



FUTUROPHTA  
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# AMD : DRUSENOID DEPOSITS « LIPID Type », « L », « PROTEIN-CELLULAR Type », « P »:

Characterization, Evolution, Structural Analysis with MULTIMODAL IMAGING and

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MORPHOLOGY - STRUCTURAL Software

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## METHODS

### ▲ PATIENTS

178 Eyes of 94 AMD patients, 31 Men, 63 Women with AMD Drusenoid Deposits:

- "LIPID Type" ("L"): Soft Drusen, Drusenoid PED "L"
- "Protein-Cellular Type" ("P"): Subretinal drusenoid deposits (SDD), Drusenoid PED "P", Cuticular drusen, Pseudovitelliform AMD

### ▲ METHODS - FOLLOW-UP

#### ◆ MULTIMODAL OPHTHALMOLOGIC Exam

- Best refracted ETRS decimal scale Visual Acuity (VA)
- Complete ophthalmic examination with Ocular Fundus
- FAI Images, InfraRed (IR) Images ; potentially FA, ICG
- Ocular confocal tomography with spectral domain OCT, analyzed and compared Time to Time and Cut to Cut
- OCT en face « Transverse » Software

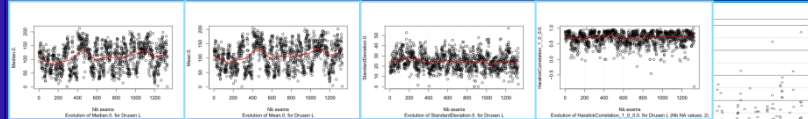
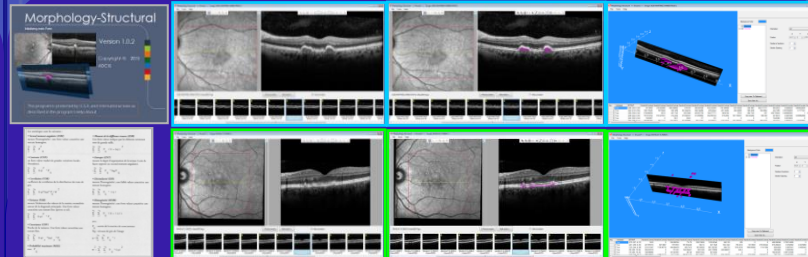
#### ◆ MORPHOLOGY-STRUCTURAL Software (M-S software) (ADCIS) let

- drusenoid deposit volume and contours analyze
- 3D deposit reconstruction, display in 3D space, volume (in  $\mu m^3$ )
- density (gray levels of deposits), (Statistics moments of pixel intensities: minimum, maximum, average, standard deviation, skewness and kurtosis) structure (structural measures, texture parameters), Haralick texture measurements for distances of 1 to 10 pixels) composition (density calculation) evaluation and characterization

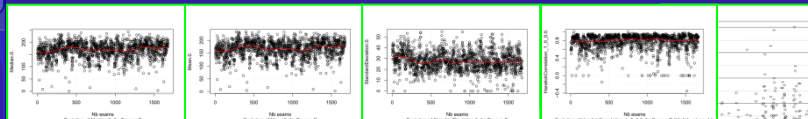
#### ◆ Lesions evaluation :

- size, characteristics, number, topography, growth way, as well as their environment above and below (particularly IS-OS, plexiform layer, choriocapillaris structure and thickness)
- Each element was studied, Compared Cut to Cut, Layer to Layer, and Time to Time to itself and to each other data

## RESULTS



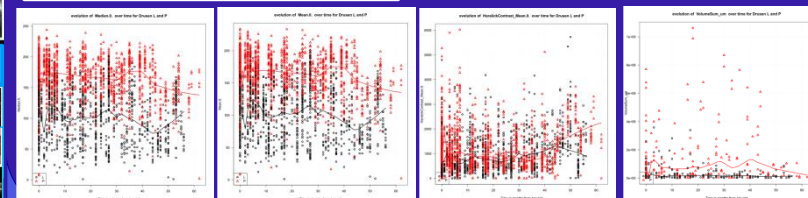
### DRUSENOID DEPOSITS « LIPID Type » « L »



