Torque Perception in Colonoscopy

Aim: To determine the smallest perceivable relative changes in torque.

Background: Colonoscopy involves inspection of the entire colon using a flexible endoscope inserted via the rectum. One of the main complications in colonoscopy is the formation of loops, which can hurt the patient and prevent the physician from being able to progress the endoscope. To prevent or resolve loop formation, the physician must be aware of the amount of torque applied. Teaching torque awareness is pivotal in colonoscopy training. This study aims to improve our basic understanding of torque perception as well as provide quantitative guidelines for teaching and development of teaching tools such as colonoscopy simulators.

Methods: Perception of variations around two torque levels commonly used in colonoscopy[1], 0.1Nm and 0.2Nm, was investigated in fourteen healthy, medically untrained subjects. Two separate tests for each torque level were set up, one where the subject would hold on a solid rod with their right hand and one where the subject would hold on to the rod with their right hand and with their left hand to a flexible extension attached to the rod and thus simulate a colonoscopy procedure. Subjects were asked to reply with “increase”, “decrease” or “uncertain” whenever a change in torque was applied to the rod.

Results: Just noticeable differences (JNDs) of 4-7% increase and 11-12% decrease were observed when only holding on to the rod directly, with the lower JNDs observed for the higher torque level. When using the flexible extension JNDs of 7-12% increase and 10-14% decrease were noted.

Conclusions: The slightly higher JNDs suggest that using an extension to apply torque negatively affects the perception thereof. In colonoscopy terms, this means that using the left hand as a cantilever to facilitate torque application affects perception and should be done with caution. Trainees should be made aware of this during their training and should focus on controlling the torque with their right hand. Although this work was conducted with colonoscopy in mind as its specific application, the results are applicable to all situations where torsional feedback is used.

References: