(MP47-07) Motion analysis to promote understanding of laparoscopic surgery-dexterity and objective assessment-based simulation training

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Infrared reflective markers are attached to each surgical instrument with an individual arrangement pattern. Therefore Mocap technology can track multiple surgical instruments simultaneously during a training session.

Participants (n=45) performed tissue dissection around the aorta, dividing encountered vessels after applying a Hem-o-Lock (Task 1), and renal parenchymal closure (Task 2: suturing only, Task 3: suturing and knot tying), using swine cadaveric organs placed in a box-trainer under the Mocap system. A total of 15 experts, 12 intermediates, and 18 novices participated in the training.
Task 1: Principal component loading

Twenty parameters with significant differences among the three groups comparison were utilized for principal component analysis. The right-directed vectors were associated with speed-related metrics (e.g., velocity and acceleration), and the left-directed vectors were associated with efficiency-related metrics (e.g., pathlength, task time, and frequency of opening and closing).

Hem-o-Lok clip applier-related metrics strongly contributed to the axis of the 1st principal component (red arrows).
Conclusions

• Our novel Mocap system identified significant differences in several motion metrics (e.g., path length, velocity, acceleration, and jerk) for multiple surgical instruments during a series of wet-lab training according to the level of surgical experience. “Applying a Hemo-o-Lok clip on a pedicle” strongly reflected the level of surgical experience, although that was a quick procedure. We consider that getting surgical devices in/out correctly requires highly trained visual spatial skills, and it well-reflected the level of surgical experience in laparoscopy. A raining task required to exchange surgical instruments safely should be included in a laparoscopic training curriculum.

• Overall, our results strongly show the possibility of digitizing laparoscopic surgical skills and a novel surgical simulation program whereby trainees are able to immediately receive objective feedback during wet lab training.