual microsurgical anastomosis. Learning curve of the system was explored with 3 engineer students who never experienced micro-anastomosis.

Microsurgical system developped



Results

Our robotic system made possible for operators to place 4 stitches to 0.3mm artificial vessels constantly and was superior to the ability of experienced surgeons while the robotic system required much longer to place one stitch (5 minutes). The learning curve was very quick (<1hour) to learn micro-anastomosis.

Conclusions

Medical engineering has great potential in improving future care including surgical education. Our prototype microsurgical robotic system enabled super-micro-anastomosis constantly which will improve results and future education in neurosurgery, plastic surgery and other microsurgical specialty requiring high level dexterity.

Learning Objectives

To know the future possibility of neurosurgical technique.

References

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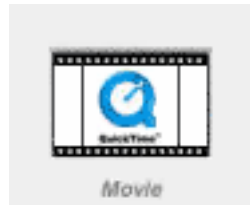

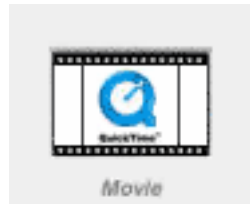

Accuracy of the system & learning curve of the robotic surgery