Comparative Assessment of Laparoendoscopic Single-site Surgery Instrumentation

Bernadette McCrory¹, Ph.D., Jake Riggle¹, M. Susan Hallbeck¹, Ph.D., P.E., CPE, Chad LaGrange², M.D.
Center for Advanced Surgical Technology (CAST) and Innovative Design and Ergonomic Analysis (IDEA) Laboratory
¹Department of Mechanical and Materials Engineering, University of Nebraska, Lincoln, NE
²Department of Surgery, Section of Urology, University of Nebraska Medical Center, Omaha, NE

Introduction
- Laparoendoscopic single-site surgery (LESS) is a surgical technique performed using a single, small incision within the patient’s navel.
- LESS is technically challenging because all of the instruments are inserted through a single incision causing collisions, an in-line view, transposed view and surgeon’s close proximity to assistants.
- Implementation of new technologies in the operating room creates new stress on surgeons (man–machine interface issues).

Method
- Usability testing was conducted to compare straight and articulating hand instruments using a standardized task in a LESS simulation test-bed.
- 24 students completed the Fundamentals of Laparoscopic Surgery (FLS) peg transfer task using each of the 3 hand instruments, presented in random order.
- Workload was assessed using the SURG-TLX (Wilson et al., 2011) on a scale form 0 to 100.
- Kruskal-Wallis tests were used to compare the medians for the six workload subscales, and a one-way ANOVA test was used to compare the means for overall workload.

Results
- There were no significant differences for the combined score of overall workload or the subscales of mental demand, temporal demand, task complexity, stress and distractions.
- Perceived physical demand of the Cambridge Endo instruments was significantly greater than the other instruments (p=0.024).
- Descriptively, the Cambridge Endo instruments resulted in higher ratings for all workload ratings while the Ethicon Endopath instruments were rated the lowest.

Conclusion
- Head-to-head evaluation of novel technologies is critical to ascertain the strengths and weaknesses of products to ensure that devices are not only safe and effective but also easy to use with low physical demand.