Improving Visualization and Interaction During Transcatheter Ablation Using A Mixed Reality System: First-In-Human Experience

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ABSTRACT

Introduction: A novel mixed reality (MR) based system that displays a real-time intraprocedural hologram of cardiac geometry, electroanatomic maps, catheter localization with a controllable via sterile interface was developed. The system improves physician visualization and data interaction, which we expect will improve understanding of patient-specific cardiac anatomy and ultimately improve physician performance resulting in improved patient outcomes. We present the first live case where we have used this system, the Enhanced Electrophysiology Visualization and Interaction system (ÉLVIS).

METHODS: Software developed with the Windows Mixed Reality platform was loaded onto the Microsoft HoloLens (HL) augmented reality head mounted display and tested with historic data, prior to use in a live study.

RESULTS: During a standard electrophysiology study and transcatheter ablation, ÉLVIS displayed a holographic projection of real time cardiac geometry during its creation and throughout the case. Local activation time (LAT) map, catheter locations and lesion markers were all overlaid onto this model. Two concurrent observers located outside the electrophysiology suite watched the live case and interacted with the model altering the scale, rotation and translating the geometry using gaze/gesture control.

Conclusion: Display of real time cardiac geometry, LAT map, catheter localization and lesion data in a single hologram within a MrXr environment that facilitates physician visualization, interaction and collaboration is feasible. Future studies will include usability testing and prospective in human validation.

BACKGROUND

SYSTEM

Electrophysiology Mapping System

METHODS

- 10 patients undergoing EPS/ablation recruited for observational study
- Patients underwent standard procedure
- 2nd EP team to observe study from control room, including geometry creation, map creation and ablations
- No feedback to performing physician
- No patient decisions made using ÉLVIS
- Inclusion criteria: Structurally normal heart

RESULTS

Performance Metrics
- Polygons: 5k-12k
- Frame Rate: 30-60fps
- Battery Performance: 191min
- Latency: <131ms

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DISCLOSURES

JNAS and JRS are founders of SentiAR, Inc. MS holds shares in SentiAR, Inc. SentiAR, Inc is a medical device company pursuing the application of augmented reality in electrophysiology.