MATHEMATICAL ANALYSIS OF THE NORMAL ANATOMY OF THE AGING FOVEA

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BACKGROUND

- The fovea is the area of retina responsible for the highest acuity, and since the introduction of optical coherence tomography (OCT), in vivo study of foveal structure has been made possible.
- With the increasing prevalence of OCT use in diagnosing and treating retinal disorders and diseases involving the fovea, it is important to understand what constitutes ‘normal’ foveal structure on OCT.
- A detailed analysis of foveal morphology including depth, diameter, and slope will add further insight into normal foveal anatomy.
- This is the first study to mathematically analyze changes in the healthy fovea that occur with normal aging.

PURPOSE

- To mathematically analyze the anatomical changes in the normal fovea according to age.

METHODS

- 2,912 spectral domain OCT (SD-OCT) normal foveal scans were analyzed.
- Subjects scanned were healthy individuals between the ages of 13 and 97 years, with visual acuity of 20/40 or better, and without clinical evidence of foveal pathology.
- 390 eyes were divided into 9 groups representing each decade of life between the 2nd and 10th decade of life (10-19 years, 20-29 years, …, 90-99 years).
- Foveal thickness maps were analyzed using several measurements.
- The mathematical analog of foveal configuration was analyzed using the automated symbolic regression software Eureqa (version 0.99.8 Beta).
- A unique mathematical equation was derived for every decade of life, between 10-100 years.

CONCLUSIONS

- The normal foveal anatomical configuration changes with increasing age, with the mathematical foveal analog becoming significantly more complex.
- Normal aged foveas are less symmetric and have significantly steeper maximal slopes.
- The ability to differentiate between normal foveal aging and pathological foveas by SD-OCT may allow for early diagnosis as well as better follow up and management of the aging population.

 Mathematical analog of foveal configurations for each decade of life.