• Brief Report •

Recording the direct surgeon's view with an operating microscopic view improves microscopic ophthalmic surgery training

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Abstract

● **AIM:** To establish a recording system with a direct view of the surgeon to supplement video recording under an operating microscope, which lacks information on the movement and position of the surgeon's hands, and to facilitate the reproduction of a skilled surgeon's technique by a surgeon in training.

● **METHODS:** A small camera was attached to the operating microscope with a custom adapter. Microscopic surgeon's view and direct surgeon's view through this new camera were recorded in the surgical recording system. Both movies were synchronized and analyzed how do surgeons handle the instruments.

● **RESULTS:** A small camera attached to the operating microscope allowed the surgeon's hands motion to be recorded without interfering with the surgeon's movements. Different surgeons used different methods to manipulate the ultrasound handpiece and the irrigation/aspiration device. Even in the simple paracentesis procedure, different surgeons used different methods. Surgeons-in-training were able to identify and improve their weaknesses by watching synchronized movies of their hand motions and microscopic view.

● **CONCLUSION:** Simultaneous recording the surgical field out of the operating microscopic view by a small camera set on the microscope is comprehensive and improves surgeons-in-training understanding and learning surgeries.

● **KEYWORDS:** operating microscopic view; direct surgeon's view; video recording; microscopic surgery training

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INTRODUCTION

There is no doubt that recording surgical procedures is important for education, quality improvement, and research[1-2]. However, since the microscopic surgeon's view lacks information such as the motion and position of the surgeon's hands, surgeons-in-training often fail to reproduce expert surgeons' procedures from microscopic movies. Normally, a surgeon-in-training learns by observing the surgeon's motion from the outside, then trying to reproduce the procedures. There are a few reports of point-of-view (POV) cameras mounted on a microscope to record hand position and motion[3-5]. Using POV camera to record surgical field in the direct surgeon's view is simple, but the storage location is separated from the main unit, making it difficult to synchronize and check the videos. These systems no longer meet recent standards of personal information management and they should be integrated into surgical recording systems (SRS).

Various types of webcams were developed during the coronavirus-2019 pandemic situation. We found a webcam that could be set in the middle of the monitor of personal computer (PC) to make eye contact with other online viewers. The webcam consisted of a small camera and a flexible cable to set the camera at the center of the monitor of a PC. We realized that the camera could be hung on the microscope between the surgeon's eyes and the surgical field to directly record the surgical field of view. We developed a novel system capable of simultaneously recording both the microscopic field of view and the surgeon's direct view on a SRS.

Direct Surgeon's View Camera A small video camera, MS-163FHS (Moswell Co, Ltd., Yokohama, Japan) was used. The camera had a 1/2.8-inch complementary metal oxide semiconductor sensor which offered 1920×1080 (full-high definition, HD) at 30/60 frames per second (fps) *via* an HD serial digital interface (HD-SDI). The minimum illumination

required was 0.1 lx. A camera was set on an OPMI Lumera 700 (Zeiss, Germany) between the two knobs in front of the surgeon with a stainless-steel adapter created by Shinmei-Kogyo Co. Ltd. (Osaka, Japan; Figure 1A). The direct view output cable was connected to INPUT-2 of the SRS (Mediplus Co. Ltd., Kyoto, Japan; https://medi-plus.co.jp/), while the output of the microscopic camera was connected to INPUT-1. This SRS provides simultaneous recordings of up to four inputs. Multiple recordings are stored with the start time as the file name; therefore, each recording must start at least one second later than the previous recording. All the recordings were stopped synchronously using a single stop button. The monitor tower is shown in Figure 1B; therefore, anyone in the operating room can observe not only the microscopic view but also the surgeon's direct view simultaneously.

Ethical Approval The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Osaka Red Cross Hospital (protocol code J-0476). A signed statement of informed consent to publish the patient descriptions and photographs was obtained from a representative patient.

Recording and Education with Microscopic View and Direct Surgeon's View We simultaneously recorded both the microscopic and the direct surgeon's views (Video 1, online supplementary). Since there is still no viewer software that provides parallel playback of two movies, we used movie editing software in timeline mode to align the two movies for simultaneous playback and editing (Figure 1C). We can perfectly synchronize the two movies by aligning them at the end.

