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COMPARISON OF THE PHOTORECEPTOR MOSAIC BEFORE AND AFTER MACULAR HOLE SURGERY WITH HIGH RESOLUTION ADAPTIVE OPTICS IMAGING

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Introduction:

There is currently limited literature on the use Adaptive Optics enhanced retinal imaging (AO) for Macular Hole (MH). In a case series of three patients, Markan et al used adaptive optics imaging to assess photoreceptor changes after successful MH surgery. They also described a mechanism to explain recovery of vision after successful MH closure: migration of cells from the parafoveal retina toward the center leads to vision improvement (1). Sotaro Ooto et al, reported that cone disruption occurs in eyes with macular microholes, with larger cone disruption areas being associated with worse visual acuity (2). Another case series of four patients who underwent PPV for surgical closure of MH, demonstrated that photoreceptor disruption exists even after MH closure and that remodeling of the foveal cone mosaic continues for several months following surgery (3). To our knowledge, there are no studies assessing photoreceptors changes before and after macular hole surgery. The aim of this study was to assess the photoreceptor mosaic in patients with idiopathic macular hole before and after pars plana vitrectomy (PPV) with adaptive optics enhanced retinal imaging.

Materials and methods:

Prospective cohort study of patients with MH treated with PPV. Imaging using an AO fundus camera (Imagine Eyes, RTX1) was performed preoperatively and 3-months following successful MH repair in both eyes. Cone density (CD), regularity, dispersion and spacing were measured at 2° and 4° of eccentricity in 4 quadrants (superior, inferior, nasal, and temporal) with pre- and postoperative values compared. Patients were excluded if they had secondary MH (e.g., resulting from: trauma, cystoid macular edema due to inflammation, retinal vascular disease, macular pucker, or retinal detachment). Eyes with high myopia (axial length >26.5 mm), media opacity precluding OCT or AO imaging, or previous intraocular surgery except for cataract extraction were excluded. Patients unwilling or unable to provide consent or comply with all study-related procedures were also excluded. This study was performed with the approval from the Research Ethics Board at the University of Toronto and was conducted in accordance with the Declaration of Helsinki.

Results:

We included 9 patients. There was significant reduction in cone density and increase in spacing and dispersion and a non-significant change in regularity post-operatively at 2°.
Comparison between preoperative and postoperative measurements at 2° mean (Standard deviation= SD) were: CD= 14612 ± 3003 and 12280 ± 4632 photoreceptors/mm2 [95% CIs= -2413 to -702] p= 0.0004, regularity: 88 ± 7% and 84 ± 12% [95% CIs= -4.67 to 0.04] p= 0.054, dispersion: 19 ± 6% and 23 ± 10% [95% CIs= 0.5 to 4.24] p= 0.013, spacing: 9±1 microns and 10± 2 microns [95% CIs= 0.40 to 1.27] p= 0.0002; at 4° was: CD= 13377 ± 4339 and 12770 ± 4391 photoreceptors/mm2 [95% CIs= -1368 to 252] p= 0.176, regularity: 87 ± 9% and 86 ± 12% [95% CIs= -4.65 to 0.08] p= 0.74, dispersion:

20 ± 8% and 20 ± 9% [95% CIs= -2.11 to 1.5] p= 0.74, spacing: 10 ± 2 microns and 10 ± 3 microns [95% CIs= -0.23 to 0.58] p= 0.39.

Conclusions:

Adaptive optics imaging allows quantitative assessment of the photoreceptor mosaic pre- and post-PPV in patients with macular hole. There was a significant change to the photoreceptor mosaic related to the MH at 2°. Adaptive optics imaging enables high-resolution investigation of the photoreceptor remodeling process following surgery, which may allow for a more thorough assessment of surgical outcomes.

Sources:

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