Glaucoma is the second leading cause of blindness globally. Early detection and treatment are essential to mitigate vision loss. Morphological change of the optic nerve head (ONH) is a key indicator for early detection since it can precede vision loss. This work explored this idea.

**Method**

**Device Calibration**  
Calibration Toolbox for MATLAB®

**Optical Design**  
(based on the Normal Eye Model)

**Mechanical Design**  
Imaging Mode Calibration Mode

**Fabrication**  
Terracotta ONH Model

**Snellen Chart Target**

**Powerful accuracy (particularly in (prone cases) could be boosted with 3D images) such as**

Exploiting computer stereo vision on slit lamp images could be a cost effective solution.

**3D Stereo Reconstruction**

**3D Stereo Vision Techniques**

**Performing Testing in Phantom and Porcine Eye**

**Intrinsic & Extrinsic Camera Parameters**

**Stereo Matching**

**Rectification**

**Calibration Images**

**Posterior Section for Calibration Part 2**

**Goal**

The goal of this work was to initially assess the feasibility of generating 3D reconstructions of the optic nerve head by applying computer stereo vision techniques to stereo images obtained using a slit lamp which is available in practically every primary care clinic fitted with low-cost add-on components. The technique was tested on a life-sized fluid-filled eye phantom and a porcine eye in this work.

**Phantom Eye Reconstructions Obtained**

Glaucomatous

(RMS Error = 0.068 mm*)

Normal

(RMS Error = 0.037 mm*)

**3D reconstructions of normal and glaucomatous ONH models were obtained (which closely matched ground truths), together with that of a porcine ONH.**

**Outcome**

3D reconstructions of normal and glaucomatous ONH models were obtained (which closely matched ground truths), together with that of a porcine ONH.

**Significance**

The positive results warrant further work to assess the potential of the slit lamp to be used as a quantitative 3D retinal imaging device.

**References**


**Results**

**Phantom Eye Reconstruction**

**Porcine Eye Reconstruction**

**Conclusions**

**Conclusion**

This work explored the possibility of using a commercial stereo vision system to generate 3D reconstructions of the optic nerve head. The technique was tested on a life-sized fluid-filled eye phantom and a porcine eye in this work. The positive results warrant further work to assess the potential of the slit lamp to be used as a quantitative 3D retinal imaging device.