2D Versus 3D Visualization: Impact on Laparoscopic Proficiency Using the Fundamentals of Laparoscopic Surgery Skill Set

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863: 2D VS. 3D VISUALIZATION: IMPACT UPON LAPAROSCOPIC PROFICIENCY USING THE FUNDAMENTALS OF LAPAROSCOPIC SURGERY SKILL SET

Brian Benway
Alethea Paradis
Kerry Madison
Youssef Tanagho
Gurdarshan Sandhu
Gerald Andriole

Introduction and Objectives
Traditional laparoscopy relies upon 2D images displayed on a monitor, and requires the surgeon to use auxiliary visual cues to judge instrument position and depth. This can pose a significant challenge, especially for maneuvers requiring precision and dexterity. The advent of 3D visualization technology for laparoscopy may reduce this challenge. We compared 2D vs. 3D visualization during laparoscopic skills performance assessment using the Fundamentals of Laparoscopic Surgery (FLS) skill set.

Methods
20 individuals with varying laparoscopic experience completed 4 essential drills from the FLS skill set (peg transfer, pattern cutting, bean drop, and suturing with knot tying) in both 2D and 3D (Viking Systems 3DHD). To control for the effect of learning curve, the subjects were randomized to begin with either 2D or 3D and completed all tasks before switching visualization modality. Time to completion was measured, along with the number of attempts required to achieve proficiency and the number of surgical errors. Each subject completed a post-hoc questionnaire evaluating their experiences with performing tasks in both 2D and 3D.

Results
All subjects perceived stereoscopic 3D. Across all tasks except for bean drop, subjects completed each task more quickly in 3D. 6 subjects required multiple attempts to achieve proficiency in one or more tasks in 2D, compared to just 1 subject in 3D. Objective and subjective measurements of efficiency and accuracy favored 3D. There were no differences in reported side effects, such as eye strain or headache. Most subjects reported that all tasks were easier in 3D. 90% of participants preferred 3D visualization to 2D.

Conclusions
3D visualization appears to greatly enhance the ease and efficiency of basic laparoscopic skills and hastens the development of surgical proficiency. 3D visualization produced no more eye strain or headaches than 2D visualization. 3D visualization was overwhelmingly preferred by our subjects. Our investigation into the impact of visualization technology upon laparoscopic surgical skills remains ongoing.

	Completion Time 2D (sec)	Completion Time 3D (sec)		Ease of Task 2D	Ease of Task 3D		Efficiency of Task 2D	Efficiency of Task 3D	
Peg Transfer	253	164	p< 0.001	4.2	5.2	p=0.010	4.2	5.1	p=0.090
Pattern Cutting	202	138	p=0.005	3.8	4.9	p=0.006	3.9	4.9	p=0.015
Bean Drop	156	123	p=0.056	4.4	5.5	p=0.011	4.3	5.4	p=0.013
Suturing/Knot Tying	356	246	p=0.038	3.4	4.7	p=0.006	3.4	4.8	p=0.003

Ease rated from 1 (very difficult) to 7 (very easy). Efficiency rated from 1 (very inefficient) to 7 (very efficient)

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DEVELOPMENT AND EVALUATION OF A NOVEL GEL-BASED URETERAL STENT WITH BIOFILM RESISTANT CHARACTERISTICS.

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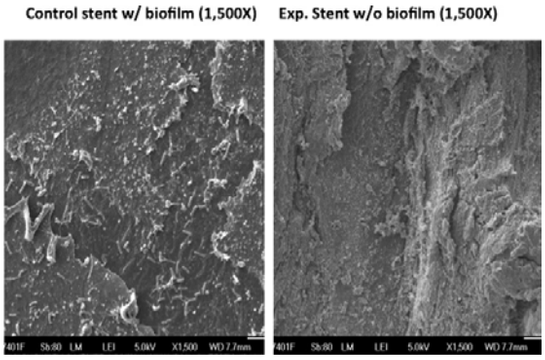
INTRODUCTION AND OBJECTIVES: Ureteral stents are utilized following surgery in order to ensure the patency of the ureter. Current stents, while effective at maintaining a ureteral lumen, are both a cause of discomfort for the patient and a substrate for bacterial growth. This increased propensity for biofilm formation can be a nidus for growth leading to infection, and a reason for early removal of a stent before it is clinically indicated. A new stent material, composed of a highly hydrated partially hydrolyzed polyacrylonitrile, is believed to have antibacterial properties. The objective of this study is to evaluate the biofilm growth and antibacterial properties of this novel stent.

METHODS: Sections of the experimental and conventional (control) stent (polymer stent, Boston Scientific, Natick MA) were incubated for 3 days in the following: Soy Trypticase broth ("broth"), broth and sterile urine, and broth and swine blood. After the incubation period, 5mL of broth laden with J96 human pathogenic E.Coli (OD 0.6-0.7 relative to sterile broth) was added to each vial. One segment of the control and experimental stents were removed at 3, 6, 9, 12, and 15 days. At each time point, the stents were washed in sterile saline to remove any bacteria laden fluid, leaving only the biofilm. After 4 successive washes, the stents were sonicated in an ultrasonic bath to break up any biofilm present. The solution was diluted and plated on permissive media. Subsequent quantification of bacterial growth by CFU counts provides a direct assessment of the biofilm growth. Incubated stents were sent for Scanning Electron Microscopy (SEM) imaging to confirm biofilm formation.

RESULTS: Experimental stents demonstrated significant reductions in bacterial counts when compared to control stents in all conditions tested: in broth (100 to 1000 fold reduction); in broth + urine (10 to 100-fold reduction); and broth + blood (10 to 100 fold reduction). SEM imaging demonstrated biofilm formation on both types of stents in all media, with a relative reduction in apparent cell debris and bacteria on the experimental stent.

CONCLUSIONS: In this study, the gel based stent shows a demonstrable reduction in bacterial counts and biofilm formation. The use of this novel stent may reduce the risk of infection associated with stent usage, avoiding the need for prophylactic antibiotics.



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2D VS. 3D VISUALIZATION: IMPACT UPON LAPAROSCOPIC PROFICIENCY USING THE FUNDAMENTALS OF LAPAROSCOPIC SURGERY SKILL SET

Brian Benway*, Alethea Paradis, Kerry Madison, Youssef Tanagho, Gurdarshan Sandhu, Gerald Andriole, Saint Louis, MO

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DA VINCI SKILLS SIMULATOR CONSTRUCT VALIDATION STUDY

Kyle T. Finnegan*, Anoop M. Meraney, Ilene Staff, Steven J. Shichman, Hartford, CT

INTRODUCTION AND OBJECTIVES: With the increased utilization of robotics, more training is necessary for surgeons to become proficient with the new technology. Barriers initially encountered by novice robotic surgeons include lack of familiarity with the robotic platform/controls and lack of the psychomotor skills.

The goal of this study is to assess the construct validity of the da Vinci Skills Simulator (Intuitive Surgical, Sunnyvale, CA). Optimally,