PAPERS

Virtual Reality in Microsurgery Training

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BACKGROUND

Microsurgery is a well-established medical field, and involvesrepair of approximately 1mm vessels and nerves under an operatingmicroscope in order to reattach severed fingers or transfer tissuesfor reconstruction. Initial skills in microvascular surgery areusually developed in the animal lab and subsequently in the operatingroom. Development of these skills typically requires about 6 monthsof animal based training before additional learning takes placein the operating room. The experience level of the microsurgeonwas shown to be significant in the outcome of these procedures.We have developed a virtual reality computer system that allowsthe user to realistically simulate vessel anastomosis and is ableto monitor the progress of the trainee as well as compare theperformance to an experienced microsurgeon.

PURPOSE

To provide an additional teaching tool for the beginning microsurgeonthat is more convenient, faster and in the long term more costeffective than the animal lab. The progress of the trainee canbe monitored and the performance compared to that of an experiencedmicrosurgeon

MATERIALS & METHODS

The system consists of a fully configured Sun Ultra 60/Elite3D Graphics workstation connected to and a stereoscopic displayby Fakespace Technologies (the BOOM). Real microsurgery instrumentswere adapted and were used as input devices so that the surgeonsexperience would be as realistic as possible. An electromagnetictracking device was mounted on these instruments to provide 3Dlocalization and orientation. Using a physically based model,two vessels were simulated in the virtual environment. Throughthe tracked instruments the user is able to perform microsurgicalanastomoses. The system evaluates the surgeon's performancebased on a number of heuristics.

RESULTS

Because of the lack of force-feedback in actual microsurgery,the virtual environment is extremely realistic. The virtual instrumentsare responsive and their interaction with the virtual vesselsis very close to reality. The vessel images deform like livingtissues and anastomoses can be performed over and over again atany magnification or vessel orientation. The computer is ableto calculate the redundant motions of the users in their attemptsto perform the repair and is able to keep track of the performanceof a user over time as well as compare the performance of differentusers.

SLIDESHOW

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