NEW EDUCATIONAL METHOD

Distance Surgical Mentorship for Ophthalmologists in Northern Peru [version 1]

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Abstract
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Purpose: To evaluate the quality of live distance surgical mentorship as an alternative way to provide continuing professional development (CPD) to practicing ophthalmologists. An activity which could be particularly beneficial to surgeons in remote locations where CPD is difficult to access.

Methods: Orbis paired ophthalmologists from the Regional Institute of Ophthalmology (IRO) in Trujillo, Peru and a senior ophthalmologist from Vanderbilt Eye Institute in Tennessee, USA (LW). One week in advance, the Peruvian surgeon sent the mentor patient information confidentially via Cybersight.org, Orbis' telemedicine platform. The mentor reviewed the preoperative information to determine if the case was appropriate for remote guidance and formulated questions to help guide the educational experience. The mentor and mentee also consulted on specific learning objectives. The mentor observed live phacoemulsification surgery over the Internet using audio-visual equipment and Zoom desktop video conferencing software, allowing her to see through the operating microscope in real-time and have constant voice contact with the local surgeon. Post-mentorship a survey was administered to gauge acceptability of the CPD method, as well as their self-assessment on its impact on their skill development.

Results: Latency experienced was well within the suggested margin of acceptability and the video quality was broadcast-grade, allowing the mentor to clearly see the anatomy and instrument manipulation. Seven surgeons over four sessions performed twelve phacoemulsification surgeries in Peru, 91.67% of those 12 patients achieved postoperative best corrected visual acuity ≥6/18. Four
surgeons completed the survey and 100% agreed or strongly agreed that their objectives had been met and that the CPD had increased their confidence and their surgical skills. The step in the procedure most commonly reported for improvement was nuclear cracking (75% of respondents), followed by hydrodissection, quadrant removal and wound closure (50% each).

Conclusions: Distance surgical mentorship in phacoemulsification is an acceptable form of CPD for consultant ophthalmologists. We describe a program with positive user feedback and experiences of improved confidence and microsurgical skill among participants.

Keywords
Telementoring, Continuing Professional Development, Medical education, Surgical Skill Development

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Introduction
Presently there are not enough ophthalmologists with competency in cataract surgical skills to meet the growing global need (Resnikoff et al., 2012 and Bourne et al., 2017). This burden is unfairly distributed towards low and middle-income countries (LMICs), which severely lack ophthalmologists (Naidoo et al., 2016). Among existing ophthalmologists, many are non-operative and of those that are, many have low surgical output (Sommer et al., 2014). Additionally, studies show that visual outcomes of cataract surgery in many LMIC regions fail to meet the World Health Organization (WHO) recommended standards (Lindfield et al., 2012). Many consultant ophthalmologists graduate from residency programs having not received adequate hands-on surgical training to ensure competency and confidence in cataract surgery, with some receiving none at all (Thomas and Dogra, 2008 and Jiang, et al., 2016). This is coupled with the fact that many consultant ophthalmologists lack support networks and professional development opportunities (IAPB, 2014).

The live distance surgical mentorship approach enables an expert ophthalmologist anywhere in the world to observe and coach local ophthalmologists on safe, high-quality surgical techniques by providing real-time video and audio feedback during cataract surgery. Studies have demonstrated distance mentorship as a reliable, efficient and cost-effective educational tool and model for mentorship (Moore et al., 1996 and Challacombe et al., 2006). However, technical problems, such as low video resolution and communication latency, may affect the quality of the mentorship delivery which may limit the benefits of this approach. In addition, ophthalmologists may not accept surgical mentorship delivered via distance learning, because they are uncomfortable with the technology or feel disconnected from their mentor. The purpose of this project is to evaluate the quality of live distance surgical mentorship as an alternative way for ophthalmologists in remote regions to obtain personalized CPD.

