Google Glass Assisted Spine Instrumentation Using a Novel Video Streaming System: A New Usage of Wearable Computing In the Operating Room

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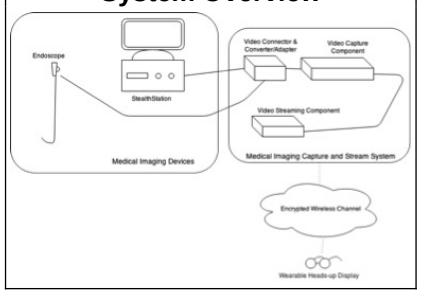
Introduction

Image guidance for spine instrumentation has helped provide spine surgeons with improved accuracy and safety. Currently, navigation images are displayed on a separate screen away from the surgical field on the monitors. During spine instrumentation, surgeons have to take their attention away from surgical field and look at the navigational display then look back at the field to make sure the screw is following the planned trajectory. Multiple head turns between the navigation screen and the surgical field not only cause delays during implant placement but also cause the surgeon's hand to deviate, potentially causing the screw to take a different trajectory than intended.

Spine Surgery in Current State

The surgeon has to look at the monitor while keeping the instruments in the surgical field in order to use the navigation system.

System Overview



Device Testing

After obtaining an approval from institutional review board, we enrolled ten patients undergoing 3-D image guided spine instrumentation at Mayo Clinic Florida from December 2014 to April 2015. Two authors (JWY, SMP) wore the Google Glass during 10 separate surgeries, in which neuronavigation images were streamed to the Google Glass using our novel device. Two authors (JWY, SMP) wore the Google Glass during 10 separate surgeries, in which stealth images were streamed to the Google Glass using our novel device. Post-operatively, both JWY and SMP filled out a survey; The survey question consisted of two questions related to the helpfulness of the wearable device and the quality of image displayed on the scale of 1 to 5 and 8 yes-no questions (4 positive and 4 negative responses).

Results

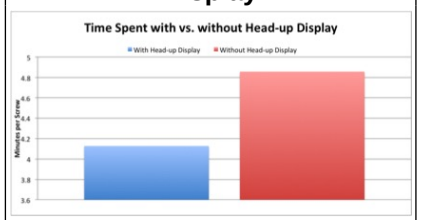
Spine instrumentation using this novel video streaming system was successfully performed in ten patients as a pilot study for feasibility. There is a learning curve associated with use of wearable devices to assist in spine instrumentation. An enlarged display and higher processing speed of the wearable device can significantly improve the utilization of this technology.

Survey Results

Positive	Freq	Negative	Freq
Improved focus on the patient	18	Difficult to wear the display	2
Picture quality is good	17	Difficult to see the image	3
Better concentration on operation	16	Display interferes with surgery	4
Results in lower anxiety	12	Results in greater anxiety	8
Total	**63**	**Total**	**17**

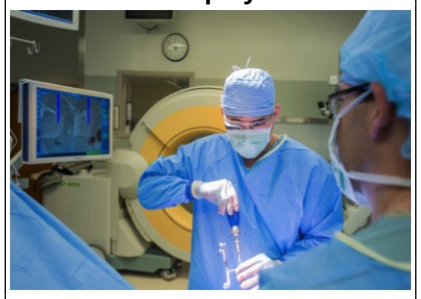
User experience survey immediately post-op

Time Saved with Head-up Display



Average screw placement time with head-up display vs. without

Spine Surgery with Head-up Display



Utilization of head-up display eliminated head motions that can cause delays and deviations in pedicle screw placement.

Discussion

- An overall average of 15.05% time saved per pedicle screw (4.13 minutes vs. 4.86 minutes)
- One minute in the OR is estimated to be $133 in 2005.
- Surgeons report less anxiety, better concentration on operation and improved focus on the surgery when head-up display is utilized.

Conclusions

- We report for the first time utilization of novel streaming systems to assist surgeons in spine instrumentation.
- This technology may improve and make spine instrumentation using image guidance more efficient and seamless.
- Utilization and integration of this technology may be a critical component of building the next generation microscopes.

Reference

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