Augmented Reality for Enhanced Technical Training

Macfie R, Ramly E, Schipper P, Schreiber M, Abraham C
Oregon Health & Science University

Background:
The newest modality in the rapidly evolving field of surgical education is augmented reality (AR), in which virtual projection are superimposed onto real-word images or video. We report the use of a novel AR platform for a proctored vascular anastomosis skills lab.

Methods
The Proximie Augmented Reality software (Proximie, Boston, MA) was used for a proctored skills lab between a resident in VirtuOHSU and an attending vascular surgeon in the OHSU Porter Library. The resident completed an aortic anastomosis using a porcine vascular model, a laptop computer and a plug-in HD camera (Figure 1). The surgeon proctor used a laptop computer and the Proximie software to remotely lead the anastomosis lab (Figure 2).

Results
The resident successfully completed an end-to-end aortic anastomosis with only AR coaching via the Proximie platform. The proctor was able to clearly delineate where each stitch should be placed using the AR screen. Both technical and clinical aspects of the lab were taught via AR.

Future Directions
On February 12, 2018 our team performed the first successful completion of aortic Endovascular Aneurysm Repair (EVAR) using Augmented Reality platform for remote proctoring. From Porter Library Dr. Abraham used AR software to provide interactive intraoperative teaching and guidance to two vascular surgery fellows through critical operative steps. For enhanced patient safety during this trial, a second attending surgeon (Dr. Landry) was available for supervision in the operating room.

AR allowed intraoperative teaching of a highly complex procedure. The use of AR facilitated safe and effective communication, shared decision making, and learner autonomy.

Conclusions
We have demonstrated that a vascular anastomosis skills lab can be successfully proctored with the use of AR software. OHSU is the first US institution to employ this platform for technical training of surgical residents.

We have additionally demonstrated that AR can be safely used for intraoperative teaching of complex procedures. The use of AR can facilitate safe and effective communication, shared decision making, and learner autonomy.

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Figure 1. Resident setup in VirtuOHSU
Figure 2. Attending setup in Porter Library
Figure 3. Resident’s view of on-screen annotation by attending surgeon
Figure 4. The attending surgeon providing intraoperative guidance from Porter Library

Simulation at OHSU