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## Validation of the dv-Trainer ®, a novel virtual reality simulator for robotic surgery

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### Validation of the dv-Trainer ®, a novel virtual reality simulator for robotic surgery

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**Background:** Simulation is an established component of laparoscopic training, and may prove to be a valuable tool in robotic surgery. The dv-Trainer ® (Mimic Technologies Inc, Seattle, WA) is a virtual reality simulator for the da Vinci ® Surgical System (Intuitive Surgical Inc, Sunnyvale, CA) that is in beta development. We sought to assess the face, content and construct validity of the dv-Trainer.

**Methods:** Medical students, residents, and attending surgeons were enrolled in a prospective, IRB-approved study. All data was de-identified at study outset. Subjects were prospectively categorized as either novice (<10 robotic cases) or expert (≥30 robotic cases). Following a standardized introduction and 10 minutes of practice time, each subject completed two endowrist modules and two needle driving modules in sequence. Performance was recorded using a built-in scoring algorithm. Each subject completed a questionnaire after finishing the modules.

**Results:** The novice group (n=19) was composed of 16% students, 58% residents, and 26% attending surgeons. Novices had operated an average of 1.3 ± 2.2 hours at the da Vinci console prior to using the simulator. On average, experts (n=7) had performed 140 ± 116 robotic cases.

Expert robotic surgeons outperformed novices on the simulator in nearly all variables in a pooled data set (Tables 1 and 2). All novices ranked the simulator as a realistic practice format. All experts ranked the simulator as useful for training residents and attendings, and agreed with incorporating the simulator into a residency curriculum. The haptic feedback, virtual reality and instrumentation all achieved acceptability. The needle driving modules did not exceed the acceptability threshold.

**Conclusions:** The dv-Trainer has face, content and construct validity as a virtual reality simulator for the da Vinci Surgical System. Needle driving modules will need to be refined. The dv-Trainer may become a valuable training simulator in robotic surgery.

Table 1. Pooled data (Pick & Place, Pegboard, Dots & Numbers, Suture Sponge)

	Novice	Expert	P value
Total task time (sec)	269 ± 196	139 ± 56	<0.01
Max Force	6.02 ± 13.52	2.71 ± 5.34	0.07
Max Strain	4.28 ± 4.80	3.56 ± 4.66	0.49
Total motion (mm)	2635 ± 1682	1674 ± 712	<0.01
Instrument Collisions	4.9 ± 7.8	0.9 ± 1.3	<0.01

Table 2. Pooled data (Pick & Place, Pegboard, Dots & Numbers, Suture Sponge)

	Novice	Expert	P value
Time out of view (sec)	21 ± 63	2 ± 5	0.02
Time out of center (sec)	87 ± 104	32 ± 36	<0.01
Dropped targets	0.3 ± 0.6	0 ± 0	0.02
Successful targets	10.8 ± 4.7	12.6 ± 3.8	0.04
Unsuccessful targets	2.2 ± 3.0	2.0 ± 3.1	0.72
Unattempted targets	0.3 ± 3.5	0 ± 0	<0.01

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