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# DRISHTI- A PORTABLE FUNDUS CAMERA TOOL DEVELOPED FOR SMARTPHONES

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## ABSTRACT

*Darshana* is one of the *trividha roga pariksha* methods. *Darshana* means examining the patient or disease condition by the means of *pratyaksha Pramana*. But it is also mentioned that *pratyaksham hi alpam* and *apratyaksham analpam*. This indicates the lacuna of advancement in visualizing aids during *Samhita Kala*. By means of which many diseases in *Netra roga* were considered as *asadhya*, where they examine the inner aspects of the eye was not possible to know the pathology. Recent advances by application of physics in ophthalmology instruments like ophthalmoscopes and fundus cameras are developed, that help understands changes in the retina and other inner structures of the eye. Fundus cameras are too expensive and not portable; to outcome this problem various tools were developed to capture the fundus image using the smartphones. Several smartphone applications are available to capture the images and videos of the fundus with a + 20D condensing lens in the android and ios application store. This is a potential tool for mass screening, documentation, telemedicine and it will serve the need of a fundal camera even in the small setup of OPD. But these tools are also expensive for individual practitioners and beginners. By considering all these points "***Drishti***"-a tool with minimal expenditure was developed to get the stable, clear fundus images on principles of indirect ophthalmoscopy using a smartphone and +20D lens. The fundus pictures captured using this tool was clear enough to understand the pathological changes. Which are helpful for documentation, early diagnosis, and referral if required.

**KEYWORDS:** *Drishti*, *pratyaksha*, shalakya, *drishtiroga*, smartphonefundoscopy

## INTRODUCTION

Fundus imaging with a structured camera is an important part of the ophthalmic observation. Portable with its intrinsic camera and flash may be accustomed to acquire structure pictures quality once in addition to a condensation lens. It works as associate degree indirect ophthalmoscope[1]wherein the structure may be viewed with expanded pupils. On this principle, Drishti fundal camera tool is developed. This tool may be carried to camps and far off wherever the carrying of the fundal camera is tough because of its delicacy. This tool may be used with all types of smartphones with the assistance of camera applications accessible in-app store like RET cam. It'll facilitate the first diagnosing, store the photographs for documentation, patient education, assessment before and when the treatments,

and early referral if any complications are found. Once we compare the value of this tool with accessible fundal cameras it's economically cheap to any or all the young budding ophthalmologists. It permits ophthalmologists to document and share findings, and it's a tool for telemedicine.

**METHODOLOGY:[2] DRISHTI(TRIAL)**

Fig 1 - Instruments used for **DRISHTI** trial


Fig 2- After mounting to slit lamp

The 60 mm pipe was used as the optical tube.

1. A piece of sandpaper 17 cm × 14.8 cm, was rolled and inserted into the tube and glued and sanded surface facing inward to prevent dazzle.
2. 15.5 cm × 2 cm sandpaper was glued inside the reducer base leaving 1.0 cm bare area toward the wider end.
3. Insulation tape was used to place the optical tube and reducer base.
4. At one end, the condensing lens widening reducer is fixed and 8–12 rounds of tape for snug fitting of the lens is applied.
5. The phone attached to the mobile adapter is fixed to the reducer at one end.
6. The 20 D condensing lens was fixed in the front.
7. Slit mounter was made ready with the help of metal with an 8 mm bolt.

**DRISHTI (FINAL PRODUCT):**

As there was a success of ***Drushti*** in getting the clear images of the retina easily we moved to further step of prototyping and 3D designing and a new stable ***Drishti*** device were obtained with the help of 3D printing.

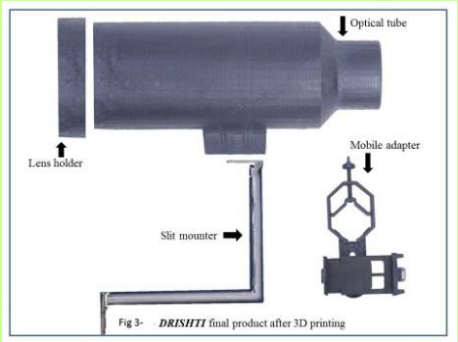

Fig 3- ***DRISHTI*** final product after 3D printing

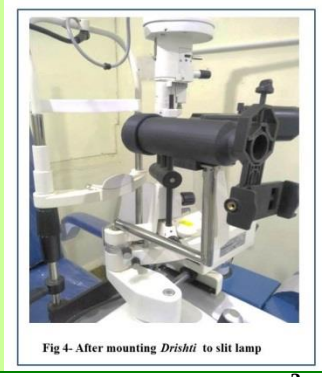
Fig 4- After mounting *Drishti* to slit lamp

**PROTOCOL FOLLOWED:[3]**

1. The patient was explained about the process of pupil dilatation and time consumption for examination and blurriness

of eyes after dilatation and permission was obtained.

2. The patient pupil was dilated using a mydriatic drop.

3. Waited about 15 - 20 min for pupils to dilate.

4. Made the patient sit in a patient chair.

5. Then ***Drishti*** fundal camera tool is mounted to slit lamp in the slot for the focusing rod after moving observation illumination columns to one side.