Methods
Orbis evaluated the video-audio latency and video resolution of the live phacoemulsification cataract surgery between junior ophthalmologists at the Regional Institute of Ophthalmology (IRO) in Trujillo, Peru and a senior ophthalmologist (LW) at Vanderbilt Eye Institute in Tennessee, USA, using Zoom (San Jose, California) video conferencing software. Prior to the start of the project, the technical setting was established by the Orbis International IT department with a high-definition camera on the operating microscope, USB video capture card connected to a laptop, wired ethernet network connection, and an USB wireless lapel microphone. The quality of video and audio, and internet bandwidth performance and consistency were tested and found to be of excellent quality.

Enrollment for the remote surgical mentorship was voluntary, with consultants self-selecting to participate. The sessions were scheduled quarterly, with each session conducting 3 surgeries. Sessions were conducted in March, May, August and November 2018.

Before the live surgical mentorship sessions, the Peruvian surgeons sent the mentor patient information via Cybersight. org, including photos and lab work. All patients are counseled and consented not only on the surgery, but that the surgery will include telementorship. The surgeon completes a standardized form in Cybersight’s eConsultation, outlining the surgical plan and the mentor evaluates whether the case is appropriate for remote guidance. Additionally, mentor and mentees have one-on-one discussions where they identify goals for the remote mentorship session.

Surgeons performed twelve phacoemulsification surgeries in the Instituto Regional De Oftalmología operating room in Peru, while the mentor observed over the internet using audio-visual equipment and Zoom desktop video conferencing software, allowing her to see the surgeon’s view through the operating microscope in real-time while in constant voice contact with the local surgeon. All mentorship sessions were recorded to serve as a continued reference for mentees.

Following the surgery, mentees sent post-operative reports on every patient, including best corrected visual acuity (BCVA) of patients at one day post-operatively. A post-mentorship survey was administered to gauge acceptability of the CPD method, as well as their self-assessment on its impact on their skill development, which step of the procedure most benefited from this model of mentorship, and if they would like to participate in additional remote surgical mentorship sessions.

Results
The quality of the audio and video was assessed as follows:

- Video latency from IRO to mentor: average of 226ms
- Audio latency from mentor back to IRO: average of 232ms
Video resolution: 1280 x 720 pixels, at an average of 26 frames per second

Latency experienced is well within the suggested margin of acceptability (Xu et al., 2014 and Fabrìzio, et al., 2000). Video quality was broadcast-grade, allowing the mentor to clearly see the anatomy and instrument manipulation and audio quality did not result in delays in communication.

In total, seven ophthalmologists opted to participate in the program, four male and three female surgeons. Of the seven, five were classified by their department head as having an intermediate skill level and two as having a basic skill level. The surgeons performed twelve surgeries in total. Patients ranged in age from 50-82 years, with the mean (standard deviation) age being 68 (9.8) years, and 7 (58%) of the patients were women. Fifty percent of patients (6) patients presented with one or more systemic or ocular comorbidity, most commonly diabetes (3), arterial hypertension (3) and suspected glaucoma (1). Post-operative, 91.76% of patients had a day one BCVA of $\geq 6/18$, (range 6/7.5 - 6/42, median 6/15) meeting the WHO criterion for quality cataract surgery (WHO, 2008).

Four of the seven participating surgeons completed the post-mentorship survey. Two females and two males. Three (75%) reported learning Phaco surgery on the job, and only one (25%) reported learning during residency. All agreed (75%) or strongly agreed (25%) that the Zoom platform was easy to use, and that the internet connection was stable. All strongly agreed (75%) or agreed (25%) that they were comfortable asking the mentor questions and that her responses were clear and informative. Further, 100% strongly agreed (75%) or agreed (25%) that the CPD had increased their confidence and their skills as a surgeon. The step in the procedure most commonly reported for improvement was nuclear cracking (75% of respondents), followed by hydrodissection, quadrant removal and wound closure (50% each). At least one respondent also reported improvements in each of the following steps: cortex removal, IOL insertion, nuclear sculpting, surgical prep and draping, temporal wound, and viscoelastic removal.

