Optical Head-Mounted Computer Display for Education, Research, and Documentation in Hand Surgery

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Intraoperative photography and capturing videos is important for the hand surgeon. Recently, optical head-mounted computer display has been introduced as a means of capturing photographs and videos. In this article, we discuss this new technology and review its potential use in hand surgery. *(J Hand Surg Am. 2016;41(1):150–153. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Photography, documentation, research, education.

Surgical imaging has been an integral part of medical practice and research and now is more frequently utilized for medicolegal documentation and patient's and physician's education. Technology continues to advance, making intraoperative photography and videography more widely available. Recent technological advances have produced wearable cameras and computers. This paper reviews an optical head-mounted computer display (OHMD) function and its utility in the operating room during hand surgery for enhancing documentation, research, and education. The quality and ease of using this device as compared with other cameras during surgery is reviewed. Google Glass is one such device and has a practical merit in documentation, research, and medical education, particularly with regard to its video capture function.

OBTAINING PICTURES IN HAND SURGERY

Surgical photography is becoming an important component of documenting functional capacity in hand surgery.[1]

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High-quality images are utilized in medical education and research and are frequently utilized for medicolegal documentation and patient and physician education.[2–4] Photographs and videos are also used to document injuries and disease patterns. Obtaining intraoperative photographs and particularly capturing videos require the services of photographers, videographers, or assistants with reasonable knowledge of photographic or video equipment. Obtaining videos during surgery would normally not be possible without an assistant to manage the video equipment and frame the video.

The medical community has been swift in adopting advances in technology. In 1865, less than 6 years after the first photograph was taken, photography was being used in medical journals and textbooks.[1,5] Continued advances make intraoperative photography and videos more widely used. Wang et al[1] described in depth the utility of surgical photography and provided a set of guidelines to obtain the best images. Photographs should be standardized to produce comparable images.[1]

OPTICAL HEAD-MOUNTED COMPUTER DISPLAY

Recent technological advances have created a wearable computer with OHMD, such as Google Glass (Google, Santa Clara, CA), which underwent limited release in April 2013. This device and other similar head-mounted computers have been developed and are currently evolving and improving quality of images

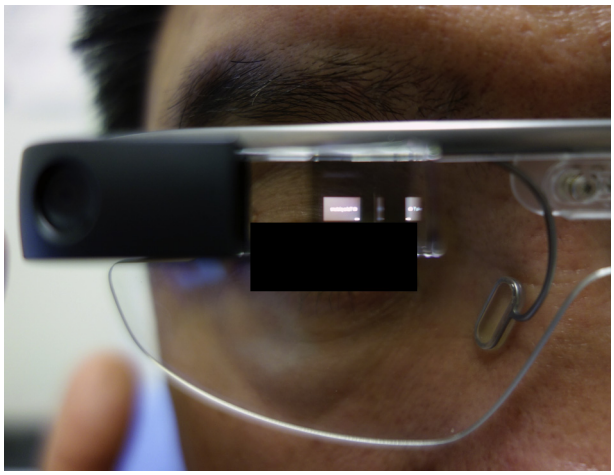

FIGURE 1: This figure demonstrates the heads up display of OHMD. Heads up display is a transparent projection that does not require the surgeon to look away from the surgical field.

and their functionality. From our review of the literature, this device has not been used previously for hand surgery and is only beginning to have limited use in any field of medicine.

Current versions of Google Glass offer a 640 × 360-pixel optical display (Fig. 1) on a lightweight titanium frame with a 5-megapixel camera and a cost of $1,500, at the time of this manuscript preparation. The optical display allows the surgeon to visualize the area being photographed or videoed and accurately "frame" and position the camera to best view the subject matter. OHMD is activated with a simple head tilt or by touching the touch pad (Fig. 2), which interfaces with the onboard computer. Various touches or swipes allow the user to navigate the computer. The additional advantage of the device is the voice command capability. The voice commands start with "OK Glass," followed by a second command, "Take a picture" or "Record a video." This device creates possibilities for use in a sterile environment, allowing the wearer to stream video of an operation, capture intraoperative images, and record video with descriptive audio.[6]

POTENTIAL USE IN HAND SURGERY

Grossmann in 2013[6] first used OHMD in surgery during a percutaneous endoscopic gastrostomy placement. Engelen in the same year in Europe began a study evaluating the use of OHMD in healthcare.[7] Since then, a few surgeons have attempted to stream surgery from the device.[8,9] Meunsterer et al[8] began an exploratory study for OHMD application in pediatric surgery and found some limitations in the current version of the hardware; however, they did note great

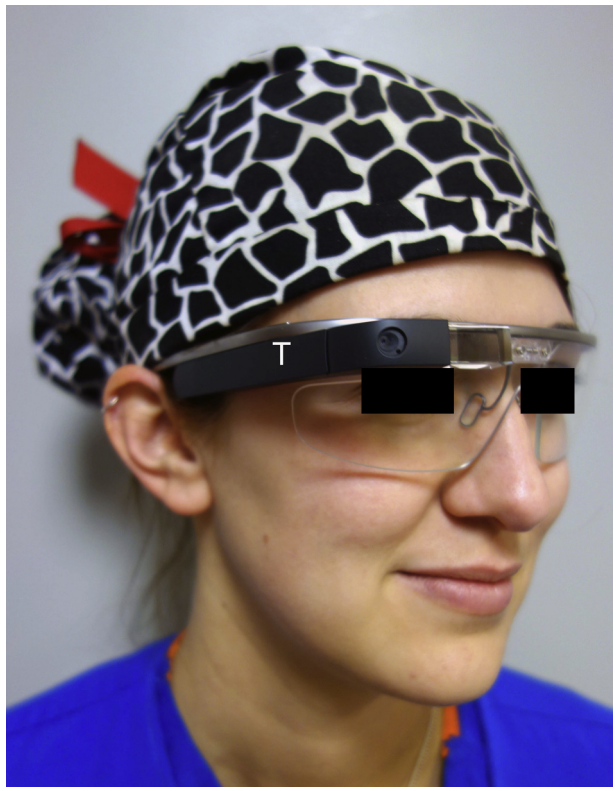

FIGURE 2: This figure demonstrates OHMD worn and the touchpad indicated by 'T' and used for interface.

potential in this evolving technology. This novel device has many early adopters in the medical field searching for the appropriate use of this tool.

In our review of surgical imaging options, we considered 3 cameras commonly used in our practice for surgical images in Table 1. We obtained images with a Nikon D80 (10.2 megapixel) SLR, iPhone 5S, and OHMD in both surgical lighting and with lights directed away from the field (Fig. 3). There are advantages and disadvantages of the different camera options. With the exception of OHMD, all devices require a nonsterile photographer or the surgeon donning a second pair of gloves. Standards of imaging required for publication are typically 300 DPI and DPI comparison of the images are noted in Table 1. These standards regulate only resolution and leave image quality and framing unaddressed, leaving no objective comparison for images obtained.

The professional quality of single-lens reflex (SLR) camera can outperform the other photography options subjectively by review of images in Figure 3. The SLR camera and iPhone require a nonsterile assistant and repeat image owing to image framing, camera angle, or the assistant's unfamiliarity with the device, the SLR camera being more difficult to use. The SLR, without a zoom lens, and OHMD required