

SUPPLEMENTARY FILE _2

Assessment of corneal damage

The input of the semiautomatic method is a Region Of Interest (ROI) drawn manually by an expert on the images. The first step of the algorithm aims to detect and remove the specular reflections within the cornea region due to the illuminating light. The color images, originally represented by the common RGB (Red, Green, Blue) space, were first converted to the HSV (Hue, Saturation, Value) representation. We then extracted the brightest pixels through global thresholding in the Value channel. The spot due to the reflection has been determined as the object with the largest area among all the extracted ones. We finally excluded the specular reflection from the calculation and subtract the spot area from the total area of the cornea.

To calculate the fluorescence staining we then return to the initial RGB color representation and select the Green channel, since fluorescence from epithelial defects happens in the green region. Since many images present a non-uniform background, we corrected this effect by using a “rolling ball” algorithm. In practice, a local background value is subtracted from the original image, for removing large spatial variations of the background intensities. Once the background has been corrected, we then extracted pixels included in the fluorescence area by means of an auto local thresholding with Bernsen method [Bernsen, J. Dynamic thresholding of gray-level images. Proc. 8th Int. Conf. on Pattern Recognition, Paris, 1986, pp. 1251–1255].

Here, the threshold is computed for each pixel according to the image characteristics within a window of a certain radius around it. Objects with large area (usually located in the proximity of the ROI border) are then removed. Finally, we calculate the output of the semiautomatic method as the percentage of the fluorescent area: the ratio of the total number of extracted pixels divided by the area of the cornea, detracted by the area of the specular reflections.

The semiautomatic method outcomes were compared with those obtained by manual grading performed by three independent, experienced ophthalmologists, which used the standardized NEI grading criteria. There was a significant correlation ($R=0.78$) between the NEI grading scale and the semiautomatic measurement.