
Validation of RetmarkerAMD for Quantification of Early Age-Related Maculopathy Features

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TAKEAWAY

RetmarkerAMD can be used as a platform for clinical trials and epidemiologic studies

The software is an efficient tool for AMD lesion annotation that allows their quantification and localisation in each sub-field. It also denoted a good inter-grader agreement.



Validation of RetmarkerAMD for Quantification of Early Age-Related Maculopathy Features

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PURPOSE:

To validate a new computer assisted grading tool for evaluating Age-related Maculopathy Degeneration (AMD) features using digital color fundus images.

INTRODUCTION:

RetmarkerAMD-Research is a new software solution for the assisted grading of color fundus images from patients with AMD. It provides the tools for AMD lesion annotation and automatically computes lesion s number and areas, per subfield.

The system was developed and fine-tuned to process 35° color fundus images, centered on the posterior pole (Field 2).

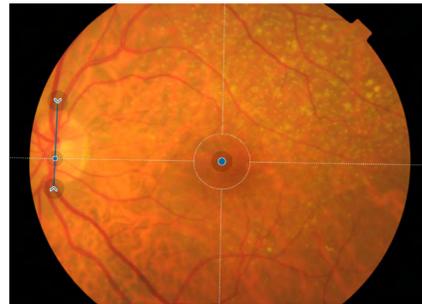


Image 1 – Calibration Computer assisted grading system

METHODS:

Fifty RE/LE 35° digital stereoscopic colour fundus images were acquired from 50 participants using a Topcon TRC- 50DX mydriatic camera. Grading of AMD features was then performed by 2 senior ophthalmologists using the RetmarkerAMD software (Critical Health SA). The International Classification Grading System guidelines was followed to assess inter-grader agreement and to validate the system.

Software Procedure

The first step of the procedure is to calibrate the image: A cursor is placed on the banks of the optic nerve and it is assumed that its average diameter is 1.5 mm. A blue dot is then placed in the center of the fovea, as seen in image 1.

The system overlay a standard grid dividing the eye fundus image in 10 sub-fields for graders geographic reference: Field 1 (central circle centered in fovea); Fields 2 to 9 (inner circles); Field 10 (outer circle).

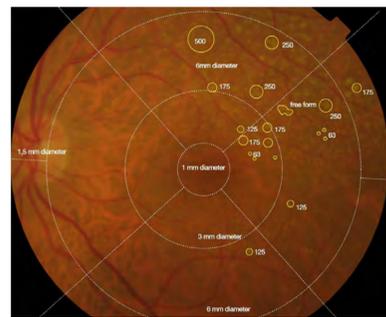


Image 2 - International Classification Grading grid

With the RetmarkerAMD software, graders are able to pinpoint (draw-over) the following significant AMD features:

- Drusens, using 5 circles with standard dimensions: C0: <63µm; C1: 63µm<125µm; C2: 125µm<175µm; C3: 175µm<250µm and C4: 250µm<500µm);
- Geographic Atrophy and Exudative Lesions using freehand drawing tools, as seen in images 3 and 4 respectively.

For each lesion type the system used a unique color-code representation.



Image 3 - Geographic atrophy

Image 4 – Wet AMD

Apart from drusens the software allows also to marked areas of hyperpigmentation (in black) and hypopigmentation (in white) (image 5).

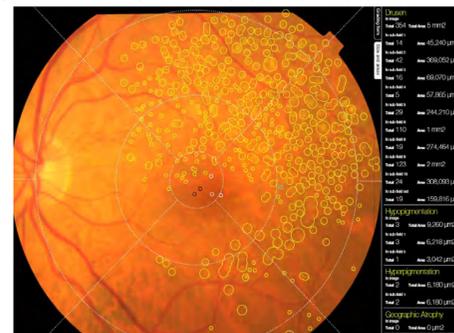


Image 5 – Drusens, hyper-and hipigmentation

Different filters can be used to better visualize certain lesions. The filter of image 6 gives a green image to detect a greater number of drusens (not visible in normal color photography).

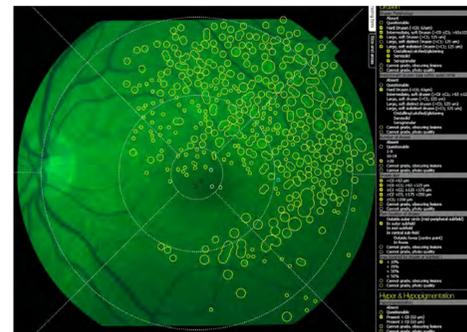


Image 6 – image with green filter

The results are displayed onscreen in real time.

Inter-Grader Assessment

The agreement between graders was tested using the Weighted Kappa coefficient.

The following parameters were considered:

- Number of drusens : None; <10; 10-19 and ≥20;
- Predominant drusen type within outer circle;
- Area covered by drusens per subfield: < 1%; < 10%; < 25%; < 50% and ≥ 50%;
- Presence or absence of hyper–and hypopigmentation, Geographic Atrophy and Exudative Lesions;
- Stage of AMD.

RESULTS & DISCUSSION:

A good agreement was found for all the parameters assed (Kappa value between 0.669 and 0.884, $p < 0.001$), except for the confluence of drusens where the agreement was weak ($p > 0.001$).

Parameter	Kappa Value
Number of drusen	0.801
Number drusens < 63	0.777
Number drusen 63-125	0.769
Number drusen 125	0.672
Predominant drusen type within outer	0.759
Total area occupied by drusens	0.716
Area covered by drusen in subfield 1	0.797
Area covered by drusen in inner circle	0.670
Area covered by drusen in outer circle	0.811
Confluence of drusens	0.220 ¹
Hyperpigmentation	NA
Hypopegmentation	0.884
Neovascular AMD	NA
Geographic Atrophy	NA
Stage ARM	0.669

¹ $p > 0.001$

The new software was more effective and less time consuming (near 35% faster), allowing the identification of more lesions (near 32% than standard manual grading system) and the reduction of human error.

CONCLUSIONS:

The RetmarkerAMD software showed a good agreement between graders and reveals to be a less time consuming and more effective tool for AMD lesions detection.

This system allows the quantification and localization of the different AMD features in the different sub-fields.

This software can be used as a platform for clinical trials and epidemiologic studies and is being used in an ongoing epidemiologic study for AMD in Portuguese population with an estimated number of 4000 participants (NCT 01298674).