Virtual ACS 2021 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

Research In-Progress

Motion Tracking Accurately Distinguishes Trainee Experience in Laparoscopic Surgery

Khaled Abdul Jawad, MD; Jonathan Parks, MD; Matthew Sussman, MD; Tyler Herrington, BA; Gerd Daniel Pust, MD, FACS; Danny Sleeman, MD, FACS; Omaida Velazquez, MD, FACS; and D. Dante Yeh, MD, FACS, MHPE.

University of Miami Miller School of Medicine, Miami, FL

Introduction: Caseload reduction of surgical residents has resulted in increasing demand for simulation to assess surgical competence. Current assessment in laparoscopic simulation is based on time-per-task. Real-life assessment also includes economy of motion and working volume but is rarely used outside of robotic simulators. We investigated the role of motion-tracking software in the assessment of technical proficiency in laparoscopy.

Methods: Using a motion tracker (Polhemus Patriot, Colchester, VT, USA) attached to surgical instruments, we captured motion (60 Hz) from subjects completing a standardized Fundamentals of Laparoscopic Surgery (FLS) task. Data was passed through a Savistky-Golay filter to reduce background "noise" and tremor and was analyzed using custom-built software to measure task time, path length, movement count, and working volume. Data was converted to visual representation of continuous movement from task start to finish.

Preliminary Results: 34 students and 14 residents were recruited. Training levels ranged from second-year medical school to fourth-year post-graduate year (PGY4) residency. Performance of an FLS exam proctor was used as the mastery benchmark. Residents had shorter time (45.6 ± 8.5s vs 241.8 ± 100.9s, p=<.001), shorter distance (47.5 ± .8.4cm vs 121.9 ± 56.3cm, p=.004), and faster speed (1.0 ± 0.2cm/s vs 0.5 ± 0.1cm/s, p=<.001) compared to students. Differences were detected in movement count (31 ± 7.02 vs 43 ± 26.5, p=1.0) and working volume (3.4 ± 1. cm^2 vs 5.1 ± 2.9cm^2, p=0.19) but were not statistically significant. Movement tracings were easily distinguishable between novice (student), intermediate (resident) and expert (FLS proctor) levels **(Figure).**

Next Steps: The custom-built software needs to be externally validated by others to confirm content validity and incorporated into simulation training to provide immediate feedback after each trial. The new approach will be valuable if it can demonstrate greater learning efficiency that standard simulation training without motion-tracking.

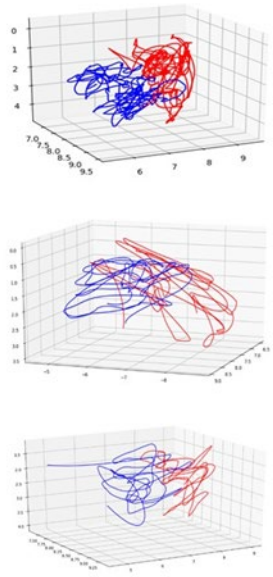

Figure: Motion Tracking Graphs for Students, Residents, and FLS Exam Proctor From Top to Bottom Respectively