Virtual Reality Simulators: Valuable Surgical Skills Trainers or Video Games?

Ross E. Willis, PhD, Srinivas Ivatury, MD, Hari Mitra, BS,
Pedro Pablo Gomez, MD, Kent R. Van Sickle, MD
Department of Surgery, University of Texas Health Science Center at San Antonio

Background:
Two types of surgical simulators are currently in use: virtual reality (VR) and physical-model (PM, e.g., box trainers). While these simulators share commonalities, one major difference is whether the trainee is manipulating actual 3D objects (PM) or computer-generated 3D objects (VR). Much like video games, VR simulators utilize computer-generated graphics. Previous research has examined a link between surgical skills and video game (VG) performance with equivocal results. Some studies report correlations between VG and laparoscopic performance using VR simulators while others found no correlations using PM simulators. Furthermore, previous research using EEG measurement has reported significantly different neural activation with 2D and 3D VR environments. These differences may have profound effects on the utility of VR and PM training platforms. In this study, we aimed to determine whether a relationship exists between VR, PM, and VG platforms.

Methods: VR and PM simulators for laparoscopic camera navigation (LCN, Experiment 1) and flexible endoscopy (FE, Experiment 2) were used in this study. Three levels of Marble Mania (MM) on the Nintendo Wii system were used to assess VG performance. In Experiment 1, 20 laparoscopic novices played MM and performed 3 trials of each 0° and 30° LCN exercise on the VR (SurgicalSim) and PM (Tulane trainer). In Experiment 2, 20 FE novices played MM and performed 2 trials of colonoscopy exercises on the VR (GI Mentor II) and PM (Kyoto).

Results: In Experiment 1, performance on MM Level 12 correlated significantly with VR 30° LCN time and tip trajectory (p<.001 and p<0.005, respectively) but not with PM LCN time. Performance on PM LCN time did not correlate with performance on respective VR model LCN time. In Experiment 2, performance on MM Level 12 correlated significantly with VR total time (p<.008) but not with PM. Performance on VR colonoscopy did not correlate with PM performance.

Conclusions: VG performance correlated with VR but not with PM performance for these LCN or FE exercises. Furthermore, performance on VR did not correlate with PM. Both findings support the hypothesis that VR and PM environments differ. VR environments may be more like VG than previously thought.