Evaluation of a novel tablet application for improvement in colonoscopy training and mentoring (with video)

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Background and Aims: Endoscopic training can be challenging for the trainee and preceptor. Frustration can result from ineffective communication regarding areas of interest. Our team developed a novel tablet application for real-time mirroring of the colonoscopy examination that allows preceptors to make annotations directly on the viewing monitor. The potential for improvement in team proficiency and satisfaction is unknown.

Methods: The on-screen endoscopic image is mirrored to an Android tablet and permits real-time annotation directly on the in-room endoscopic image display. Preceptors can also "freeze-frame" an image and provide visual on-screen instruction (telestration). Trainees, precepted by a GI attending, were 1:1 randomized to perform colonoscopy on a training phantom using the application with traditional precepting or traditional precepting alone. Magnetized polyps (size < 5 mm) were placed in 1 of 5 preset location scenarios. Each trainee performed a total of 10 colonoscopies and completed each location scenario twice. During withdrawal, the trainee and the attending identified polyps. Outcome measures included number of polyps missed and participant satisfaction after each trial.

Results: Fifteen trainees (6 novice and 9 GI fellows) performed a total of 150 colonoscopies where 330 polyps in total were placed. Fellows missed fewer polyps using the tablet versus traditional precepting alone (4.2% vs 12.5%; $P = .04$). There was no significant difference in missed polyps for novices (12.5% vs 18.8%; $P = .66$). Overall, fellows missed fewer polyps when compared with novices regardless of the precepting method ($P = .01$). The attending and all trainees reported reduced stress with improved communication using the tablet.

Conclusions: Fellows missed fewer polyps using the tablet when compared with traditional endoscopy precepting. All trainees reported reduced stress, quicker identification of polyps, and improved educational satisfaction using the tablet. Our application has the potential to improve trainee plus attending team lesion detection and to enhance the endoscopy training experience for both the trainee and attending preceptor. (Gastrointest Endosc 2017;85:559-65.)

Abbreviations: CCE, Colon capsule endoscopy; MCCE, magnetic-controlled capsule endoscopy; CRC, colorectal cancer.

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This video can be viewed directly from the GIE website or by using the QR code and your mobile device. Download a free QR code scanner by searching "QR Scanner" in your mobile device's app store.

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Training GI fellows in endoscopy can be challenging for both the trainee and preceptor. Frustration can come from the inability to effectively communicate an area of interest or direction of view in the on-screen image. This may result in potentially missed lesions and erosion of a productive teacher–trainee relationship.

Developing proficiency in training is difficult to measure. Quality parameters set by the American Society for Gastrointestinal Endoscopy in clinical practice define competence as achieving cecal intubation in more than 90% of all cases and adenoma detection rates of at least 25% for men and 15% for women aged 50 or older.[1,2] During training, these detection rates are usually obtained after 450 colonoscopies.[3] Polyp detection rate has been shown to correlate with adenoma detection rate.[4] Tandem colonoscopy studies have shown that polyps less than 5 mm are missed 26% of the time, and improvement in the detection rate by 1% has been shown to decrease interval colorectal cancer by 3%.[3,5] Various methods to improve detection rates have been suggested, with a focus on endoscopic training hypothesized as a high-yield approach.[6] In 1 study evaluating simple educational interventions, adenoma detection rates increased significantly from 36% to 46%.[6]

More recent approaches for improving procedure-based education in surgery have been made using telementoring. Telementoring is the development of relationships between trainees and those with experience where the mentors are geographically removed from the trainee and communication is accomplished electronically. Telestration was developed to allow real-time freehand markups or annotations over images or videos similar to use in sports or weather broadcasts since the early 1960s. The theory is that the annotations allow visual illustration in addition to verbal teaching, leaving less room for incorrect interpretation of the preceptor's instructions. Telestration can also add interactivity that results in increasing the quality of education, leading to more efficient training.[7] Additionally, telestration has the ability to improve clinical outcomes through more accurate directions that help avoid clinical errors and reduce postoperative recovery time.[7]

Our team has developed a novel tablet-based application (ScopeVUe) that allows for real-time mirroring of the colonoscopy examination while allowing the preceptor to telestrate directly on the viewing monitor (Fig. 1). The utility of this application for improvement in trainee–team proficiency and team satisfaction in endoscopy remains unknown.

METHODS

Tablet application

ScopeVUe mirrors the on-screen endoscope image to an Android tablet (Asus Transformer T700; ASUSTek Computer Inc., Taipei, Taiwan) and allows for real-time annotation directly on the endoscopic image. The annotations are then simultaneously displayed on the standard in-room endoscopy monitor. Preceptors can also "freeze-frame" an image and provide visual on-screen instruction. ScopeVUe can be used with any endoscopic platform that has a video output port.

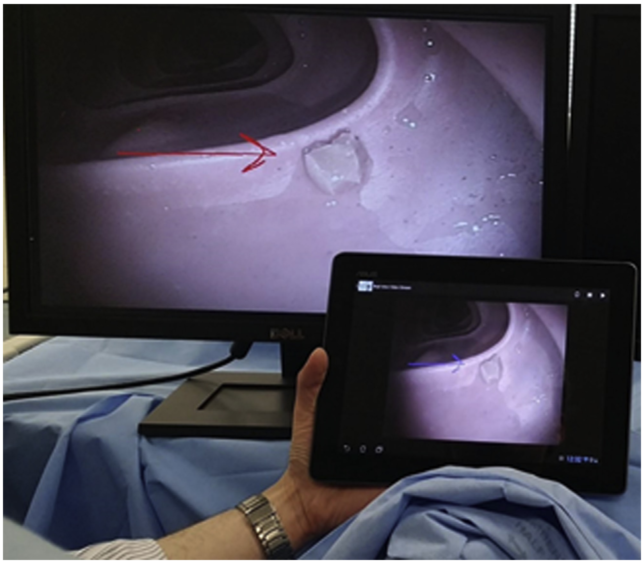

Figure 1. Real-time annotation (*arrow*) of a polyp on the tablet simultaneously displayed on an endoscopy monitor.

Tablet environment

ScopeVUe was deployed on an Intel Core i7-2600 CPU (Intel Corporation, Santa Clara, Calif, USA) on a 3.4-GHz host computer running Windows 7 (Microsoft Corporation, Redmond, Wash, USA). This computer was used to acquire high-fidelity composite video from the endoscopic video feed using a frame grabber (CronosPlus; Matrox Electronic Systems, Ltd., Dorval, Quebec, Canada) and MIL-Lite and OpenCV C++ application programming interfaces. The video was transmitted wirelessly to an Android tablet (Asus Transformer T700; ASUSTek Computer Inc., Taipei, Taiwan) using TCP/IP communication protocols for reliable transmission via a Netgear RangeMax 150-Mbps wireless router (Netgear, San Jose, Calif, USA). Any annotations made by the preceptor on the tablet were integrated into the endoscopic video using the host computer. The endoscopy environment included a tower and endoscope (13803PKS; Karl Storz Gmbh & Co., Tuttlingen, Germany). Colonoscopy was performed using a colon phantom (Kyoto Kagaku, Case 2, M40 latex colon training model; Kyoto, Japan). A technical team member confirmed polyp visualization with a MacAlly 2.0 megapixel camera (MacAlly USA, Ontario, Calif, USA) that was located inside the phantom.

Study design

Trainees (novices and GI fellows) performed colonoscopies on a colon phantom under the guidance of 1 attending preceptor (experience level, >2000