Smartphone ophthalmoscopy: a potential way forward for non-ophthalmology medics in the COVID-19 era

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It is acknowledged that direct ophthalmoscopy is underutilised by non-ophthalmic specialists, a view which is frequently supported by research. Omission of ophthalmoscopy is, of course, perilous as it may lead to delayed diagnosis and treatment. Clinicians will miss the opportunity to undertake a non-invasive in vivo assessment of retinal integrity, vasculature, and the optic nerve head; thus, potentially limiting the examination of patients with suspected conditions such as malignant hypertension; raised intracranial pressure; secondary metastases; and more common ocular conditions such as diabetic retinopathy or macular degeneration.

The exact reasons for poor ophthalmoscopy uptake remain unclear, but there is indication that medics would be more inclined to embrace ophthalmoscopy if there were easier access to a working instrument. However, such rationale is somewhat at odds with more recent work where constant provision to an ophthalmoscope failed to stimulate a significant increase in usage. Other reasons for not undertaking ophthalmoscopy may include time constraints; an inability to see anything useful, which could particularly be the case with elderly patients who may have smaller pupils and hospital wards are generally well-illuminated environments; a belief that the procedure was low priority or a lack of confidence using the instrument, especially on undilated pupils. The consensus appears to be that more training is required. Indeed, adequate ophthalmoscopy training in UK medical students has often been a point of concern.

Successful direct ophthalmoscopy requires competence in at least two distinct tasks: proficiency in the technical operation of the instrument and the subsequent interpretation and management of findings. While medics may have difficulties with the technical aspects, it seems they fare better with image interpretation. Specifically, medics may be able to identify ocular fundus features, or eye disease more accurately (or more often) using photographs than through examination by direct ophthalmoscopy.

A key advantage of employing a fundus camera is the technical simplicity and speed by which non-medics can be trained to obtain images on behalf of multiple clinicians. At a time where the spread of COVID-19 has necessitated an increase in home working and a shortage of medical and nursing staff, it is perhaps worth stressing that use of digital photographs also opens up the possibility of telehealth services, that is, sending photos to an ophthalmic specialist for interpretation thereby reducing on-site personnel. This expert input may help reduce false positive referrals into secondary care. Additionally, patient image archives can help provide more comprehensive care where longitudinal monitoring is required.

Despite the promising outcomes, adoption of traditional non-mydriatic fundus cameras appears to be limited to core ophthalmological/optometric, rather than general medical practice. A more viable alternative may be the smartphone ophthalmoscope; the adoption of which has possibly been impeded by a lack of evaluative research. Several comparison studies have now been published,
warranting reconsideration of the typically contentious issue of whether newer technologies such as smartphone ophthalmoscopes could supplant the direct ophthalmoscope.

The handling of the smartphone ophthalmoscope has generally been reported more favourably than the direct. In particular, the smartphone’s longer working distance allows practitioners to view the fundus from approximately arm’s length rather than a few centimetres; however, the typical distance between the patient and the smartphone will differ depending on the model of smartphone ophthalmoscope. This could not be more relevant than during the current COVID-19 outbreak, whether examining in community practice or hospitalised patients. Furthermore, the practitioner’s technical input is reduced, as the smartphone’s autofocus mechanism replaces the manual focusing dial of the direct, allowing images to be easily obtained.

More accurate clinical descriptions and an increased likelihood of making the correct diagnosis has been reported with the smartphone compared with the direct. Most studies, but not all, have also found an improved ability to locate the optic nerve head. However, there remains an indication that more training is needed. Mamtora et al found that while final year medical students were significantly better at describing some ocular conditions with a smartphone compared with the direct, for example, AMD, CRVO, optic atrophy and preproliferative diabetic retinopathy, there was no significant difference for papilloedema.

Image quality with the smartphone ophthalmoscope is reported to be comparable to the traditional fundus camera when viewing the optic nerve head, but dilating agents may be required to optimise imaging. The field of view will, of course, be limited by pupil size, however, typical values are around 20–30 degrees with the smartphone and 5–8 degrees with the direct. Due to the possibility of photo capture with the smartphone, a montage of images can be constructed to provide a more comprehensive picture. See figure 1 for an example of an image obtained using smartphone ophthalmoscopy.

Gaps in the evidence base remain; there have been few investigations comparing the various brands of smartphone ophthalmoscopes. It would be reasonable to assume there are discrepancies in factors such as the practitioner experience, usability and image quality between smartphone ophthalmoscope models. In particular, there may be compatibility issues, for example, only certain phone brands or models may be compatible with the ophthalmoscope.

It ought to be noted though that experience, unsurprisingly, improves the ability to undertake traditional direct ophthalmoscopy, but smartphone ophthalmoscopes may help to improve user confidence in the short term. A study of optometry students who were experienced direct ophthalmoscopy users, were overwhelmingly positive about the smartphone ophthalmoscope on first use. Despite the encouraging outcomes, ultimately when assuming the role of the practitioner, they opted to use the direct.

In summary, smartphone ophthalmoscopes have emerged as a viable user-friendly alternative to the direct ophthalmoscope. Longer working distances, afforded by the smartphone, will prove advantageous during the current COVID-19 pandemic. The evidence shows novice users can provide an accurate, although limited, examination using the smartphone. Given the generally poor uptake of ophthalmoscopy among medics and the potential risk to patient care, smartphones may offer an immediate solution to those wishing to undertake ophthalmoscopy but dissuaded by technical difficulties.

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