Correlation of High-Definition Optical Coherence Tomography and Fluorescein Angiography Imaging in Neovascular Macular Degeneration

Panagiotis Malamos, Stefan Sacu, Michael Georgopoulos, Christopher Kiss, Christian Pruente, and Ursula Schmidt-Erfurth

PURPOSE. To correlate the morphologic characteristics of choroidal neovascular lesions (CNV) in age-related macular degeneration (AMD) using raster scanning high-definition optical coherence tomography (HD-OCT) and conventional fluorescein angiography (FA).

METHODS. In this comparative clinical study, 37 consecutive patients with classic, minimally classic, or occult CNV; 13 patients with early AMD; and 10 age-matched healthy individuals were included. HD-OCT imaging (Topcon, Tokyo, Japan) and FA (scanning retinal ophthalmoscope; HRA2; Heidelberg Engineering, Dossenheim, Germany) were performed after a complete standardized ophthalmic examination. Only one eye of each patient was included in the study. A point-to-point correlation between HD-OCT and FA images was performed. Early and late FA images at defined locations were correlated with OCT measurements, including 3D maps, 2D single scans, a thickness linear graph, and the 3D retinal pigment epithelium (RPE) segmentation.

RESULTS. With HD-OCT imaging used to delineate the lesion morphology, early AMD was detected as having a normal fovea contour and minimal alteration in the macular area; classic CNV as a well-defined lesion with steep margins and a crater-like configuration, occult CNV as an ill-defined, flat lesion with a convex surface; and minimally classic CNV as having classic and occult components. FA-OCT overlay images provided a significant correlation between FA patterns and OCT features such as retinal thickness (RT).

CONCLUSIONS. 3D-OCT provided realistic anatomic maps of the retina, RPE, and RT in patients with AMD. Discrimination between the predominant CNV lesion types was achieved, and their precise shape was identified, together with information about the lesion’s localization and leakage activity. (Invest Ophthalmol Vis Sci. 2009;50:4926–4933) DOI:10.1167/iovs.09-5610

A ge-related macular degeneration (AMD) is the leading cause of severe visual impairment in elderly people in the industrialized countries.1,2 Epidemiologically the disease is gaining importance, since the life expectancy of the elderly population is continuously increasing.3,4

The neovascular form of AMD is characterized by choroidal neovascularization (CNV) and is responsible for 85% of the severe vision loss caused by AMD.5 The classification of CNV lesions, in size, location, and composition of the neovascular process, influences the visual prognosis.6 Currently, fluorescein angiography (FA) is the gold standard for the differential diagnosis of neovascular AMD and determination of lesion characteristics. Based on FA, neovascular AMD is classified according the form—predominantly classic, minimally classic, or occult; the location—subfoveal, juxtapfoveal, or extrafoveal; and the size of the lesion.

Numerous diagnostic tools such as optical coherence tomography (OCT)7–10 three-dimensional (3D)-OCT,11,12 retinal thickness analysis (RTA),11 and topographic angiography (TAG)13 are being evaluated clinically, in addition to the conventional techniques such as FA and biomicroscopy. These methods provide improved capabilities for the imaging of the intraretinal morphology and/or allow analysis of the structural and functional aspects of leakage activity. Most important, they offer realistic 3D imaging of retinal and subretinal levels in various macular diseases. The different diagnostic procedures are used in a complimentary fashion to integrate all aspects of lesion morphology and activity. In an attempt to optimize diagnostic procedures, there is a need to identify the most informative and least invasive diagnostic modality.

To our knowledge, there is no study available in which OCT- and FA-based imaging of morphologic aspects of neovascular lesions obtained by the noninvasive 3D-OCT and invasive FA techniques has been correlated in patients with different forms of AMD. Such a correlation may offer a better understanding of the potential of noninvasive 3D-OCT imaging in diagnosis.

The purpose of the present study was to evaluate the diagnostic capabilities of the novel 3D Topcon OCT-1000 (Topcon Corp., Tokyo, Japan) in cases of early and late neovascular AMD and to correlate these findings with the features distinguished by conventional FA.

