Topographic Analysis of IS/OS Impairment and its Correlation with Fluid Markers in Wet AMD quantified by Deep Learning

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Objective

- **Quantitative characterization of the course of IS/OS integrity** in neovascular AMD before and througout anti-VEGF therapy

- **Correlation of IS/OS impairment with visual function**

- **Topographic correlation of IS/OS impairment with automatically quantified fluid markers**, such as intraretinal cystoid fluid (IRC), subretinal fluid (SRF) and pigment epithelial detachment (PED)

Patients and Methods

Data of 185 eyes of 185 patients, enrolled in the OCTAVE study (NCT01780935) were analyzed at baseline (bsl, treatment-naive), month 3 and month 12 and included OCT data and BCVA measurements.

Spectral domain - (Spectralis) OCT data were included into the analysis. Focal **absence of the IS/OS junction was annotated** in each of the 49 B-Scans of every patient at all timepoints (Figure 1).

Fluid markers were segmented automatically on a per-voxel basis by applying convolutional neural networks for IRC and SRF and by applying layer segmentation for PED.

Topographic correlation was performed using chi square testing between the en-face presence/absence of features (Figure 4).
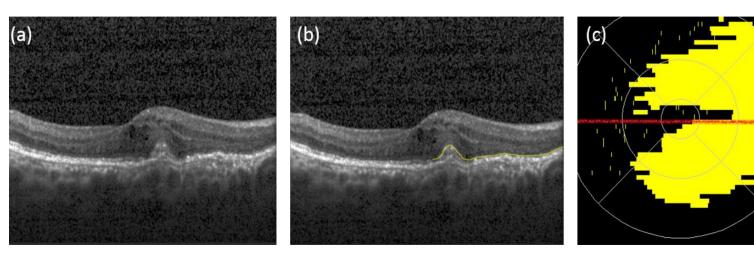

Figure 1: Central B-Scans without (a) and with (b) annotation of IS/OS impairment. (c) En-face view of IS/OS impairment with central B-Scan marked by red line.
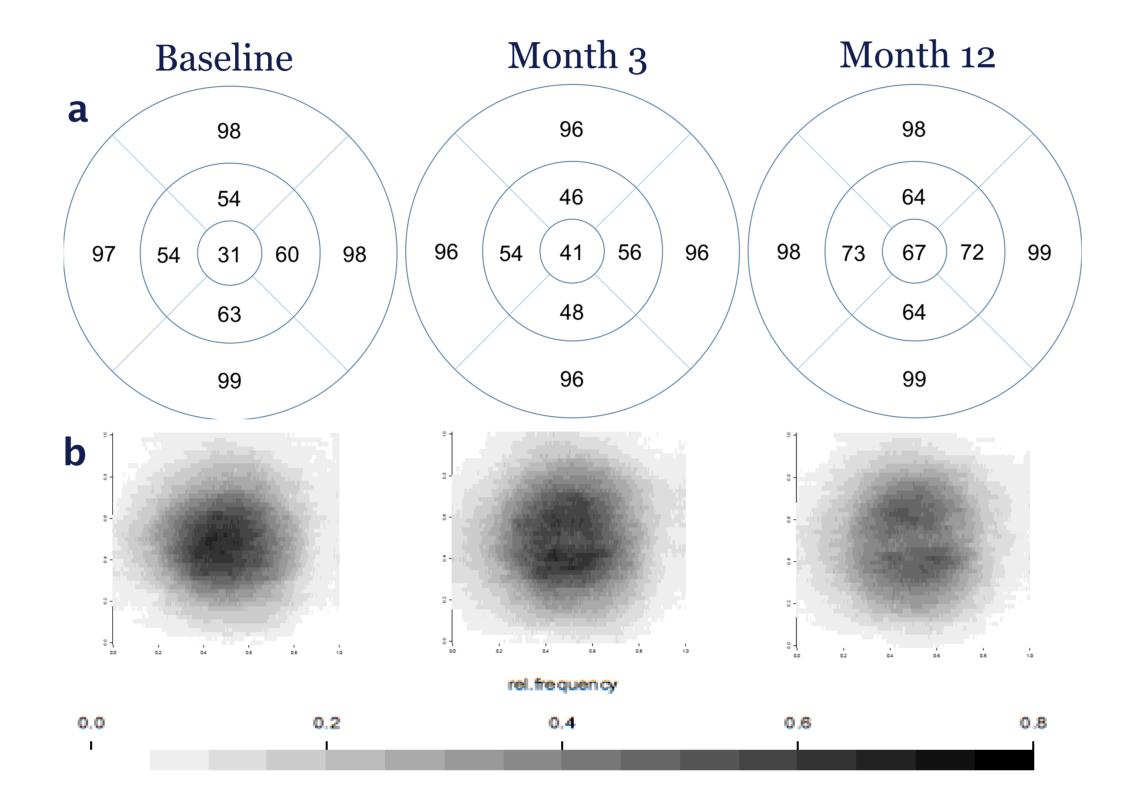

