

# Utilizing Choroidal Thickness Measurements as a Marker for Potential Myopia Control with Center-Distance Multifocal GP Lens Wear: A Pilot Study

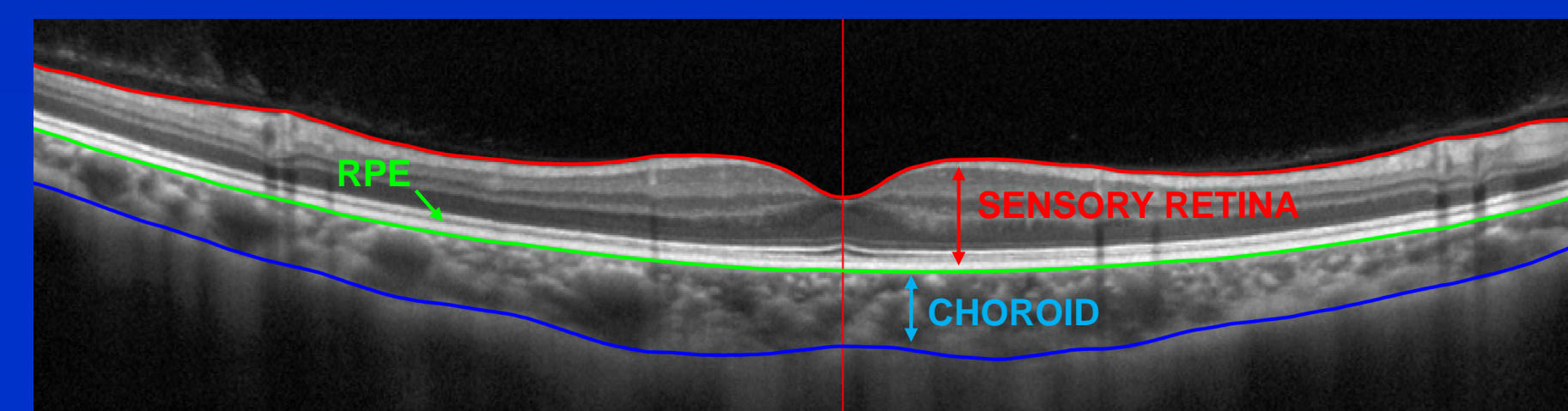
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## Introduction

It has been reported that the short-term introduction of peripheral plus power via contact lenses, ortho-k, or spectacle wear may temporarily increase the thickness in geographic portions of the choroid.<sup>1</sup> This choroidal thickening may be an effective biomarker for the presence of myopic defocus, a primary element in myopia control.<sup>1</sup>

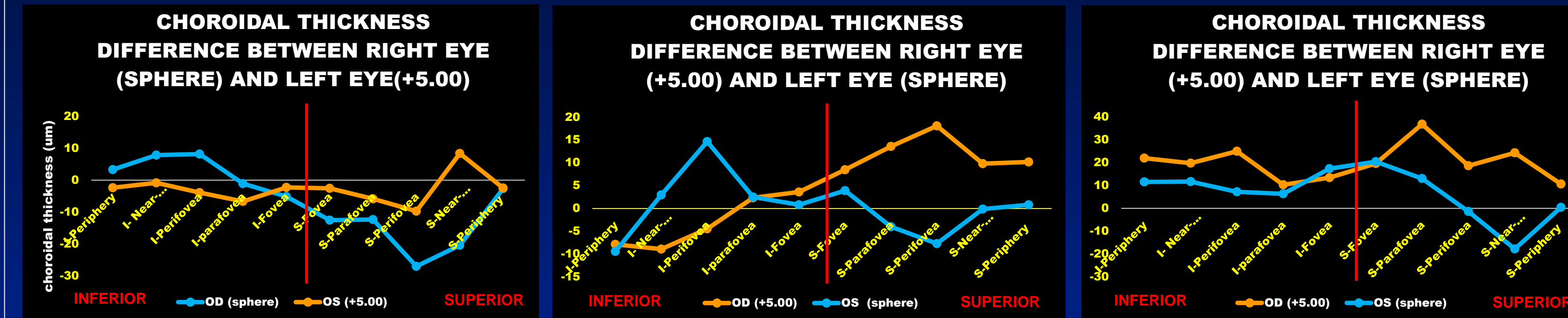
## Methods

- A randomized fit of three subjects with a spherical, single-vision, gas permeable (GP) lens on one eye and a center-distance multifocal (MF) GP (+5.00D add) on the other eye.
- The vertical meridian choroidal thickness was measured in both eyes with the OptoVue OCT, with no lens wear at 8:00 AM and again three hours later at 11:00 AM to determine the baseline thickness profiles.
  - At the lens dispense, OCT scans were taken immediately following lens application (at 8:00 AM) and then again following three hours of lens wear.
- Previous studies have demonstrated that the vertical choroidal meridian exhibits a greater thickening response to a plus power stimulus compared to the horizontal meridian<sup>2</sup>. OCT scans were analyzed in a program developed by Queensland University of Technology.