METHODS

The present study was conducted in the Department of Ophthalmology, Medical University of Vienna, according to the tenets of the Declaration of Helsinki. It was approved by the ethics committee at the Medical University of Vienna. Informed consent was obtained from all patients, with explanation of the nature and possible consequences of the study. Inclusion criteria were based on the AREDS classification for early AMD and advanced neovascular AMD with recent-onset exudative CNV. Exclusion criteria were a history of any other retinal disease, significant media opacities, previous intraocular surgery or pharmacologic intervention or laser treatment, and amblyopia. Sixty individuals met the inclusion criteria between July and October 2007 and were included in the study. The patients underwent a full ophthalmic examination, including best corrected visual acuity (BCVA) and dilated fundus examination by a retina specialist.
Fluorescein Angiography

All patients with AMD underwent a routine angiography procedure with intravenous injection of 5 mL of a 10% fluorescein solution (Novartis Pharma AG, Bern, Switzerland). After the injection, images were taken from the early phase (10–20 seconds) to the late phase (10 minutes). A confocal scanning laser ophthalmoscope (HRA2; Heidelberg Engineering, Dossenheim, Germany) was used. From each series, one representative early-phase angiogram and one from the late phase were selected for analysis.

Five groups of patients were formed. In the control group, age-matched control patients were classified and underwent a routine ophthalmic examination for any reason unrelated to macular disease and had at least one normal eye (n = 10). In the early-AMD group (n = 13), patients with maculopathy with hard and/or soft drusen accompanied with retinal pigment epithelium (RPE) alterations, such as mottling and clumping, were included according to AREDS categories 3 and 4. In the third group, patients showing classic CNV (n = 16) were included.13 The fourth group consisted of patients with minimally classic lesions (n = 5), considered to represent occult lesions with a classic component occupying less than 50% of the entire lesion area by FA. In the last group, patients with an occult-only CNV (n = 16) were included.14 All images were evaluated by two masked retina specialists. Clinical examination was used for control group assignment and FA images for the AMD groups.

Three-Dimensional OCT

Topcon 3D-OCT-1000, PC Software Version 2.00 (Topcon Corp.), was used to capture 3D-OCT images in all patients before any treatment application.

The system uses a Fourier domain spectrometric technology allowing for scanning speed of almost 25,000 A-scan/s; high-resolution, cross-sectional B-scan images (up to 4096 A-scans), and 3D volumetric images covering up to 6 × 6 mm of the retinal area. The axial in-depth resolution is 6 μm or even less, and the frame rate of the B-scans reaches the level of 5 Hz or more. In our study, a 3D-scan pattern over a 6.0 × 6.0-mm area with scan density 512 × 128 capturing a series of images was produced. A projection image was then created by summing all data points in the 3D-OCT data longitudinally displayed in black and white in the fundus photograph. This image allowed visualization of the retinal features with a pixel-to-pixel correspondence between the projection image and the 3D-OCT image. Registration of the 3D projection image and fundus photograph was processed automatically. Automated procedures from the Topcon OCT software provided quantitative data regarding RT and lesion volume, as well as 3D images of RT and the lesion surface at the level of the retinal pigment epithelium (RPE).

Correlation of FA and 3D-OCT

Using a removable hard disc storage device, we exported all FA images from the HRA2 into the Topcon software, to be used as reference images for correlation with the corresponding OCT scans. HRA2 files and Topcon software are compatible with each other. We used the pinpoint registration modality of the Topcon software to correlate, point by point, the corresponding diseases through all available images. The Early Treatment Diabetic Retinopathy Study (ETDRS) ring was overlaid on the late-phase angiograms. This ring consists of three concentric circles with the center placed on the foveal center, whereas the ring diameters are 1 mm for the central, 3 mm for the middle, and 6 mm for the peripheral ring. The middle and peripheral rings are further divided into four segments: upper, nasal, lower, and temporal quadrants.

In each group, we analyzed the angiograms of the late phases (overlaid with ETDRS ring), the 3D thickness maps, 2D scans, thickness linear graphs, and RPE 3D maps. In the control group, only the fundus image was evaluated, since an angiogram was not performed in the absence of retinal disease.

RESULTS

The demographic characteristics and all RT parameters analyzed statistically throughout all groups included in our study are presented in Table 1.

Control Group

In this group, patients had a healthy posterior pole (i.e., normal fovea reflex and macular area; Fig. 1A). The B-scans presented a clear visualization of all retinal layers (Fig. 1B). The B-scan profile thickness graph showed the foveal depression (Fig. 1C), also presented on the RT map (Fig. 1D). The segmentation of the RPE layer was also free of any pathologic deviation (Fig. 1E).

