Evaluation of Type 3 Neovascularization following anti-VEGF Treatment using Optical Coherence Tomography Angiography

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OBJECTIVE
To assess the utility of optical coherence tomography angiography (OCTA) for longitudinal evaluation and management of type 3 neovascularization in age-related macular degeneration (AMD).

PURPOSE
To analyze optical coherence tomography angiography (OCTA) imaging of type 3 neovascularization in age-related macular degeneration (AMD) at baseline and serially following multiple anti-vascular endothelial growth factor (anti-VEGF) treatments.

METHODS
This case series describes three patients diagnosed with treatment naive type 3 neovascularization secondary to AMD based on clinical examination, FA, and SD-OCT.

Snellen visual acuity and OCTA imaging with quantitative analysis of the type 3 neovascular membrane were obtained at baseline and following 1-5 monthly intravitreal anti-VEGF injections.

Quantification using the built-in AngioVue Analytics software (version 2016.2.0.35) and the Flow Tool was used to measure the type 3 neovascular lesion size at baseline and post-treatment.

RESULTS
OCTA analysis of type 3 neovascularization demonstrated regression of small caliber vessels following anti-VEGF treatment. Cystoid macular edema nearly resolved and visual acuity improved in all cases.

OCTA offers a non-invasive imaging technique in assessing morphological changes and quantitative analysis of type 3 neovascular lesions following longitudinal anti-VEGF treatment.

OCTA supplements fluorescein angiography and spectral domain OCT by providing improved microvascular identification of type 3 lesions and treatment response which may help guide clinician management and patient expectations.

CONCLUSION

REFERENCES


SUPPORT
Supported in part by an unrestricted grant from Research to Prevent Blindness

FIGURE 1
Pre-treatment: Top left: Combined en face OCTA shows enhanced flow signal of vascular tufts. Top right: Cross sectional OCTA image shows a small area of flow signal from inner nuclear layer to outer plexiform layer. Bottom left: Cross sectional OCTA image shows contrast enhanced flow signal of the type 3 lesion. Bottom right: En face OCTA demonstrates enhanced flow signal from inner nuclear layer to outer plexiform layer. Post-treatment: Top and bottom right: En face and cross sectional OCTA images shows “silhouette sign” of type 3 lesion.

FIGURE 2
Pre-treatment: Top left: Combined en face OCTA shows high flow vascular complex with large caliber vessels vertically oriented. Bottom left (Cross sectional OCTA): small vessels at the base of the lesion. Top right: Combined en face OCTA shows significant reduction in small caliber vessels leaving mostly a single large caliber vessel. Bottom right: Cross-sectional OCTA scan shows flow signal of the type 3 lesion appears to pass through the RPE and outer retina. Post-treatment: Top right: Cross sectional OCTA scan shows modest reduced flow of the type 3 lesion. Bottom left: Cross sectional OCTA scan shows no identifiable vascular lesion or flow signal.

TABLE 1

<table>
<thead>
<tr>
<th>CASE</th>
<th>PRE-TREATMENT</th>
<th>POST-TREATMENT</th>
<th>DECREASE IN %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>20/40</td>
<td>20/20-3</td>
<td>8</td>
</tr>
<tr>
<td>Case 2</td>
<td>20/400</td>
<td>20/100</td>
<td>57</td>
</tr>
<tr>
<td>Case 3</td>
<td>20/150</td>
<td>undetectable</td>
<td>100</td>
</tr>
</tbody>
</table>

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- This case series describes three patients diagnosed with treatment naïve type 3 neovascularization secondary to age related macular degeneration (AMD) based on clinical examination, fluorescein angiography, and spectral domain OCT.

- Snellen visual acuity and optical coherence tomography angiography (OCTA) imaging with quantitative analysis of the type 3 neovascular membrane were obtained at baseline and following 1-5 monthly intravitreal anti-VEGF injections.

- Quantification using the built-in AngioVue Analytics software (version 2016.2.0.35) and the Flow Tool was used to measure the type 3 neovascular lesion sizes at baseline and post-treatment.
### RESULTS

**CASE 1**

- **Pre-treatment.** Top left: 3x3mm *en face* OCTA shows enhanced flow signal of vascular tuft (yellow outline). Bottom left: Cross-sectional OCTA shows abnormal flow signal from inner nuclear layer to outer plexiform layer (blue arrowhead).

- **Post-treatment:** Top and bottom right: *En face* and cross-sectional OCTA scan shows modest reduced flow of the type 3 lesion.

**CASE 2**

- **Pre-treatment.** Top left: 3x3mm *en face* OCTA shows high flow vascular complex with large caliber vessels vertically, flanked by smaller caliber vessels on each side (yellow outline). Bottom left: Cross-sectional OCTA co-registers with the *en face* OCTA flow signal at the outer nuclear and outer plexiform layers (blue arrowhead).

- **Post-treatment:** Top right: *En face* OCTA demonstrated significant reduction in small caliber vessels leaving mainly a large caliber vascular lesion. Bottom right: Cross-sectional OCTA scan shows flow signal of the lesion appears to pass through the RPE and into the sub-RPE space.
CASE 3

RESULTS

TABLE 1. VISUAL ACUITY AND QUANTITATIVE ANALYSIS OF LESION AREA AT BASELINE AND FOLLOWING ANTI-VEGF TREATMENT

<table>
<thead>
<tr>
<th>Case</th>
<th>Pre-treatment VA and lesion area (mm²)</th>
<th>Post-treatment VA and lesion area (mm²)</th>
<th>Decrease in lesion area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20/40 0.038</td>
<td>20/20-3 0.035</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>20/400 0.099</td>
<td>20/50-2 0.042</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>20/150 0.021</td>
<td>20/60-2 0 0</td>
<td>100</td>
</tr>
</tbody>
</table>

- OCTA demonstrated resolution of cystoid macular edema in all 3 cases following anti-VEGF treatment.
- Case 1 demonstrated persistence of larger vessels even after multiple anti-VEGF treatments.
- In case 2, resolution of the edema allowed better visualization of the type 3 neovascular lesion due to intraretinal fluid obscuration at baseline.
- All cases demonstrated improved visual acuity and reduction of type 3 neovascularization area on quantitative OCTA analysis with significant reduction in 2 out of 3 cases.

- **Pre-treatment.** Top left: 3x3mm en face OCTA shows a small vascular tuft with flow (yellow outline). Bottom left: Cross-sectional OCTA co-registers a small focal area of flow with the en face OCTA identifying the lesion at the level of the deep/outer retina (blue arrowhead).

- **Post-treatment:** Top and bottom right: En face and cross-sectional OCTA shows no identifiable flow signal or vascular lesion.
CONCLUSION

- OCTA analysis of type 3 neovascularization demonstrated regression of small caliber vessels following anti-VEGF treatment.

- Visual acuity improved and cystoid macular edema nearly resolved in all cases.

- OCTA offers a non-invasive imaging technique in assessing morphological changes and quantitative analysis of type 3 neovascular lesions following longitudinal anti-VEGF treatment.

- OCTA supplements fluorescein angiography and spectral domain OCT by providing improved microvascular identification of type 3 lesions and treatment response which may help guide clinician management and patient expectations.