**Figure 1.** OCT-Tool vertical meridian retinal analysis. Copyright (c) 2012-2016 David Alonso-Caneiro at the Queensland University of Technology.

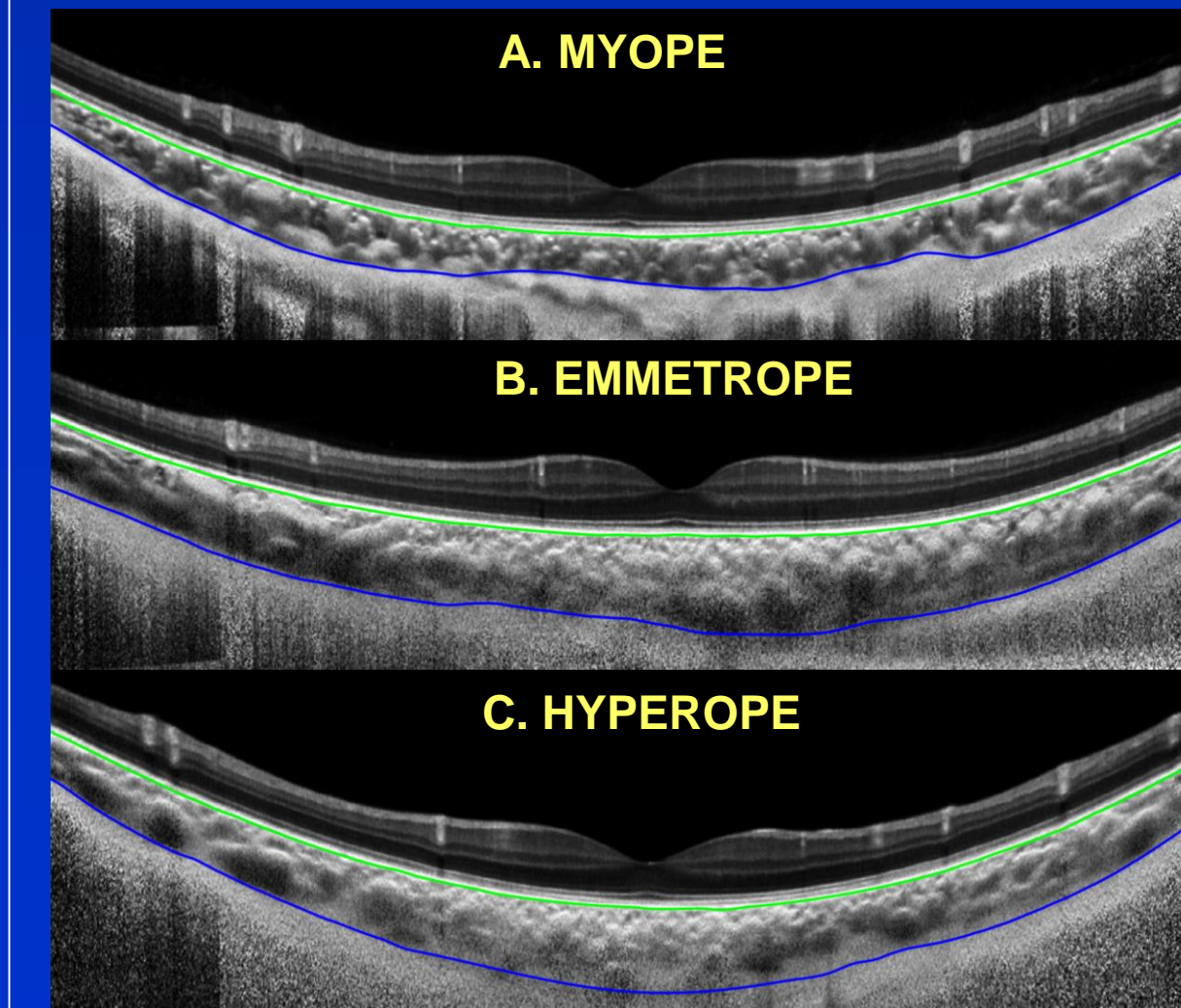
## Choroidal Thickness Changes with Center-Distance Multifocal GP Wear