Figure 2: (a) Median IS/OS integrity in macular subfields. (b) Distribution plots of IS/OS impairment of all patients. The cumulative frequency of impairment is coded in greyscale per-pixel
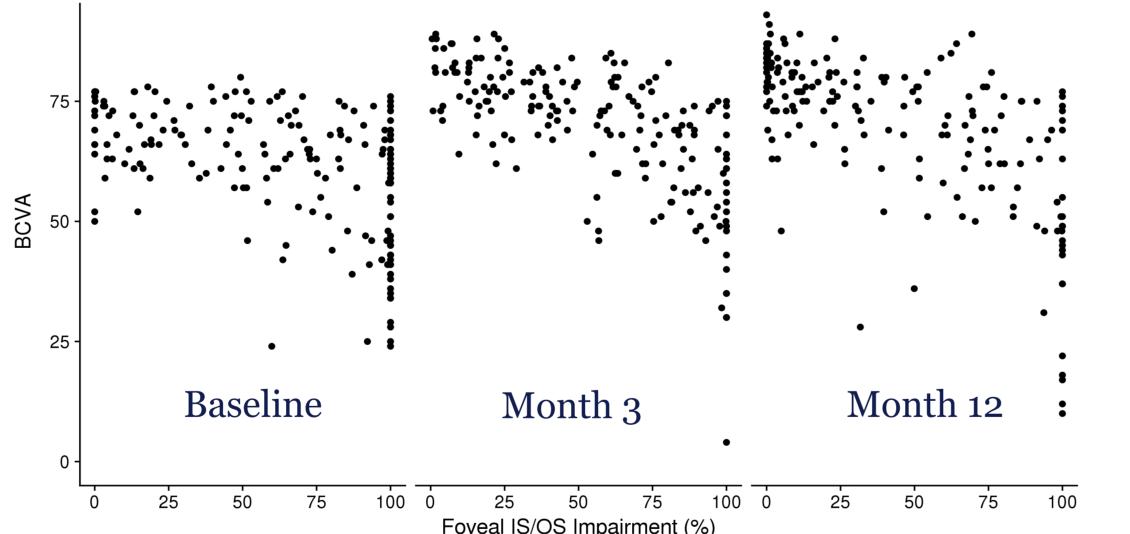

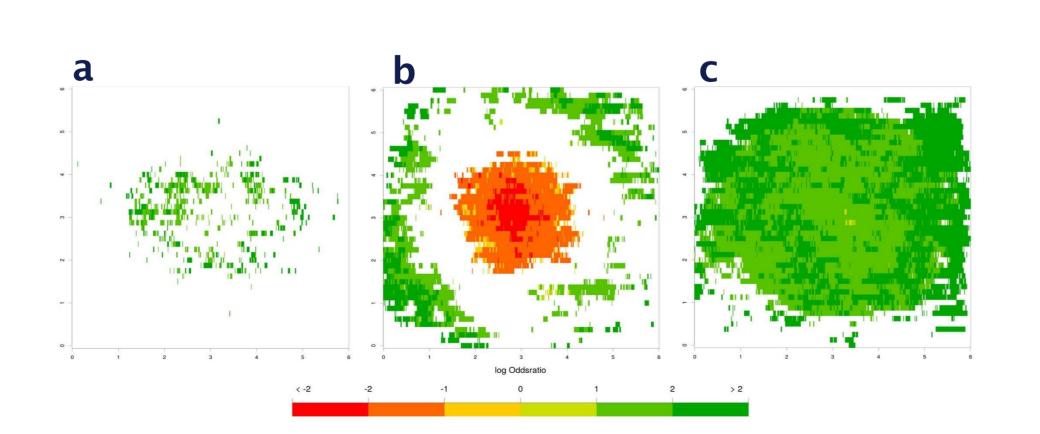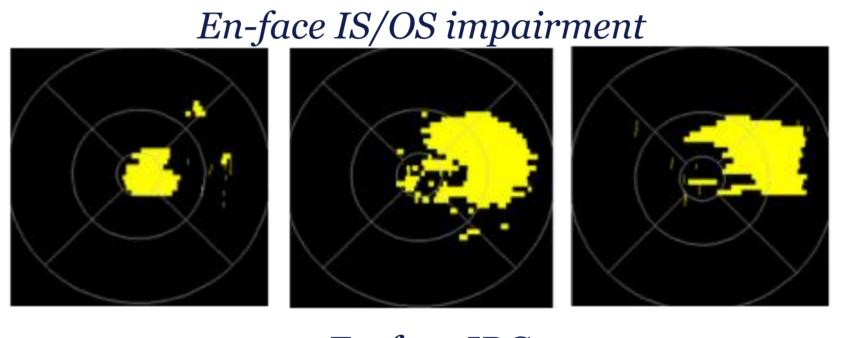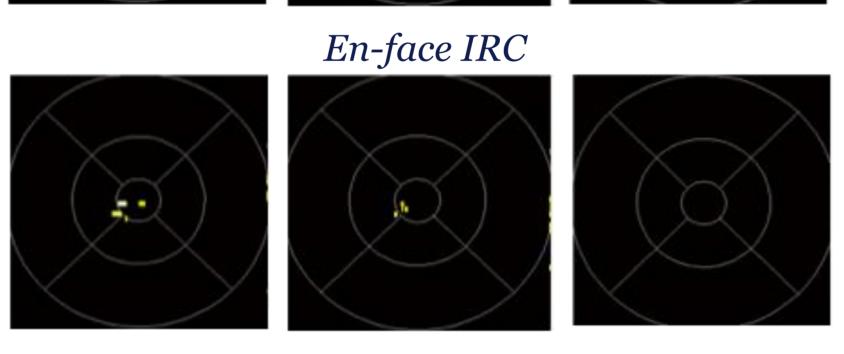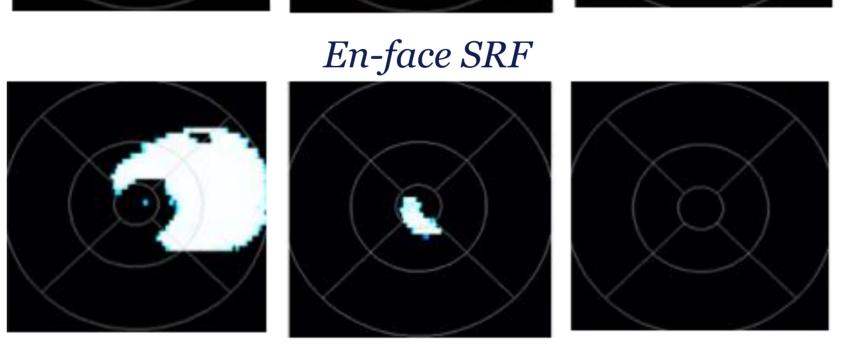Figure 3: Correlation of BCVA (ETDRS letter score) with IS/OS impairment