The direct view of the surgeon provides information on how the surgeons grab the devices, position their hands, and move them. With regard to cataract surgery, senior surgeons have developed unique techniques to manipulate these devices. Even in the simple paracentesis procedure, different surgeons use different methods. Some surgeons only used the right hand to make two symmetrical corneal incisions with a microvitreoretinal knife, whereas others changed their hands (Figure 1D-1G). As shown in the video, some surgeons used the left index finger to fix the ultrasound (US) handpiece and the irrigation/aspiration (IA) device, whereas some surgeons used the center finger. There are differences in how the chopper is grabbed by the left hand before using it. Surgeons in training often fail to fix devices, resulting in unstable actions, but can quickly improve their techniques. In regard to IA, some surgeons used wrist rotation to change the direction of the tip of the IA device. On the other hand, some surgeons rotated the IA handpiece with their fingertips. Also, some surgeons clearly changed the way they held the IA hand piece. The surgeon-in-training was able to realize the shortcomings of the way he held the US handpiece and made improvements (Figure 1H, 1I). Another surgeon, who was unsure of the hook's operation, especially in clockwise movement, found that the hook's range of motion was limited by the way it was fixed (Figure 1J, 1K).

DISCUSSION

There are a few other similar reports that recorded the surgeon's hand position using a POV camera; however, these cameras were not integrated into the recording system of the microscopic camera. Independent recordings required manual synchronization. Similar to us, Hunter[6] has started to record various hand positions during surgeries. We believe multiple angle recording must be useful; although, the camera position has to be adjusted for each case because the camera and the microscope are independent, and the view of a POV camera may be obstructed some time by movement of an assistant. The optimal angle must be the surgeon's direct view because the surgeon-in-training can mimic the motion as if he/she is performing the operation. The surgeon's camera was mounted on a microscope with a custom-made adapter that allowed us to record the same angle and magnification without any obstruction. Integration into our SRS ensures not only semi-automatic synchronization but also the privacy of patients' personal information. To integrate the surgeon's view recording into our SRS, we looked for a small camera that could record up to 60 fps of full high vision quality and export it *via* HD-SDI, similar to the format of the microscopic recording. If a signal converter can be used between the camera and recording system, there are many options. Since the MS-163FHS is the only camera that currently meets the criteria, this makes the system much simpler. The camera is placed between the two knobs of the microscope so that it does not interfere with normal operation, and the view becomes the surgeon's direct view. Using this system, the surgeon-in-training can reproduce techniques more easily with two views than with only a microscopic view. The only thing that the surgeon must be careful about is filter-switching. The laser filter of our microscope was a 2-position type, and the switch was located close to the camera. To avoid touching unsterilized areas, it is best to use long instruments such as metal plates or scalpel holders to switch levers or leave it to peripheral staff. The movies of the surgeon's direct view were very comprehensive and useful for recognizing surgical procedures, not only for cataract surgery but also for glaucoma, vitreous, and eyelid surgeries. Since the camera can capture movies in darkness at lighting intensities as low as 0.1 lx, it is possible to record the surgeon's hands even during vitrectomy.

In conclusion, simultaneous recording of the surgical field from a microscopic view using a small camera set on the microscope, along with the surgeon's direct view, is comprehensive and improves the understanding and learning of surgeons-in-training.