**Figure 2.** Subject 1 Right eye: -2.75 DS, Left eye: -3.50 DS  
**Figure 3.** Subject 2 Right eye: -2.75 DS, Left eye: -2.50 DS  
**Figure 4.** Subject 3 Right eye: -1.75 DS, Left eye: -1.50 DS

- After 3 hours of wear, all subjects presented with either thickening or stability in the superior perifoveal and the superior near peripheral areas with the center-distance MF compared to that of the spherical lens wear. Previous studies have shown that choroid thickens the most significantly in the superior retina.<sup>1,2</sup>
- The differences in the physiologic responses are apparent between subjects, but all cases consistently present with choroidal thickening or stability in the superior retina.

## The Role of Choroidal Thickness in Myopia Control

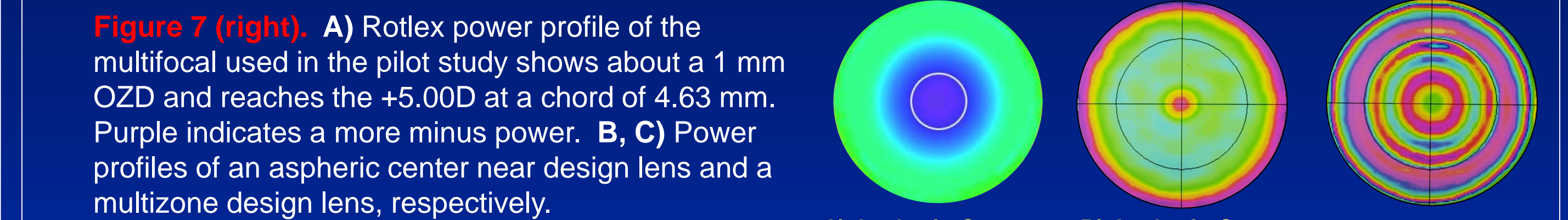


**Figure 6 (left).** Vertical choroidal thickness comparisons between age-matched A) -4.00D myope, B) an emmetrope, and C) a +4.50-2.25Dx007 hyperope. Calculations determined significant choroidal thinning of the myopic eye (A), compared to the emmetrope and hyperope (B and C). Choroidal comparison findings are similar compared to Figure 6 in Read SA, Fuss J, et al.<sup>1</sup>

- The choroid is often thinner in myopes compared to emmetropes and hyperopes. The choroidal thinning in myopes is greater than the amount expected with thinning associated with axial elongation.<sup>1</sup>
- A thicker choroid has been found to be associated with slower axial elongation.<sup>1</sup> Choroidal thickening in the superior retina of subjects after short-term center-distance MF lens wear reveals the potential for myopia control.

## Future Clinical Implications

Although more research is necessary to determine the most appropriate lens design and long-term effects on axial elongation, children with myopia and significant astigmatism unable to be effectively corrected with orthokeratology or soft multifocal CLs may have the option of an aspheric center-distance MF GP lens to slow progression of myopia.



## Conclusion

The superior retina has shown robust thickening in response to a short-term introduction of a myopia control stimulus.<sup>1,2</sup> The increase in choroidal thickness has been attributed to the increase in blood flow to the highly vascularized structure.<sup>1</sup> It has also been hypothesized that the dense localization of smooth muscle in the choroidal lumen and high concentration of retinal photoreceptors in the superior retina may play a role in the location of the thickening.<sup>2</sup> The changes in the choroid may contribute to regulating the axial elongation of the eye. This pilot study shows the potential success of aspheric multifocal gas permeable lenses in myopia management.

## Acknowledgements

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## References

- Read SA, Fuss, J, et al. Choroidal changes in human myopia: insights from optical coherence tomography imaging. *Clin Exp Optom.* 2019;102:270-285.
- Hoseini-Yazdi H, Vincent SJ, et al. Regional alterations in human choroidal thickness in response to short-term monocular hemifield myopic defocus. *Ophthalmic Physiol. Opt* 2019;39:172-182.