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The Future of Telestration in Combat Casualty Care

We've all seen it. We're watching a sporting event on T.V. and after a key play we see a video replay. A commentator describes the play and augments it by drawing arrows, circles, and other freehand additions on the screen. That ability to do freehand markup over a video is called telestration. Telestration is currently used mostly for televised sporting events and weather forecasts. However, it also has great potential in telemedicine and surgical telementoring, where it can be used to provide guidance from a surgeon in a remote location from the patient and the patient's on-the-ground caregivers. This capability is crucial in providing critical care in austere environments where trauma or combat surgeons are not available.

Research into the use of telestration and telementoring in remote casualty care is growing, and a number of capability studies are underway. One of those is the Augmented Reality Forward Surgical Care (ARFSC) demonstration project funded by the AMEDD Advanced Medical Technology Initiative (AAMTI) program, managed at TATRC. The project aims to show that telestration and telementoring using an augmented reality (AR) system is effective in remotely training and guiding non-surgical personnel through surgical procedures.

Earlier this year, the project initiated a proof-of-concept demonstration. The key players were a U.S. Army orthopedic surgeon and a U.S. Navy Physician Assistant (PA). The surgeon was in a separate location from the PA and communicated by computer. The PA wore Osterhout Design Group (ODG) R-7HL smartglasses and used them to interact with the surgeon. The objective of the demonstration was to remotely guide the PA in exposing and clamping an artery in a surgical manikin.

The demonstration was a clear success. Using the telestration capabilities of the ODG smartglasses, the surgeon remotely guided the PA through the procedure. Without prior surgical skill, the PA was able to expose and clamp the proximal common femoral artery in the manikin.

TATRC played an important role leading up to the demonstration. Prior to the demo, the ARFSC "Telestration Team" gathered at TATRC to conduct functional testing of the telestration capabilities in AR devices to deliver full-frame video, audio, still pictures, and data from one connection point to another.

The team involved in the test were comprised of subject matter experts (SMEs) from The U.S. Army Special Operations Command, (MAJ Bill Vasios, SFC Chris Perry), Womack Army Medical Center (COL Tyler Harris; TATRC (Geoff Miller, Harvey Magee, Ollie Gray), BioMojo LLC, Librestream Inc, NuEyes Inc. The Principal Investigator (PI) is COL Tyler Harris, orthopaedic hand and combat surgeon and TATRC's Medical Modeling,

LTC(P) Harris briefs Telestration team before conducting bandwidth testing.

SFC Perry to place 1 fingerbreadth above the fibula during a "dry run" of the Telestration Test & Demonstration.

Simulation & Visualization team serves as the Co-PIs led by Geoff Miller, and Project Managers Harvey Magee and Ollie Gray.

With its initial success, the ARFSC project is gearing up for its next phase, which will evaluate the clinical benefits of telestration and telementoring in supporting remote surgical interventions. In addition, the next phase will assess the educational benefits of training programs for telestration and telementoring. And lastly, the quality of telestration and telementoring will be evaluated as well as user satisfaction with the pertinent technologies and their human-computer aspects.

A mixed methods study has been designed for the next phase of the project. The study will evaluate the following aspects of providing surgical support in remote environments using telestration and telementoring:

- ***Technology requirements.*** What are the minimum requirements for telestration and telementoring between a surgical specialist in a medical treatment facility and a remote non-surgeon in a far-forward environment using existing telecommunication systems within the U.S. Army?
- ***Training requirements.*** What training is required to prepare surgeons and non-surgeons to control lower extremity junctional hemorrhage, and to use associated telestration hardware, software, and communication systems?
- ***Transferability.*** Can the training approach and technologies used in the initial phase of the project be transferred to a wider range of medical care and clinical skills in anticipation of future medical needs and environments?

This second phase of the project is part of the rigorous investigation needed to ensure that forward surgical support using AR and telestration technologies are being provided in a safe and effective way, as well as to inform the development and improvement of new and future technologies to support this capability.

COL Tyler Harris has pointed to the potential this technology has for life saving procedures on the battle field. Along with Geoff Miller, Dr. Harris is beginning to plan for the next round of procedures that need to be studied.