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Brain Function during Virtual Surgery

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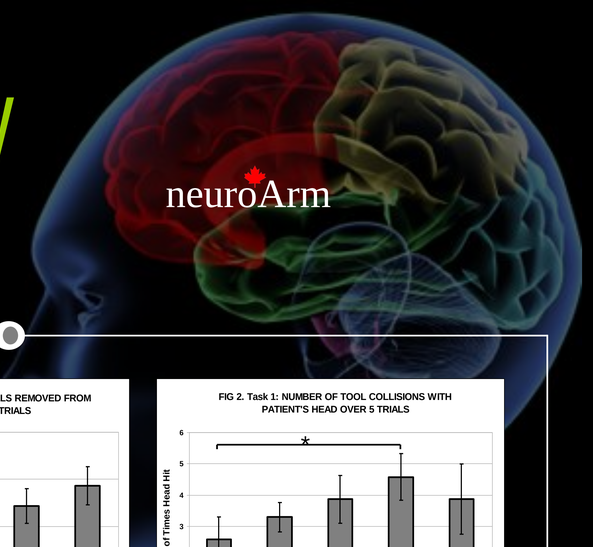
May Choi, Sun S, Goodyear B, Sutherland G



Introduction

Virtual reality (VR) simulators are valuable for training and evaluating surgeons. The University of Calgary has developed a VR simulator for a neurosurgical robot called neuroArm. Video gamers performed better on the neuroArm simulator than subjects with a surgical or medical background (1). The present study examines how previous video game or surgical experience affects brain activity as participants conduct virtual surgery using the simulator.

1. Choi, MY, Sutherland, GR. Surgical Performance in a Virtual Environment. ***On the Horizon*** 17(4), 2009.

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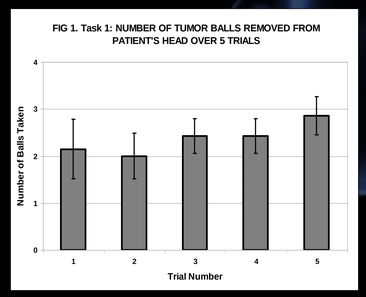
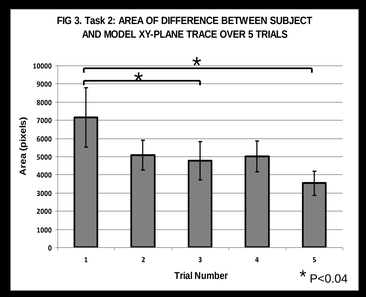
Hypothesis

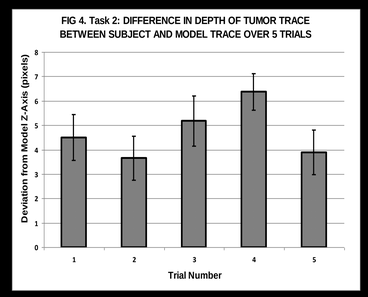
Gamers will show lower neural activities in the premotor primary motor, and posterior parietal cortices than surgeons due to long-term motor practice with video games. However, with repetition of virtual tasks on the simulator, the groups will display similar brain activation.

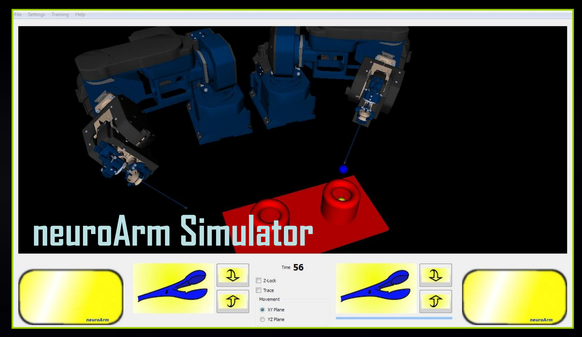
Preliminary Results

Learning was observed for several categories of performance: the number of tumors removed increased (fig.1), accuracy of tumor trace along the xy-plane improved (fig.3), and the frequency of exceeding joint limits was reduced. Participants had the most difficulty with avoiding collisions (fig.2) and tracing near the surface of the tumor (fig.4), both of which require good depth perception. The current neuroArm trainer does not provide a 3D view of the virtual environment.









Conclusion

Functional MR imaging with video gamers and surgeons are currently underway. The final results of this study may provide a neurological explanation for improved performance in virtual surgery with video game experience. Also, this study will help validate the neuroArm simulator as a tool to train, evaluate, and certify surgical trainees.

Methods

Preliminary Experiments: Seven subjects tested two virtual tasks on the simulator without functional brain imaging. Preliminary data has been collected and analyzed.

Subjects: Five video gamers (screened using a video game skills test) and five surgeons were recruited. Prior to virtual training, they complete a questionnaire.

Virtual Tasks: Two tasks will be performed on the simulator while inside a 3.0 T MR system to obtain T2* functional brain images. In Task 1, the number of tumors removed in 3 minutes, frequency of reaching joint limits and collisions were recorded. For Task 2, the participants traced the perimeter of a tumor without touching the surrounding blood vessels. Accuracy and time of trace were determined.