Rotating the Normal: Dove Prisms as Image Rotators

- Dove prisms rotate an image about their optical axis through total internal reflection when light rays travel parallel to the base of the prism [4].
- A prism rotation of 0 results in an image rotation of 2D [4].
- Revolution of the prism enables the resolution of features along any arbitrary axis.
- Confocal images taken with and without the prism show comparable contrast and brightness (shown right) despite a PMT control voltage difference of 15.5%.

Bending Light: Implementation of the Dove Prism in AOSLO

A Dove prism was placed in the detection arm of an animal-centric AOSLO [5].
- The method was validated by imaging five 13-lined ground squirrels with and without retinal pathologies at both inner and outer retinal foci.
- Three sets of images of the retina were acquired with prism rotations of 0º, 45º, and 90º, equating to final image orientations of 0º, 90º, and 180º respectively.
- Both image modalities at each prism rotation were aligned using previously described strip-wise registration software [6].

Prism Rotations for Morphological Changes

- As expected, confocal images demonstrated minimal changes in appearance as a function of prism rotation.
- Split detection images showed marked changes in appearance (0º, 45º, 90º, below); changing the prism angle revealed topographical differences.
- All split detection images exhibited similar image quality and contrast (RMS: 21.8 ± 3.5).

Uncovering the Unseen: Resolution of Off-Axis Features

- Inner retinal images revealed previously hidden off-axis structures.
- This relationship was observed in both small and large inner retinal features.
- Enables accurate calculations of vascular morphology and width.

Conclusions and Future Directions

- Dove-prism enhanced split-detection can resolve features regardless of their orientation to the detector.
- Use of a Dove prism allows for reduced complexity and cost compared to other approaches.
- Future work will examine the use of a Dove prism for split detection in humans and fully explore its use for any prism rotation.

References