### DRUSENOID DEPOSITS « PROTEIN-CELLULAR Type » « P »



### « L » - « P » Evolution



## DISCUSSION - CONCLUSION

### ► DISCUSSION

#### ● RESULTS / AF / IR / OCT / FA / ICG

- IR=clinical exam: AF=EP, structure, function and functionality
- OCT=structural retinal, cellular layers analysis; map, level (OCT en face)
- FA, ICG = dynamic, flow exploration
- Data of all exams are COMPLEMENTARY

#### ● RESULTS / OCT, en Face OCT :

- lesion characteristics, evaluation: overview, overall, front view (as FA)
- 3D study: retinal structure, layers, lesions, in all axis, above and below
- structural, morphologic study of retina tissue, layers, lesions
- comparison of the tissues, layers, per se and in between
- thickness evaluation, comparison of the layers, per se and in between and to all retina ( keeping in mind morphology- thickness/functional correlation is not complete)

#### ● RESULTS / M-S Software :

- ▲ VOLUME : - volume of each lesion (Drusenoid PED "L", "P"), each eye
- comparison, evolution of the deposit ( / patient, / time)

#### ▲ DENSITY, STRUCTURE, COMPOSITION of the deposit "L", "P"

- Average brightness ("Median" and "Mean" measurements), Haralick Correlation measurements, Haralick Entropy measurements
- Evaluation, comparison, evolution of the deposit, for itself, eye, patient
- Obvious difference between deposit "L", "P" ; well separated
- Significance of differences between deposit "L", "P" (Welch t-test)
- Possibly "L", "P" automatic classification adding other measurements
- M-S Software: reliability, relevant, characterization of deposit
- material identification mode, diagnostic way and identification of deposit
- Option to determine the composition of the Drusenoid deposit or all various kinds of material inside the deposit
- Morphology, volume, contents, modification, evolution of the material

#### ● RESULTS / DRUSENOID PED "L": (Soft Drusen, Drusenoid PED "L")

- "L" : - dark grey, dome-shaped, homogeneous, translucent,
- optically empty, Fatty, as lipid pearl drops, under the RPE
- Low density, well defined / M-S Software
- same aspect / OCT, OCT en Face
- equal and the same in all cross-section
- abnormal Pigment epithelium above, but layer quite preserved
- abnormal Photoreceptor on top too, but layer overall normal
- evolution to abnormal Photoreceptor layer, Pigment Epithelium layer (granular, irregular, less thick, thinner and thinner to disappear) so, to - ATROPHY

#### ● RESULTS / DRUSENOID PED "P":

- (SDD, Drusenoid PED "P", Cuticular Drusen, Pseudovitelliform AMD)
- "P" : - dense, white, granular, as Basal Laminar Deposit
- homogeneous, sometimes irregular, mixed, heterogeneous PED
- below Pigment Epithelium and / or just above
- Medium density, well defined / M-S Software
- same aspect / OCT, OCT en Face
- different in all cross-sections
- abnormal Pigment epithelium above, heavily unstructured layer interrupted, cells disappeared, irregular IS/OS facing
- evolution to abnormal Photoreceptor layer, Pigment Epithelium layer (irregular, granular, even disappearance, disrupted, crumbled, thicker) so, to - NEOVASCULAR COMPLICATION

#### ● COMMENTS / RESULTS :

- MULTIMODAL IMAGING : allow to - better analyze drusenoid material, characterize, differentiate, determine "L" and "P" type Drusenoid Deposit
- M-S Software : - enable - determine drusen contents, composition - discriminate "L" and "P" drusenoid deposits, modification, evolution - let become an Analyze, Follow-up, Study Drusenoid Deposit Method

- So better
  - understand the metabolic pathways
  - consider Various metabolic malfunctions,

- ▲ LIPID ▲ Cellular-Protein EthioPathogenic Pathways enrolled in their occurrence, determinism ("L": Lipid metabolic pathway disorder; "P": oxydative stress - inflammation (ROS, mitochondria, complement...))
- Drusenoid deposits "L" and "P" = Biomarker Feature

### ► CONCLUSION

Multimodal Imaging, Morphology-Structural Software contribute to, improve AMD Drusenoid deposits "L", Lipid, "P", Protein-Cellular type, study and knowledge and so AMD ethioPathogeny understanding