

Potential of smartphone enabled otoscopy for teleconsultation and teaching

Krishnan Rajam, FRCP¹, Shivali Shamsher, MD², Narayanan Prepageran, FRCP³

¹Family Medicine, Unit, Faculty of Medicine, Asian Institute of Medicine, Science and Technology (AIMST) University, Bedong, Kedah, Malaysia, ²Anaesthesia Unit, Faculty of Medicine, Asian Institute of Medicine, Science and Technology (AIMST) University, Bedong, Kedah, Malaysia, ³Department of Otorhinolagynology, Faculty of Medicine, Universiti Malaya, Kuala Lumpur

SUMMARY

The smartphone enabled otoscope (SEO) provides an opportunity for telemedicine and enhancing teaching of otoscopy. We describe our preliminary experience with the use of one such inexpensive device bought from an online store. It is a simple and feasible procedure which patients can perform on themselves (or guardians on their wards) after minimal training. The resolution of the image is adequate for follow up through teleconsultation. It is also a good teaching tool as it enables the sharing of views.

Medical technology has come a long way since the invention of stethoscope and the current pandemic has accelerated the widespread use of telemedicine and ever-advancing medical innovation. One such innovation is the smartphone enabled otoscope (SEO) which provides an accessible and cost-effective way of ear examinations. Meng et al reported a series of patients who performed otoscopy on themselves and

relayed the images / video to the doctors who successfully monitored them.¹ We describe our preliminary experience with one such device.

The SEO is a small camera with LEDs and is available from online stores as “boroscope”, “endoscope” or “otoscope”. They are advertised for use in pipelines, small holes, industries, etc. where direct visual access is difficult or not possible. The diameter of the cameras varies from 5 to 8 mm. The SEOs come in various price ranges (from USD 5-25 each), camera resolution and lengths. Some of them are deemed waterproof. The images (photos or video) are seen or stored on a smart phone with appropriate software. The brightness of the light can be adjusted. Some of them are equipped with a small hook and magnet to enable removal of small objects. Power supply is 5V via the USB from the smartphone.

After reviewing many models, the first author obtained one SEO made of composite material based on the diameter of the camera. The camera properties were as follows: diameter 5.5 mm, resolution 640 x 480 pixels, frame rate 30/second, focal length of 2 cm, JPEG photo image and AVI video format, 6 LEDs with adjustable brightness.



Fig. 1: Patient pulls the ear backwards while inserting the otoscope and monitors the image on the smartphone.



Fig. 2: Image of an ear with wax.

This article was accepted: 24 August 2021
Corresponding Author: Shivali Shamsher
Email: shivalibernard@gmail.com

Patients with common ear conditions requiring otoscopy were selected in a general practice setting. Approval was obtained from the institution's ethics committee.

The first author ensured that the device was not flimsy and that the small parts at the end of the tube were fused well. He practised inserting the device on himself on many occasions. In order to convince patients, he demonstrated the procedure on himself. Patients who consented to this procedure were instructed to slowly and carefully insert the device while pulling the ear with the other hand (Figure 1). The author and the patient monitored the image on the smartphone throughout the procedure. The resolution of the image was sufficient for initial screening for common abnormalities (Figure 2). The device was cleaned with spirit after use. The author also attempted to cover the tip of the device with a transparent finger glove for safety and hygiene purposes. The quality of the image was not affected. When needed a regular otoscope was used for further examination.

The major advantage of this device is that teleconsultation is facilitated by training patients to perform the procedure at home and transfer the images to their doctors. They can also be reassured visualizing the images themselves. Patients suitable for teleconsultation could include those requiring follow up after procedures like tympanoplasty as shown by Don et al in their study.²

An earlier study reported the sensitivity and specificity of the SEO to be 87.8% and 80%, respectively.³ Parents can also be taught to carry out the procedure on their children and the images can be relayed to their doctors.²

The smartphone enabled otoscopy enables sharing of views and was shown to be a better teaching tool than conventional otoscopy.⁴ Hence, it can be used to teach initial approaches to otoscopy. We emphasize that the quality and safety of the device should be ensured. Wireless SEO models with higher resolution cameras offer better pictures but may be more expensive.

In summary, the SEO is a feasible system which facilitates teleconsultation and teaching of otoscopy. Further studies of feasibility of use of SEO for mass screening in remote areas through teleconsultation should be carried out.

REFERENCES

1. Meng X, Dai Z, Hang C, Wang Y. Smartphone-enabled wireless otoscope-assisted online telemedicine during the COVID-19 outbreak. *Am J Otolaryngol* 2020; 41(3): 102476.
2. Don DM, Koempel JA, Fisher LM, Wee CP, Osterbauer B. Prospective evaluation of a smartphone otoscope for home tympanostomy tube surveillance: A pilot study. *Ann Otol Rhinol Laryngol* 2021; 130(2): 125-132.
3. Bhavana K, Ahmad M, Sharma P. Smartphone otoscopy sans attachment: A paradigm shift in diagnosing ear pathologies. *OTO Open* 2018; 2(3): 2473974X18786496.
4. Hakimi AA, Lalehzarian AS, Lalehzarian SP, Azhdam AM, Nedjat-Haiem S, Boodaie BD. Utility of a smartphone-enabled otoscope in the instruction of otoscopy and middle ear anatomy. *Eur Arch Otorhinolaryngol* 2019; 276(10): 2953-6.