Early AMD Group

In the angiograms (Fig. 2A) of this group the fovea appeared as a hypofluorescent oval area surrounded usually by focal spots of late staining without leakage, consistent with drusen. The FA-OCT overlay images regularly detected normal RTs in both the central foveal area and the perifoveal quadrants. B-scans (Fig. 2B), as well as the RT B-profile (Fig. 2C), delineated all retinal layers without irregularities (i.e., with regular inner limiting membrane [ILM] and a normal foveal contour). The RPE band appeared focally elevated due to the presence of soft drusen (Fig. 2B). The RT maps showed a normal foveal contour within normal thickness limits and focal depressions (Figs. 2A, 2D). The 3D segmentation of the RPE layer demonstrated a regular morphology with some distinct surface elevations representing soft drusen, as shown in the B-scan images (Fig. 2E).

Obviously, these RPE elevations correspond to the focal depressions in the RT maps, as well as to a focial thinning of the retinal layer overlying the drusen location. This focial thinning, however, did not influence the mean thicknesses in the affected segments of ETDRS rings and thickness maps.

Classic CNV Subgroup

Classic CNV was observed by FA to have characteristics associated with its definition (Figs. 3A, 3B). In late-phase FA OCT overlays, increased RT values were detected over the lesion area (Fig. 3B). The B-scan delineated a subretinal prominence contiguous with the RPE band with retinal thinning collateral to the lesion peak (Fig. 3C). The RT B-profile highlights the lesion characteristics with the retinal thinning at the lesion borders and a loss in RT in the lesion center (Fig. 3D). On the 3D RT maps, the lesion appeared as a round prominence with steep borders, well-defined margins, and a concave-shaped surface with a central depression (Fig. 3E). The surface surrounding the central depression appeared red, representing the thickened part of the retina at the borders of the lesion. The 3D map of the RPE layer highlighted the subretinal neovascular complex as a distinct prominence rising sharply from the flat surrounding of the RPE layer (Fig. 3F).

Statistics

Descriptive and inferential data analyses were performed with commercial software (SPSS 14.0 software for Windows; SPSS, Chicago, IL). To search for intergroup differences with respect to distance BCVA and mean RT, we performed one-way ANOVAs, using group as the fixed factor. Whenever significant differences were observed with ANOVA, two-sample t-tests were performed in all pairs of groups to search for significant differences between the different groups. P < 0.05 was considered statistically significant.
Minimally Classic CNV Subgroup

In this category, early angiograms showed a focal hyperfluorescent area (Fig. 4A) within an area of diffuse hyperfluorescent dots and leakage consistent with a fibrovascular pigment epithelium detachment (PED) in late angiograms (Fig. 4B). The FA-OCT overlay image displayed the increased RT in the area of leakage in the upper and nasal quadrants of the middle circle of the ETDRS ring. The B-scan of the occult area detected the presence of subretinal fluid (SRF) and RPE fragmentation (4C). In the RT B-profile, the curve inclined slowly, with a convex surface (Fig 4D).

In a characteristic 3D RT map in one of our cases (Fig. 4E), the lesion seemed to be composed of two distinctive, prominent parts in proximity to each other. The upper portion temporally, with concave surface slightly depressed centrally, was steeper and more elevated in comparison with the other portion, which was less prominent and flatter with a convex surface. Obviously, the former corresponds to the classic component and the latter to the occult one. The 3D segmentation of the RPE revealed an elevation at the classic component, seen also in the superimposed B-scan image. The occult portion appeared as an irregular surface with slight elevation consistent with the SRF area of the B-scan (Fig. 4F).

Occult CNV Subgroup

Early angiograms detected a barely visible, dim hyperfluorescence in the macular area of all patients. In most of the cases, the origin and the margins of the hyperfluorescence were ill-defined or even completely undetectable (Fig. 5A). In late angiograms, the hyperfluorescence extended and became brighter with an irregular patchy pattern. The FA-OCT overlay images revealed a moderately increased RT of all segments of the ETDRS ring but no significant differences in RT between areas of hyperfluorescence and areas of normal fluorescence (Fig. 5B). The B-scan revealed a PED with irregular surface most of the time, consistent with a fibrovascular PED (Fig. 5C). A focal RPE disruption was seen in some cases. The RT B-profile demonstrated an inhomogenous retinal morphology with thicker and thinner areas in an irregular pattern (Fig. 5D). In the 3D RT map, most of the occult lesions appeared as low prominence with ill-defined borders (Fig. 5E). The 3D RPE surface map detected a dome-shaped central area with concave surface (Fig. 5F).