Surgeons unanimously agreed (75%) or strongly agreed (25%) that their objectives had been met, they would recommend telementorship to others (50% agreed and 50% strongly agreed) and that they would be interested in repeating this telementorship experience (50% agreed and 50% strongly agreed).

**Discussion**

Telementoring in medicine is not an entirely new concept, and in other fields of medicine, particularly in laparoscopic procedures, has been shown to be successful (Moore et al., 1996). There is great potential for using telementoring to provide ongoing continuing professional development for ophthalmologists practicing in remote settings or in countries where access to CPD is limited. Participants in telementorship report improved skills and at times, preference for the mode of teaching (Campbell et al., 2015 and Tang et al., 2017). In addition, there are potential cost benefits in limiting travel to mentors and mentees and to engage in in-person mentorship (Means et al., 2013). Lastly, there is the potential benefit to the patient, with increased patient quality assurance.

The obvious barrier to telementorship is the requirement of audiovisual equipment and the need for reliable internet with appropriate bandwidth. IRO and Orbis invested in upgrading the internet connectivity of the operating room facilities, as well as the provision of the audio-visual equipment. The average cost for the AV equipment required ranges from $8,000 to $20,000USD depending on what is currently available at the facility. However, these are all fixed costs, once the investment is made, recurring costs are quite low with mentors volunteering their time, a one-time $5 user enrollment fee for Cybersight.org (currently borne by Orbis) and a pro-account subscription to Zoom costing $150/year.

Additionally, Rosser et al., 1999 applied telementoring in rural Ecuador using low bandwidth mobile telemedicine applications to support a mobile surgery program and were able to successfully perform a laparoscopic cholecystectomy mentored by the department of surgery at Yale University School of Medicine. Demonstrating that it is possible to offer telementorship in locations without the use of sophisticated technology or high-speed internet.

Thus far, the data generated from this project, is from a small sample size (N=7). However, IRO has currently adopted this mode of teaching and the twining between Vanderbilt and IRO is entering its second year. Additionally, Orbis is currently investing in upgrading the infrastructure at partner hospitals in Bolivia, Mongolia, Ghana and Zambia to expand the telementorship portfolio. The successful implementation at these various locations representing a diversity of patient populations, surgical skills, infrastructure and access, will generate additional data on this method of mentorship.

**Conclusion**

The project demonstrated that distance surgical mentorship in phacoemulsification is an acceptable form of obtaining CPD for consultant ophthalmologists. So far user feedback is positive, and participants report improved confidence and
technical skill. Surgical cases performed under this mentorship were successful, with good patient outcomes. Telementorship can help overcome access and cost barriers for ophthalmologists globally trying to obtain (or maintain) CPD.

Take Home Messages
- Telementorship in phacoemulsification surgery is an acceptable form of CPD for consultant ophthalmologists.
- Surgeries performed under telementorship had good patient outcomes.
- Mentees report improved confidence and skills as a result of telementorship.
- Telementorship can provide access to CPD for ophthalmologists working in remote areas with limited support and professional development opportunities.

Notes On Contributors
Amelia Geary is Director of Program Development & Quality for Orbis International. She studied International Development and Infrastructure Development at Columbia University in New York City, USA. Under her portfolio, she leads the training and innovation team, developing new training modalities and approaches for ophthalmic medical education. Her focus has been largely blended learning, distance learning and simulation training.

Sara Benavent is the Senior Program Manager, Latin American and the Caribbean region, for Orbis International. With a master’s degree in International Development and Population Sciences from the University of Brussels, she has broad experience in socio economic research, strategy and policy design and field program management. She has successfully led initiatives in capacity building in the public sector.

Edy Amador De La Cruz, MD obtained his degree in medicine at the Faculty of Medicine of the National University of Trujillo (UNT). He is currently a consultant ophthalmologist at the Instituto Regional De Oftalmología Javier Servat Univazo.

