

Novel Handheld Technology for Fundus Fluorescein Angiography Imaging

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Introduction

Fundus fluorescein angiography (FFA) is a special test of the retina whereby a dye is injected into a vein and multiple fundus images are taken through special filters to view the passage of dye through the retinal vasculature. It typically involves a table top setup with a non portable fundus camera. In this study a new portable hand held fundus camera is evaluated with regard to its ability to perform fundus fluorescein angiography.

Purpose

To evaluate the use of Optomed Smartscope FA system© for fundus fluorescein angiography and compare its performance with a standard fundus camera.

Methods

The study recruited patients having known retinal pathology who underwent fundus fluorescein angiography at an ophthalmic centre in India. All patients enrolled were older than 12 years of age and had no contraindication for FFA. Patients having a significant media opacity or nystagmus or those having FFA contraindications such as allergy to dye or severe renal failure were excluded in this study.

FFA was performed after dilating the pupil using 1% tropicamide eye drops and taking a written informed consent.

First, color fundus photographs were taken with both the Optomed Smartscope M5 EY4 and the Canon CF-1 fundus camera. Next, the Optomed Smartscope with FA module was mounted on the slit lamp adapter and positioned next to the Canon camera. The FFA procedure was initiated on the Canon CF-1 camera and images were taken every second up to 30 seconds and then in every 5 seconds up to 60 seconds. Thereon, 10 mid phase images (1 to 4 minutes) were taken first using the canon CF-1 and then the Optomed Smartscope FA. Photographs were taken sequentially with a quick alternation between the two devices. In a similar manner, 10 images of late phase (4min to 10 min) were taken from both devices.

The images were saved and the print-out of the reports of each instrument (Canon CF-1 & Smartscope FA) were coded. The coded images were presented to 10 different ophthalmologist for interpretation. Under this technique of blinding, the clarity and captured content was scored on a subjective confidence level in detecting the retinal pathology by the image's output. A Likert scale ranging from -1 to 3+ was used for less confident, confident, moderately confident and very confident respectively. The final values obtained were compared.

Statistical analysis was done using the student t-test with a $p < 0.05$ being deemed significant.

Results

Seventeen eyes of 15 patients were enrolled in the study. The various diagnosis of patients included diabetic retinopathy, hypertensive retinopathy, vascular occlusion, cystoid macular edema, age related macular degeneration and central serous choroidoretinopathy. The diagnosis also included optic nerve conditions such as optic neuritis, papilledema and glaucoma.

Mean confidence score for the Optomed Smartscope FA camera was 2.4 in comparison to a mean score of 2.5 for the Canon CF-1 camera ($p=0.25$). Therefore, there is no significant difference in the sensitivity of Optomed Smartscope and Canon CF-1 in detecting retinal pathologies. [Levine test for equality; $p=0.014$]

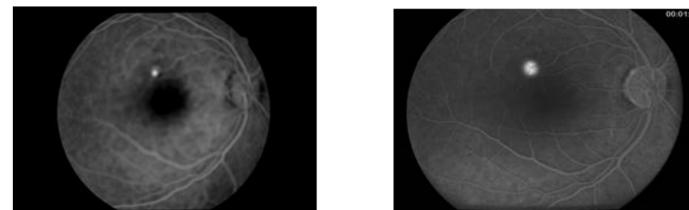
Mean confidence score for diagnosis of pathologies by fundus fluorescein angiography procedure when plotted graphically (below) . The mean values for sensitivity of the two devices are approximately equal.



Graphical Representation of Mean Confidence Scores for diagnosis of various retinal pathologies

The overall quality of the images was noted as remarks from the 10 ophthalmologists who were blinded to the device used. Some specific observations were noted for various pathologies and parameters:

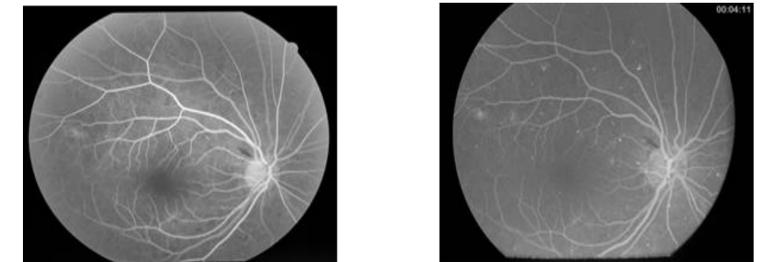
Central serous choroidoretinopathy: The growing size of the leak is well observed in Smartscope images compared to the Canon CF1. This was a common observation noticed by the surgeons. The reason could be better magnification by the Smartscope camera..



Central Serous Choroidoretinopathy: FA image taken from Smartscope FA camera(right) shows greater leak

Optic disc analysis comparison: With Smartscope FA, in late phase optic disc can be visualized better and it defines details better than Canon CF-1. Hyperfluorescence of optic disc was found with CF-1 and finer details were missing. The cup disc ratio is better analyzed with Smartscope FA, which is clinically more important in cases of glaucoma, neuritis and papilledema.

Diabetic retinopathy: Initially, micro aneurysms were not picked up very clearly due to extra brightness and less contrast of the Smartscope FA. However reducing the brightness level of the Smartscope FA to 6 and reacquiring images improved the quality of images and enabled much easier detection of micro aneurysms. It is recommended that the level 6 setting of brightness may work better in cases of diabetic retinopathy.



Smartscope FA images with high brightness (left) and moderate brightness (right) demonstrating the better visibility of micro aneurysms in the latter.

Vitreous Pathology: The pathologies in vitreous fluid could be better assessed and imaged with Smartscope FA than Canon CF-1.

Patient Positioning: Smartscope FA had better visualization and control of the patients position during the procedure by the examiner. The face of the patient is usually occluded by large Canon camera body, thus the observation of fixation cannot be controlled by the ophthalmologist or observer. With the Smartscope FA, the examination may also be performed easily with a wheelchair patient.

Handling: The smaller size of the Smartscope FA makes it easier to hold the patient's eye lid when imaging, and this helps taking both superior and inferior gaze pictures.

Fixation Targets: Smartscope FA has 9 internal fixation targets which enable taking images with centration on the macula or optic disc. This gives better quality and complete retina imagery.

Brightness settings: Most images were captured best with brightness level set at 7 with the Smartscope FA. However, brightness level 6 offered better imaging of micro aneurysms in diabetic retinopathy cases.

Conclusions

Optomed Smartscope FA is a clinically relevant tool, which can be used for detecting various retinal pathologies by FFA procedure and it is comparable in performance with other commercially available fundus cameras.