DISCUSSION

Most of the retinal diseases with visually devastating potential are characterized by an anatomic disturbance of retinal morphology that particularly affects the macular region. Exudative macular disease, hemorrhage, subretinal fluid, and cystoid edema are common findings, reflecting the vascular nature of the underlying disease. Neovascular proliferation is the primary event, and intra- and subretinal exudation is the secondary destructive consequence. Specific diagnostic tools are available in clinical practice to evaluate CNV-related disease.

TABLE 1. Demographic Characteristics and Statistical Data of Retinal Thicknesses between Groups

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Early AMD</th>
<th>Classic CNV</th>
<th>Min Class CNV</th>
<th>Occult CNV</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (f/m)</td>
<td>10 (4/6)</td>
<td>12 (4/8)</td>
<td>16 (10/6)</td>
<td>5 (3/2)</td>
<td>16 (9/7)</td>
</tr>
<tr>
<td>Eye (right/left)</td>
<td>7/5</td>
<td>7/5</td>
<td>8/8</td>
<td>4/1</td>
<td>7/9</td>
</tr>
<tr>
<td>Age (y)</td>
<td>58 ± 9.0</td>
<td>72 ± 6.0</td>
<td>76.3 ± 9.9</td>
<td>77 ± 8.3</td>
<td>77.4 ± 8.1</td>
</tr>
<tr>
<td>BCVA Mean</td>
<td>1</td>
<td>0.94</td>
<td>0.22</td>
<td>0.19</td>
<td>0.28</td>
</tr>
<tr>
<td>P*</td>
<td>0.08</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>RT center Mean</td>
<td>221</td>
<td>229</td>
<td>365</td>
<td>368</td>
<td>293</td>
</tr>
<tr>
<td>P*</td>
<td>0.447</td>
<td>0.001</td>
<td>0.002</td>
<td>0.057</td>
<td>0.057</td>
</tr>
<tr>
<td>RT 12h mid Mean</td>
<td>292</td>
<td>280</td>
<td>324</td>
<td>317</td>
<td>307</td>
</tr>
<tr>
<td>P*</td>
<td>0.195</td>
<td>0.302</td>
<td>0.122</td>
<td>0.408</td>
<td>0.408</td>
</tr>
<tr>
<td>RT nasal mid Mean</td>
<td>283</td>
<td>268</td>
<td>319</td>
<td>301</td>
<td>323</td>
</tr>
<tr>
<td>P*</td>
<td>0.208</td>
<td>0.406</td>
<td>0.468</td>
<td>0.135</td>
<td>0.135</td>
</tr>
<tr>
<td>RT 6h mid Mean</td>
<td>274</td>
<td>271</td>
<td>369</td>
<td>320</td>
<td>291</td>
</tr>
<tr>
<td>P*</td>
<td>0.727</td>
<td>0.011</td>
<td>0.031</td>
<td>0.583</td>
<td>0.583</td>
</tr>
<tr>
<td>RT temp mid Mean</td>
<td>276</td>
<td>284</td>
<td>349</td>
<td>332</td>
<td>311</td>
</tr>
<tr>
<td>P*</td>
<td>0.387</td>
<td>0.15</td>
<td>&lt;0.001</td>
<td>0.125</td>
<td>0.125</td>
</tr>
<tr>
<td>RT 12h out Mean</td>
<td>253</td>
<td>245</td>
<td>238</td>
<td>249</td>
<td>253</td>
</tr>
<tr>
<td>P*</td>
<td>0.366</td>
<td>0.466</td>
<td>0.726</td>
<td>0.994</td>
<td>0.994</td>
</tr>
<tr>
<td>RT nasal out Mean</td>
<td>255</td>
<td>236</td>
<td>261</td>
<td>292</td>
<td>271</td>
</tr>
<tr>
<td>P*</td>
<td>0.066</td>
<td>0.808</td>
<td>0.313</td>
<td>0.433</td>
<td>0.433</td>
</tr>
<tr>
<td>RT 6h out Mean</td>
<td>229</td>
<td>234</td>
<td>274</td>
<td>318</td>
<td>256</td>
</tr>
<tr>
<td>P*</td>
<td>0.551</td>
<td>0.056</td>
<td>0.004</td>
<td>0.243</td>
<td>0.243</td>
</tr>
<tr>
<td>RT temp out Mean</td>
<td>238</td>
<td>258</td>
<td>274</td>
<td>277</td>
<td>265</td>
</tr>
<tr>
<td>P*</td>
<td>0.054</td>
<td>0.015</td>
<td>0.002</td>
<td>0.051</td>
<td>0.051</td>
</tr>
</tbody>
</table>

RT, retinal thickness; center, central 1 mm of ETDRS ring; 12h mid, middle upper segment of ETDRS ring; nasal mid, middle nasal; 6h mid, lower middle; temp mid, temporal middle; 12h out, upper peripheral ETDRS segment; nasal out, nasal peripheral; 6h out, lower peripheral; temp out, temporal peripheral; mean, mean value; min class, minimally classic.

