Evaluation of a Novel Optic Disc Grading Software for used in Population-based Studies

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Purpose:

To determine the validity of a novel optic disc grading software for use in population based studies and to assess its performance against the standard manual stereo grading method.

Methods:

100 optic disc images were randomly selected from the Singapore Epidemiology of Eye Disease (SEED) studies, comprising 32 Malay, 32 Indian and 36 Chinese subjects. Vertical cup-to-disc ratio (VCDR) was measured from retinal photographs using a novel semi-automated optic disc grading software (Singapore Optic Disc Assessment [SODA], jointly developed by I\textsuperscript{2}R and SERI) which is based on polynomial curve fitting algorithm for demarcation of cup and disc margins. A glaucoma specialist and an experienced grader, masked to subjects’ characteristics and clinical diagnosis measured the images independently to assess inter-grader agreement. The same grader repeated the measurement after 1 month to assess intra-grader agreement. A separate set of 85 optic disc images was randomly selected from the Blue Mountains Eye Study (BMES). VCDR of the 85 BMES images were measured using SODA and the standard manual stereo-grading method (Wisconsin protocol), performed 1-month apart by the same grader. Agreement between graders (intra and inter) and between methods were evaluated with Bland Altman plots (mean difference and limits of agreement [LOA]), intraclass correlation coefficient (ICC) and weighted Kappa statistics (K). In Kappa statistics, cup-to-disc ratios were evaluated as ordinal variables.

Results:

Using SODA, there was good to excellent inter-grader agreement (Bland Altman plot mean difference = -0.01 [95% LOA -0.13 to 0.11], ICC= 0.87 [95% CI 0.82 to 0.91], K= 0.86 [95% CI 0.80 to 0.91]) and intra-grader agreement (Bland Altman plot mean difference = -0.01 [95% LOA -0.07 to 0.09], ICC= 0.94 [95% CI 0.91to 0.96], and K =0.88 [95% CI 0.84 to 0.93]). In addition, there was excellent agreement between SODA and the standard manual stereograting method (Bland Altman plot mean difference = -0.03 [95% LOA -0.16 to 0.09], ICC = 0.94 [95% CI 0.88 to 0.97] and K= 0.92 [95% CI 0.90 to 0.94]).

Conclusions:

The agreement for the VCDR measurements between SODA and the reference standard method was excellent. Moreover, the inter- and intra-grader agreement for the VCDR measurement using SODA was also good. SODA has therefore great potential for grading optic disc images for population-based studies. With further validation, this novel software may also conceivably serve as a glaucoma screening tool in public health domain.