6. The ***Drishti*** fundal camera tool was used like a fundus camera using the joystick with the camera in the continuous flash on mode.

7. As in indirect ophthalmoscopy[2], the images are laterally reversed and vertically inverted, and therefore the movements to align the field of view will be in the opposite direction to the images seen.

8. Images are captured using app MI ret cam and several other applications are available in the android and ios store which can be used to capture the retinal images. Video capturing also can be done.

9. Utilizing a 20D lens under 3.13x amplification we can see about 46° under working separation of 5cm

**Retinal Images Captured With Drishti Fundal Camera Tool**

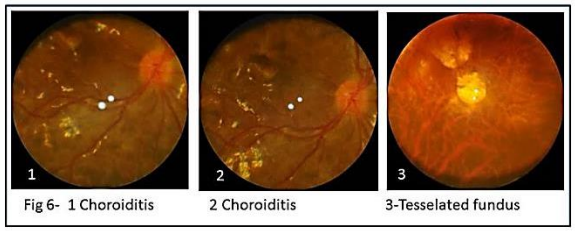


Fig 6- 1 Choroiditis 2 Choroiditis 3-Tesselated fundus

**Comparison of Image Quality Between Fundal Camera And *Drishti* Fundal Camera Tool**

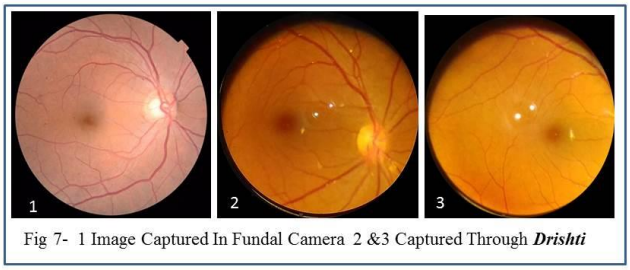


Fig 7- 1 Image Captured In Fundal Camera 2 &3 Captured Through ***Drishti***

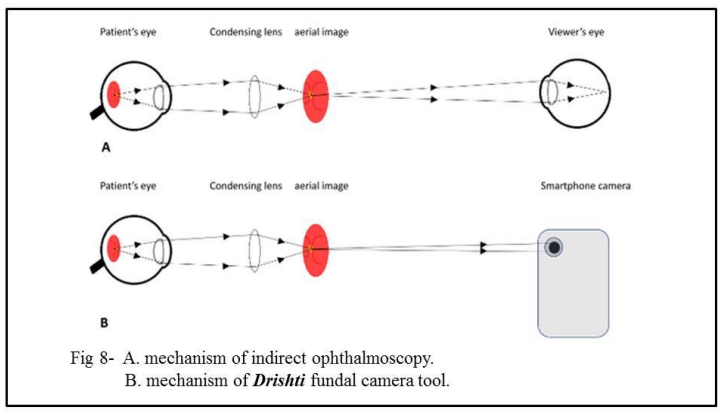


Fig 8- A. mechanism of indirect ophthalmoscopy.
B. mechanism of ***Drishti*** fundal camera tool.

## DISCUSSION

The optics of the ***Drishti*** fundal camera tool is similar to the principle of the indirect ophthalmoscope. In an indirect ophthalmoscope, a beam of light is directed toward the patient's retina and the reflected rays of the retina are condensed to a real aerial image using a handheld +20 lens. The viewer sees the real, inverted aerial image that is located 2 – 4 cm from the handheld lens, depending on the power of the lens. With a smartphone, the camera's flashlight replaces the

indirect ophthalmoscope light source and the smartphone camera recording the aerial image replaces the observer's eye. Conventional fundus cameras are also designed based on the same optical principles; the camera's film or digital sensor array is located where the aerial image is formed. The quality of the retinal images will be based on the magnification and resolution of the mobile camera. When we compare the quality of the images captured with the ***Drishti*** fundal camera tool and other available fundal cameras we observed that there is no much difference in image quality. Initially, we got some artifacts due to dazzling later when we coated with black color anti-reflecting coat to inner coat the tool there was an absence of artifacts in the images. This tool can be used with all sorts of smartphones with the help of camera applications available in-app store like MI ret cam. It will help us with the early diagnosis; store the images for documentation, patient education, assessment before and after the treatments, and early referral if any complications are found. When we compare the price of this tool with available fundal cameras it is economically affordable to all the young budding ophthalmologists. It enables ophthalmologists without a fundus camera to document and share findings, and it is a tool for telemedicine.

## RESULT

Good quality images of the retina are obtained by using Drishti with the mobile under the principle of indirect ophthalmoscopy.

## CONCLUSION

*1. Drishti* a fundal camera tool is economically affordable.

2. It is portable so that it can be carried to remote places for camps and can be used in OPD setups.

3. It can be used with all sorts of smartphones with an inbuilt camera as well as the other applications available in the play store.

4. It’s a tool for telemedicine were storing and sharing of the images can be done. Will help to educate the patient and assessment of the condition before and after the treatment.

5. It will help to early diagnosis as well as refer if any complications are found.

6. The image quality when compared with an image captured with a fundal camera there is no much difference.

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