Figure 4: En-face per-pixel odds ratio maps at baseline show areas with significant topographic correspondence of IS/OS impairment with IRC (a), SRF (b) and PED (c).
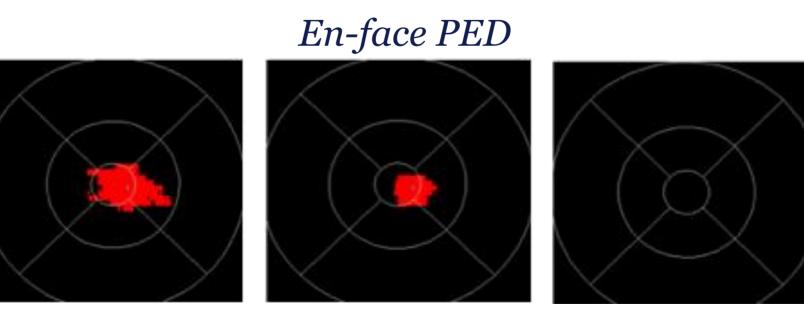

Figure 5: Example case showing progressive improvement of IS/OS integrity in the fovea and occurrence of IS/OS impairment in the area of SRF resolution

Results

Figure 2:
- At baseline, we observed **IS/OS impairment predominantly in the fovea.**
- Overall, IS/OS integrity decreased from 85% at bsl to 82% at month 3 before increasing to 88% at month 12.
- **Improvement of IS/OS integrity was greater in the foveal area** compared to the total scan from bsl to month 3 (+6% ±33 vs. -3% ±10; p<0.01), from month 3 to month 12 (+12% ±26 vs. +4% ±7; p<0.01), and from bsl to month 12 (+18 ±37 vs. +1 ±12; p<0.01).

Figure 3:
- **Foveal IS/OS impairment showed a moderate negative correlation with BCVA** (r=-0.47, r=-0.64, r=-0.63 at bsl, month 3 and month 12, respectively).

Figure 4:
- Baseline en-face chi-square maps revealed that **IS/OS impairment was less likely in areas with SRF** and vice versa.

Figure 5:
- We observed an **association between the resolution of SRF (from bsl to month 3) and the occurrence of IS/OS impairment at month 3** (r=-.351, p<0.001 in a bivariate correlation of SRF area and area of IS/OS impairment).

Conclusion

This post-hoc analysis reveals predominant improvement of IS/OS integrity in the fovea throughout anti-VEGF therapy in neovascular AMD. IS/OS integrity correlated with BCVA at all timepoints. In areas of SRF accumulation, IS/OS integrity is preserved and seems to deteriorate with SRF resolution.