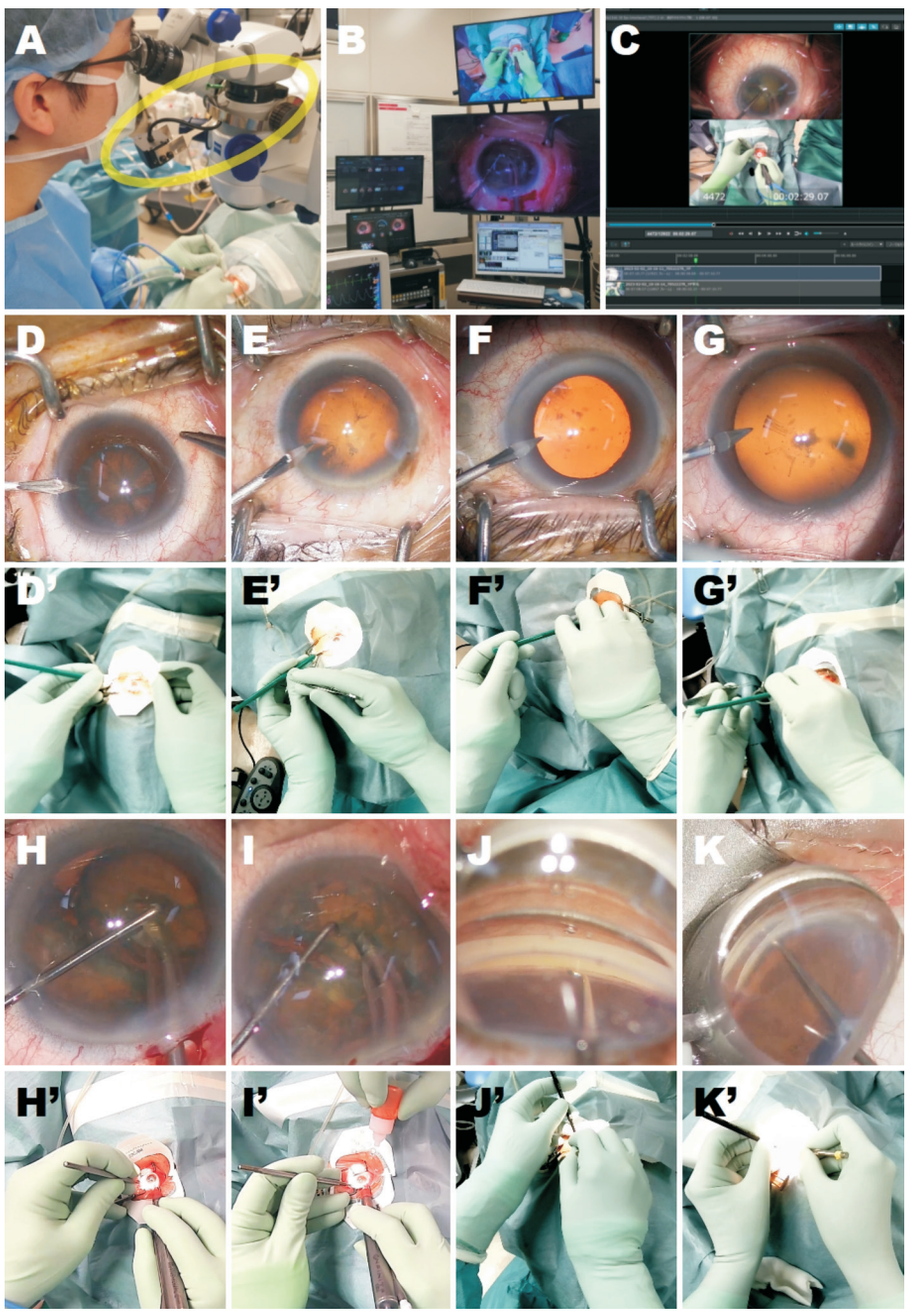

Figure 1 System and actual footage A: The camera (yellow circle) was mounted on microscope with a custom-made adaptor between two knobs. B: A special monitor for the surgeon's view was placed above the standard monitor for the microscopic view. C: Two movies were aligned in timeline view with a movie editor. Microscopic (D-G) and direct view (D'-G') of different surgeons while making a corneal incision on the left side are shown. The surgeon changes the hand to the left, while the right hand fixes the eye with forceps (D, D'). The surgeon changed the hand to the left, while the right hand stabilized the knife (E, E'). The surgeon maintains the hand, while the left hand stabilizes the knife (F, F'). The surgeon maintains the hand without any assistance from the left hand (G, G'). An experienced surgeon has a stable grasp of the ultrasound (US) handpiece, resulting in a stable deep insertion of the US tip (H, H'). The surgeon-in-training has an unstable grasp of the US handpiece, resulting in unstable superficial insertion of the US tip (I, I'). The surgeon has difficulty with the clockwise movement of the hook because his hands are outstretched and immobilized (J, J'). The surgeon has his hands fixed in a rounded position, which allows him to use his wrists and facilitates the clockwise movement of the hook (K, K').

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Authors' contributions: Akimoto M designed the devices and wrote draft of the manuscript. All authors performed surgeries, discussed the procedure, examined the patients, and edited the manuscript.

Conflicts of Interest: Akimoto M is a consultant for KOWA

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REFERENCES

1 Gandhi Bhatt A, Dole KS, Deshpande M, Bharucha K, Kalyani VKS. Impact of a structured training program to enhance skills in phacoemulsification surgery. *Indian J Ophthalmol* 2021;69(12):3697-3702.

2 Thia BC, Wong NJ, Sheth SJ. Video recording in ophthalmic surgery. *Surv Ophthalmol* 2019;64(4):570-578.

3 Gooi P, Ahmed Y, Ahmed IIK. Use of a microscope-mounted wide-angle point of view camera to record optimal hand position in ocular surgery. *J Cataract Refract Surg* 2014;40(7):1071-1074.

4 Lin LK. Surgical video recording with a modified GoPro Hero 4 camera. *Clin Ophthalmol* 2016;10:117-119.

5 Nair AG, Kamal S, Singh S. A flexible tripod mounted video camera: an economical and effective method to record oculoplastic surgeries. *Indian J Ophthalmol* 2019;67(9):1460-1462.

6 Hunter L. Get a Grip on cataract surgery review of ophthalmology. https://www.reviewofophthalmology.com/article/get-a-grip-on-cataract-surgery; Accessed on 2023 February 10.