Validation of a Physical Simulator Model for Training and Evaluating Endoscopic Endonasal Surgical Skills

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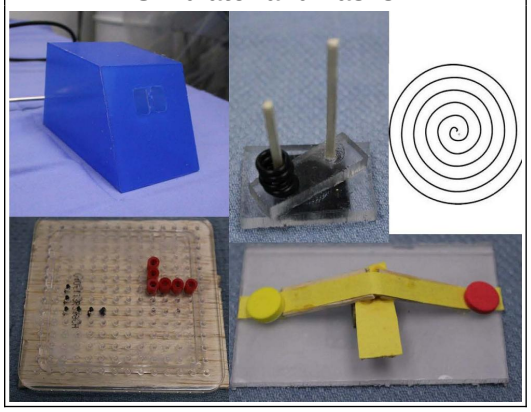
Introduction

There is a need for evaluating endoscopic endonasal surgical skills outside of the operating room for training purposes and for proficiency assessment. We describe the validation of surgical tasks in a physical simulator model.

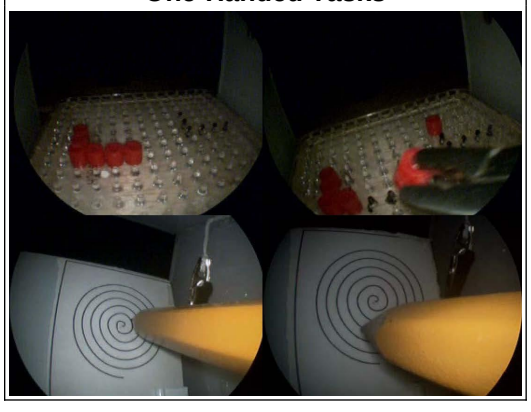
Simulator and Tasks



Learning Objectives

Validate an endoscopic physical simulator model and tasks which can be used as a tool in residency training and evaluation.

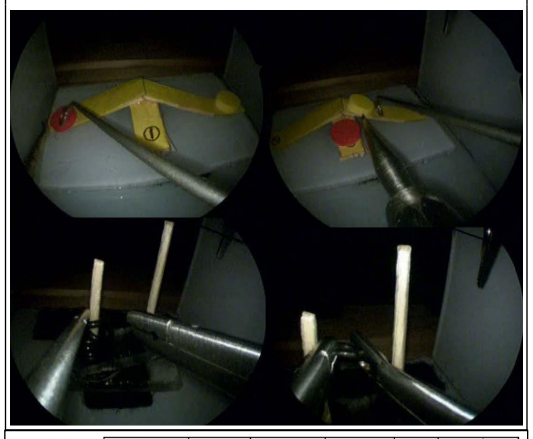
One-Handed Tasks



Methods

Five tasks that sought to replicate basic endoscopic surgical maneuvers were developed and tested by neurosurgeons and otolaryngologists at two skull base workshops. Participants were scored by measuring speed and accuracy. After normalization of task scores, exploratory univariate GLM models were conducted to determine predictors of performance. Participants also completed a modified NASA Task Load Index and offered constructive feedback.

Two-Handed Tasks

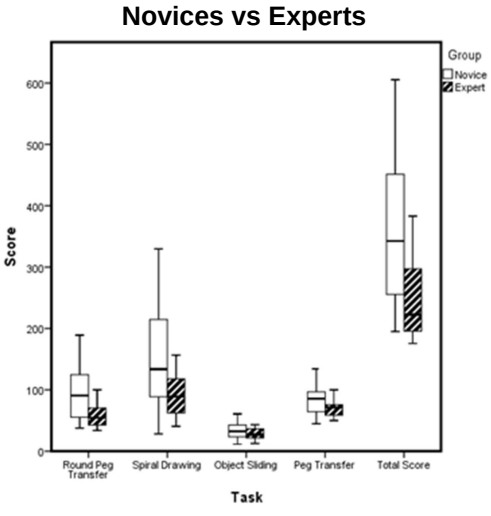


Task	Novice Group Mean(SD) n = 32	95% CI Novice Group	Expert Group Mean (SD) n = 14	95% CI Expert Group	P value	h_p^2 (Effect size)
Round Peg Transfer	91.9(37.5)	80.9-103.0	58.0(10.5)	39.9-76.1	.002	.17 (large)
Spiral Drawing	154.8(87.2)	129.6-179.9	90.3(35.3)	48.9-131.7	.01	.13(medium)
Object Sliding	37.0(27.2)	29.2-44.8	28.2(9.6)	15.3-41.0	.24	.03 (small)
Peg Transfer	85.6(27.8)	77.5-93.7	70.0(13.7)	56.7-83.3	.051	.07(medium)
Total Score	369.3(12.9.9)	331.3-407.3	246.5(65.3)	183.8-309.1	.001	.19(large)

Results

52 surgeons participated (14 experts and 32 novices). Scoring on the cutting task was suspended after 12 participants because it was judged to be too difficult. The remaining four tasks were completed by all participants. One-handed peg transfer (p=0.002, large effect size), spiral drawing tracing (p=0.01, medium effect size), and two-handed peg transfer (p=0.051, medium effect size) were able to discriminate between experts and novices, whereas object sliding was not (p=0.24). Modified NASA Task Load scores suggested that 94%, 90%, 69%, and 65% of the participants felt that two-handed peg transfer, one-handed peg transfer, object sliding, and spiral drawing, respectively, well-replicated intraoperative maneuvers and would improve their surgical skills.

Novices vs Experts



Conclusions

We have developed and validated three surgical tasks that are able to discriminate endoscopic surgeons by skill level. This physical simulator may be used to refine surgical skills and assess performance. Cutting and drilling tasks are being developed and the training effect is being studied.

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