* P = 0.001.
Standard methods remain FA, indocyanine green angiography (ICGA), and, increasingly, OCT. FA highlights the features of classic and occult lesion components and extravasation originating from the leaky neovascular channels in a qualitative way. However, quantitative data on leakage activity may only be estimated (e.g., as leakage area in late-phase FA). The dif-

**FIGURE 1.** (A) Fundus photograph with normal foveal reflex. (B) Horizontal B-scan image of the macula. (C) B-scan profile providing an RT graph with the curve representing the precise macular shape. (D) 3D RT map with normal foveal contour and central RT. (E) 3D surface map of RPE.

**FIGURE 2.** (A) Late-phase FA image in a patient with AMD. Focal hyperfluorescent spots with no leakage in the macular area correspond to drusen and RPE alteration. There were no signs of neovascularization. FA-OCT overlay image revealed normal thicknesses, despite the drusen. (B) HR B-scan with normal foveal contour. Focal thickening of the RPE band consistent with drusen. (C) B-scan thickness profile showing the depression of the fovea with regular shape. (D) RT map. Foveal depression in the center of the image with normal RT. (E) 3D surface map of RPE. Low and small elevations corresponding to soft drusen.
Differentiation between staining and leakage remains a substantial problem in FA-based analysis. ICGA complements FA in the diagnosis of occult lesions, where masking phenomena may prevent the visualization of the neovascular net and is less dependent on leakage as ICGA bound to albumin is kept intravascularly. In contrast, OCT offers the complementary ability of imaging the retinal structures and the level of retinal involvement by the CNV, but is compromised in terms of identifying the subretinal neovascular correlate in general and particularly with respect to the specific lesion’s composition. This deficiency is mainly based on the restrictions of conventional OCT, which offers only a limited resolution and a selected scan location with six radial scans missing information from most of the geographic areas. Many of these aspects that render conventional OCT inferior to angiography are overcome by the novel SD-OCT technology. SD-OCT offers high resolution and short acquisition times, allowing scanning of the macular area in a dense raster pattern, realistically measuring RT and reconstructing a 3D relief of the retinal condition. The novel SD-OCT should therefore compare more favorably with angiography. In this study, we evaluated the ability of 3D SD-OCT imaging to distinguish among the characteristic types of AMD, even from early changes in the neovascular disease, and to define lesion characteristics based on lesion components. The morphologic OCT findings correlated with those of conventional FA. The system (Topcon) is of the latest OCT generation with high-resolution properties, generating images with improved quality, more comprehensive retinal coverage, and more precise registration than standard OCT. In this respect, it allows improved visualization of subtle intraretinal structures as well as subretinal anatomy whereby identification of the RPE morphology including CNV-related infiltration and/or detachment add substantial information regarding the primary disease. Moreover, the pinpoint registration of the Topcon software allows a simultaneous point-by-point interpretation of every lesion with various imaging parameters, such as 3D surface and thickness maps for the retina and imaging of the RPE layer, 2D B-scans, linear profile curves, and overlay with FA images.

In the early AMD group, only discrete changes were detected, such as focal excavations on the RT map that correlated with focal elevations in the RPE map, consistent with drusen-related retinal thinning, confirmed by the single B-scan images and focal hyperfluorescent staining by late FA images. In the classic CNV subgroup, the common finding in the RT map was the specifically well-defined lesion, with steep borders and craterlike central depression (i.e., reduced retinal thickening surrounded by a rim of thickened retina). Accordingly, the 3D RPE map revealed a steep, high prominence at the level of the angiographic detection of the classic component. Retinal thickening measured at this site was substantial and had a localized peak value. The occult lesions manifested in the RT map, as well as in the RPE map as ill-defined flat convex-shaped lesions with irregular surfaces. Minimally classic lesions were perhaps the most interesting subgroup because of their heterogenous lesion composition. In this entity, the 3D RT map showed remarkable distinction of the two different components, classic and occult, with the pathognomonic characteristics shown more distinctly by OCT than by FA imaging, where masking phenomena limit the exact
delineation of the occult part. In the 3D RPE map, both components are also visible, confirming the findings in the RT map. Presumably, our results reveal the nature and localization of the occult lesions, as hidden underneath the RPE layer, since this appears to be slightly prominent, flat at the top and slowly declining toward the margins. On the other hand, the RPE CNV configuration of classic lesions (usually high and steep) may indicate breakthrough infiltration into the subretinal space above the RPE level.

