Abstract:

Longitudinal Assessment of Ellipsoid Zone Recovery using En Face OCT after Retinal Detachment Surgery

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Purpose:

Patients diagnosed with rhegmatogenous retinal detachment (RRD) can experience poor functional outcomes after treatment despite anatomic reattachment. Poor visual outcomes can be related to macular abnormalities, specifically to ellipsoid zone (EZ) alterations. The purpose of this study was to quantitatively assess EZ recovery using enface OCT after RRD surgery and to determine the correlation between EZ recovery and improvement in visual acuity.

Methods:

This is a post hoc analysis of patients enrolled in the PIVOT RCT with macula-off RRD. SD-OCT enface images of the ellipsoid zone slab at 3, 6, 12, and 24 months post-operatively were analyzed. Hyporeflective areas on the enface images were co-localized with EZ abnormalities on the cross-sectional B-Scan and manually measured by two masked graders using ImageJ software. The graders were trained together and validated an analysis methodology with 40 images of 10 patients with an ICC of 0.897 (95% CI, 0.805-0.945). The region of interest was defined as a circle with 4mm diameter in the center of the enface image. The abnormal area was defined as a continuous hyporeflective area with clear boundaries.

Results:

181 images of 52 patients were analyzed. A statistically significant reduction was observed in the mean area of the hyporeflectivity over time, $F(3,87) = 14.85$, $p < .0005$, with the mean hyporeflective area decreasing from $6.08 \pm 2.31 \text{ mm}^2$ at 3 months to $5.43 \pm 2.99 \text{ mm}^2$ at 6 months, to $4.06 \pm 2.69 \text{ mm}^2$ at 12 months, and to $3.26 \pm 2.76 \text{ mm}^2$ at 24 months. Mean abnormal area significantly decreased from 3 to 12 months (2.01 (95% CI, 0.64-3.38) mm², $p = .002$), and from 3 to 24 months (2.81 (95% CI, 1.34-4.28) mm², $p < .0001$). Additionally, there was moderate negative correlation between change in hyporeflective area and change in ETDRS letters from 3 to 24 months, $r(31) = -0.46$, $p = .007$.

Conclusions:

EZ recovery can be quantitatively documented after RRD surgery using enface OCT. A steady reduction in the area of abnormal central EZ was observed over time and correlated with ETDRS improvement in patients with macula-off RRD. Hyporeflective areas on enface OCT may serve as a useful biomarker for EZ integrity, functional outcomes and long-term visual prognosis following RRD repair.