Laura Wayman, MD is vice chair for education in the Department of Ophthalmology and Visual Sciences at Vanderbilt University Medical Center. She has served on the American Academy of Ophthalmology Committee for Resident Education and was president of the Association of University Professors in Ophthalmology Program Directors Council. She currently serves on the Accreditation Council for Graduate Medical Education Ophthalmology Residency Review Committee.

Declarations
The author has declared that there are no conflicts of interest.

Ethics Statement
Approved by the Ethics Committee of the Regional Institute of Ophthalmology.

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Trevor Gibbs
AMEE

This review has been migrated. The reviewer awarded 4 stars out of 5

A very practical and well described paper that I think adds greatly to our thinking in the area of distant practical applications. I am not too worried that the numbers are small, this can be accepted. I agree that there are knowledge / information gaps within the paper but these can be easily resolved by those wishing more details.

Competing Interests: No conflicts of interest were disclosed.

Reviewer Report 30 June 2019

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Ken Masters
Sultan Qaboos University

This review has been migrated. The reviewer awarded 3 stars out of 5

An interesting paper dealing with distance surgical mentorship for ophthalmologists in Northern Peru. The paper clearly explains the scope of the problem: too few trained surgical ophthalmologists worldwide, and even more so in low-income countries. The study is rather small, but does have value for other researchers. Some areas that should be addressed in the paper: • Although the paper adequately
discusses the problems worldwide and in low-income countries, it does not give any contextual information about Peru, where the study is set. For the reader to have an appreciation of the value of such an exercise, it is crucial for this contextual information to be given upfront, in the Introduction. • No information is given about Orbis, and the authors too quickly launch in the findings. Is Orbis an organisation? A company? A government funded project? What does it do? (I understand the authors would be loath to appear to be advertising, but some contextual information is needed). • In the Methods, the tense changes from past to present and then back to past. The authors really should select one tense (I suggest past) and then stick to it. • There needs to be more consistency in the reporting of the statistics. Sometimes we see raw numbers and then percentages, sometimes this is revered, and sometimes we see only one without the other. The recommended format is raw number followed by percentage (to at least one decimal place) in brackets. • It would be useful if the researchers could supply a copy of the survey questionnaire. • With reference to Orbis above, I strongly urge the authors to mention in the potential conflict of interests that the lead and second author are at Orbis, the company that funded the project, and whose equipment was used in the project. I realise that they have given this information in their Notes on Contributors, but it needs to be stated in the potential conflict of interests also. So, the study appears to have had value, and is a useful start in the area. The authors, however, do need to strengthen their paper somewhat. I look forward to seeing a revised version of the paper in which the weaknesses are addressed.

**Competing Interests:** No conflicts of interest were disclosed.

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**Reviewer Report 27 March 2019**

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**Helena Filipe**
Hospital of the Armed Forces/PL-EMGFA

This review has been migrated. The reviewer awarded 5 stars out of 5

The work of Geary and associates on the challenges of mentorship using live distance technology to outreach geographically remote ophthalmic surgeons within CPD is very useful and exciting. The Authors adequately inform their research background on evidence underlining the core role of mentorship in the process of developing competencies in ophthalmic surgery. They underline a special focus on those surgeons in remote regions and the global constraint of ophthalmologists and resources and adequately define their research goal. Methods are thoroughly defined to the point of replication. The section of results is clear and provides the ground for the following section of discussion. The process through which the chosen teaching methodology works is discussed with an emphasis on its feasible and well
accepted application to teach and learn within CPD in low resources and remote settings. The conclusion is appropriate and the take home messages are well defined and integrate well with the results. I hope to see a next paper, regarding the application of this same model, replicated in other regions of the globe also in need of twinning, using telementorship and thus overcoming human and financial resources constraints. This is an excellent idea that was brilliantly adapted into practice with promising results. I would love to try this method while teaching in difficult and geographically remote circumstances.

**Competing Interests:** No conflicts of interest were disclosed.