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

**Trainee Name:** Jeffrey Hawel

**Supervisor(s):** Rajni Patel, Chris Schlachta, Terry Peters

**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. It can cause significant discomfort for patients, and in rare instances, perforation of the bowel wall. The number of procedures performed during training is often cited as a surrogate marker for competency. Current training models make it difficult, if not impossible, to achieve the high procedural numbers recommended. The shift to competency based medical education places the focus on achievement of milestones rather than the number of procedures performed. Simulation has become widely embraced to help develop, practice and evaluate these milestones without risk to patients. Existing colonoscopy simulators do not take into account force transmitted from the colonoscope tip and loops to the colon wall.

Hypothesis: Expert endoscopists utilize safe techniques, which minimize the amount of force transmitted to the bowel wall compared to novices.

Objective: To define the relationship between endoscopic skill and force application by having both expert and novice endoscopists complete procedures using our 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, anatomically mobile, segments (sigmoid, transverse). Measurements of average and maximal translational motion, were recorded and used as a surrogate marker for force application. We also measured time to procedural completion, velocity and acceleration.

Results: Forty participants (novice = 16, expert = 24) were enrolled. There was a significant difference in time to completion between novices and experts (540s vs 292s). For novice endoscopists, both mean and maximum translational motion was greater than their expert counterparts. This motion was particularly noted in the sigmoid colon.

Discussion: Our results suggest that experts utilize techniques, in particular, loop reduction, to minimize force transmission to the bowel wall. We believe that the ability to alert trainees of unsafe forces during colonoscopy will encourage the adoption and application of safe techniques. Comparison to validated endoscopic assessment tools will demonstrate the added value of force transmission as a metric of endoscopic skill.