Obviously, the accuracy of 3D-OCT in delineating the precise configuration of CNV, manifested in the B-scan profile or RT graphs, requires further evaluation and discussion. Nevertheless, characteristic morphologic 2D and 3D features were consistently identified by 3D-OCT: classic CNV imaged as a retinal lesion with two steep and high elevations separated by a depression in the center, which obviously represents the impact of subretinal CNV infiltration on the integrity and thickness of the overlying retina. Occult CNV was identified as a slightly elevated prominence with convex surface. With these features 3D-OCT contributes significantly to the differential diagnosis of lesion composition. As in FA, the neovascular structures are identified in location and configuration. The lesion morphology and precise extension may be delineated with superior precision by 3D-OCT which is particularly relevant for occult lesions and occult components. This more precise imaging is achieved by the ability of 3D-OCT to image with high resolution and to segment the subretinal compartment, with delineation of RPE diseases and deviations in 2D and in all locations in the 3D mode. In addition to the detailed identification of the primary underlying neovascular correlate, the secondary leakage-induced changes in the retinal morphology can be qualified and quantified by analysis of the 2D scans and the retinal map as well as the RT measurement. The RT map appears as a negative counterpart of the underlying CNV lesion. Both aspects, origin and consequence, of active CNV are delineated by 3D-OCT analysis based on an RT map and an RPE segmentation map. FA evaluation is less informative, as occult components may not be clearly detected and delineated, and the intensity and extent of the active leakage cannot be measured precisely. Moreover, OCT easily differentiates between leakage and staining as the hyperfluorescence induced by the latter represents visualization of fibrotic tissue and not edema, which appears as a thickening of the hyperreflective RPE band on OCT. Of interest, RT appears to depend on the underlying lesion composition with lower RT values for occult lesion types (Table 1). Functional retinal mapping using microperimetry has clearly shown differences in the level of functional loss among classic and occult lesion types.17 Above all, retinal function and not morphology is the key parameter for success or failure of all therapeutic modalities.

In an attempt to optimize FA in terms of determining lesion morphology and leakage activity, our group has developed TAG.18,19 Based on a confocal detection of fluorescence in a tomographic series of conventional FA, TAG provides a 3D map of fluorescence distribution (i.e., 3D-FA of CNV in early TAG and of consecutive extravasation in late-phase TAG). This identical morphology of the CNV components between 3D-OCT and 3D-TAG provides convincing evidence that the delineation of the lesion and the retinal thickening postulated for 3D-OCT are realistic. In this respect, the B-scan thickness...
profile of 3D-OCT corresponds to the fluorescein intensity profile scans of TAG. Especially in classic lesions, the RT map offers an image almost identical with that of TAG, where the borders of the lesion are steep and more prominent and gain in elevation with time, as leakage occurs predominantly in the periphery. We observed that the retina is thickened at the borders of classic CNV where the exudative activity of the membrane leads to increased leakage over time. Furthermore, the overlay images created by the Topcon software revealed increased RT or retinal volume in the segments of the ETDRS ring overlying a lesion site as demonstrated from the FA images. This was observed particularly over the classic and minimally classic components and less, if not at all, over the occult areas. Occult lesion morphology appeared flat with 3D-TAG as well as 3D-OCT.

In conclusion, 3D-OCT offers the ability to identify AMD at all its anatomic levels, in a noninvasive and practical approach. High-resolution representation of morphology and a raster mode allow measurements at all locations, with 3D imaging.

The 3D RT maps indicate the leakage activity and level of exudative retinal alteration dependent on the lesion composition. The 3D surface maps of RPE further clarify the exact level of the lesion and its “histologic” morphology in combination with the B-scan modality. The novel spectral domain technology of OCT may be able to provide clinically relevant information to complement FA in the diagnosis of neovascular AMD. In the present study, approaches used were morphologic and the results do not reflect function. Further research is essential for evaluating the capability of 3D-OCT in the follow-up of patients with AMD and in realistically determining the efficacy of novel treatment strategies in respect to impact on lesion morphology and leakage activity as well as on functional outcome.

References


