

Title: Measuring Force Transmission During Colonoscopy: Development of a Novel Training Device

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Structured Abstract:

Background: Colonoscopy is one of the most common procedures performed by gastroenterologists and surgeons in the diagnosis and management of colonic pathology. Since the advent of colonoscopy, deaths from colorectal cancer have decreased by up to 70%. However, colonoscopy is not without risk. The most feared complication is that of perforation; furthermore, colonoscopy is uncomfortable for patients. The number of procedures performed during training is often cited as a surrogate marker of competency. It is difficult, if not impossible, to achieve the high procedural numbers recommended. Focus has now shifted to improved quality of training, rather than quantity. Simulation has become widely embraced by the medical community to provide a safe environment for trainees to develop and practice technical skills without risk to patients. Existing colonoscopy simulators are aimed at negotiating the scope to the end of the bowel with the lumen in view, but do not take into account force transmitted from the colonoscope tip and loops to the colon wall.

Hypothesis: We hypothesize that expert endoscopists utilize safe techniques, which minimize the amount of force transmitted to the bowel wall compared to novices. We aim to define the relationship between endoscopic skill and force application by having both expert and novice endoscopists complete procedures using the model. We will subsequently develop and test a device to monitor force transmission, and provide feedback to the endoscopist.

Methods: Electromagnetic tracking markers were applied to a commercially available training model of the colon (Kyoto Kagaku, KKM40) at specific anatomic segments at known risk of perforation (sigmoid, splenic flexure, transverse, hepatic flexure). Measurements of average and maximal translational motion were recorded and used as a surrogate marker for force application.

Results: Seven participants have been enrolled in the study thus far. Expected enrollment is 50. For novice endoscopists, mean displacement is 8.9cm. Maximum displacement ranges from 10-30cm. For expert endoscopists mean displacement is 4.3cm and maximum displacement is 11cm. Although data enrollment is not complete, a trend is clear towards less force used by expert endoscopists.

Discussion: Our preliminary results suggest that experts utilize techniques to minimize force transmission to the bowel wall. We believe that the ability to alert users, and in particular trainees, of unsafe forces during colonoscopy, encourages the adoption and application of safe techniques. Further, comparison to current, validated endoscopic assessment tools will show the potential added value of force transmission as a metric of endoscopic skill.