Comparison of automated and manual operation of an ophthalmic device

Amanda Carpenter, PhD; Andre Bender; Katharina G. Foote, PhD; Alejandro Millan; Kabir Arianta; Niranchana Manivannan, PhD; Lukas Rothmann; Jochen Straub, PhD

Carl Zeiss Meditec, Inc., Dublin, CA, USA

Poster # 3532603

PURPOSE

- Acquiring high quality ophthalmic images typically requires a trained operator in close proximity to a patient.
- Motorized alignment can enable remote operation, e.g. for physical distancing during a pandemic, while automated alignment can enable quality imaging when a trained operator is not readily available, e.g. in low-resource environments.
- We evaluated and compared manual and automated operation of an ophthalmic device on a motorized stage.

METHODS

- We acquired data on 5 healthy subjects (10 eyes) with both manual and automated operation using a prototype with an iris camera configuration from CLARUS™ 500 (ZEISS, Dublin, CA) and a 3-axis motorized stage (Fig. 1).
- The motorized stage allowed all data to be acquired with a plexiglass shield between the subject and operator for remote operation during the COVID-19 pandemic.
- Auto-alignment was achieved using custom software to align the device to the patient pupil, with real-time pupil detection via a deep learning algorithm[1].
- Auto-capture was triggered once the pupil was detected at the target location.
- We evaluated 3 metrics:
  - alignment success rate - alignments that trigger a capture
  - time to align
  - accuracy of alignment - mean distance between detected pupil center and target.

Automated alignment and capture using a real-time, deep learning pupil detection algorithm shows promise for quick, accurate, and reliable remote imaging

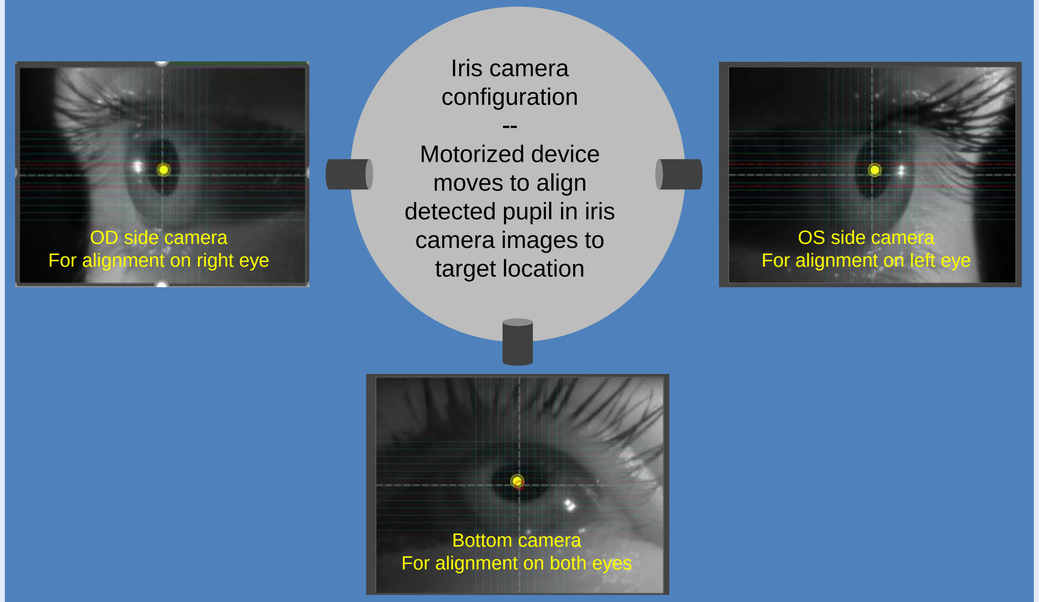

Figure 1. The device was aligned by moving a motorized stage to align the detected pupil (yellow circle) in the iris camera images to the calibrated target location (white cross-hairs).

Email: amanda.carpenter@zeiss.com

Disclosures: AC (E), AB (C), KGF (E), AM (E), KA (E), NM (E), LR (C), JS (E) – Carl Zeiss Meditec, Inc.

RESULTS

- Of 24 auto-alignments (1-3 per eye), 23 successfully triggered a capture; 1 failed due to a software malfunction.
- All 14 manual alignments (1-3 per eye) proceeded to capture.
- Mean time ± SD to align for auto-alignment (29 ± 15 s) was significantly faster than for manual alignment (72 ± 37 s).
- The accuracy of alignment was similar for auto (0.94 ± 0.59 mm) and manual (0.97 ± 0.41 mm) operation.
- Applying a two-sample t-test assuming independent populations for auto and manual results is consistent with equivalent accuracy for the two methods.

CONCLUSIONS

- This comparison of manual and automated alignment and capture for a motorized device indicated that this automated method is 2.5x faster than manual alignment, saving an average of 40 s per alignment.
- Automated operation is comparable in accuracy, and reliable on normal eyes.
- While further investigations are needed for a clinical population, this method shows promise for utility in a clinical setting.
- In settings where physical distancing is needed or expertise availability is scarce, this method provides an example of how robotic and automated methods can extend the reach of ophthalmic diagnostics.

<u>References</u>

[1]Nair et al. *IOVS* 2020; 61(9): Abstract PB0110.