Purpose

To develop an automatic method to measure the optical density of macular pigments using filtered fundus images for clinical application.

Methods

1. Input Images

- Fundus images acquired by a Zeiss fundus camera (FF450) and a special 3-band-filter
- The filter ensures equally illuminated colour channels

2. Preprocessing

- Registration of colour channels to compensate scaling due to refraction differences

3. Calculation of Optical Density of Macular Pigment (ODMP)

For each pixel in the ROI the optical density $[1, 3]$ is calculated by the following formula:

$$ODM(x, y) = -\log \left( N \cdot \frac{I_{blue}(x, y)}{I_{green}(x, y)} \right)$$

$N$ is a normalization factor

$I_{blue}$ and $I_{green}$ are the intensities of the blue and green colour channels

Reference pixels are non-vessel pixels in 6° (visual angle) distance from the center of the selected macula region

Vessel segmentation is used to exclude the vessels from the analysis.

The macula is marked manually to determine the region of interest (ROI)

4. Detection of Macula Center

- Thresholding is used to segment all the pixels above 25% of the global maximum
- Center of gravity of the segmented peak is calculated

Results

Comparison of different images of the same eye with varying illumination light intensity to test the reliability. Correlation between the curves was over 0.995 in each case.

Conclusion

A fast and reliable automatic method is presented to measure the macular pigment density using fundus images as input. The proposed method is able to extract information from fundus images, which was only available by using modified Heidelberg Retina Angiography (HRA) devices or multispectral image series [5]

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Commercial Relationship

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References