

Comparison of macular thickness maps of clinical SD-OCT and a low-cost self-administered OCT system



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PURPOSE

- Macular thickness analysis (MTA) is a widely used tool for diagnosing and monitoring patients with ocular pathologies.
- Here, we compare the performance of MTA of a commercial optical coherence tomography (OCT) device and a low-cost self-administered OCT prototype, through a subjective quality assessment of macular thickness maps (MTM) and statistical comparison of macular thickness values.

METHODS

Study description:

- Participants: 18 subjects (31 eyes) with wet age-related macular degeneration (wAMD).
- Imaging devices: CIRRUS™ HD-OCT 5000 (ZEISS, Dublin, CA); low-cost OCT prototype system with self-triggered scan acquisition (ZEISS, Dublin, CA).
- Study procedure: For each eye on each scanning visit, an operator acquired one CIRRUS scan and subjects were asked to self-acquire OCT scans with the prototype system.
- The prototype system captured 5.78 mm x 5.78 mm OCT volumes with 512 A-scans/B-scan, 128 B-scans and 2.77 mm of depth.
- For each case, the resulting OCT volumes were segmented to delineate inner limiting membrane (ILM) and retinal pigment epithelium (RPE). The segmentation was used to generate macular thickness maps.
- The low-cost thickness map was registered to the CIRRUS map and the ETDRS grid was centered on the CIRRUS scan.

Grading description:

- Three independent expert graders (optometrists) were asked for a subjective quality assessment of MTM generated by both systems.
- A correlation study and Bland-Altman analysis were used to compare the two groups of MTM.

CONCLUSIONS

This study demonstrates the ability of our low-cost OCT prototype to measure macular thickness with similar performance to that of a commercial OCT system for wet AMD monitoring.

RESULTS

- Quantitative and qualitative comparison between MTM of both systems, majority agreement (2 out of 3 graders) along with the survey questions are shown in Table 1.
- In 87.5% of cases, the graders agreed that the MTM quality of low-cost prototype is similar to the CIRRUS HD-OCT system.
- In 85% of cases, the graders agreed that they reach the same conclusion on fluid leakage of wAMD patient using MTM of both systems.
- Bland-Altman analysis shows the mean differences in macular thickness measured range between -5.8 μm and 7.8 μm and R^2 values vary between 0.91 and 0.98 depending on the sector.

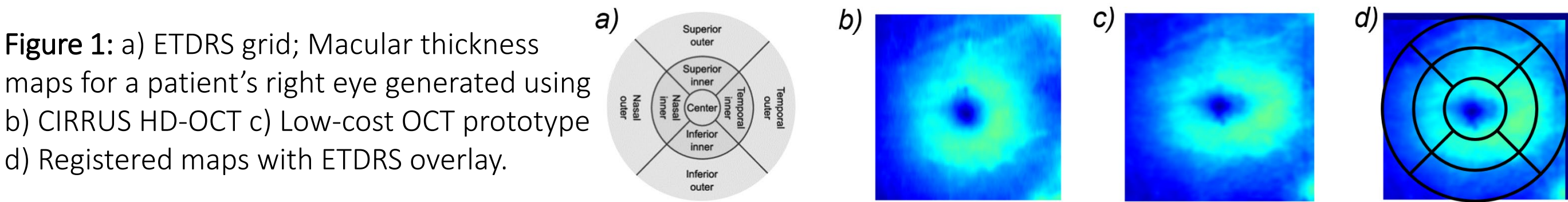


Table 1: Quantitative and qualitative comparison of 40 pairs of MTM generated by both OCT systems.

Statistical comparison of both OCT systems for each ETDRS grid			
ETDRS sector	R^2	Regression slope and intercept	Mean difference (um)
Central	0.91	1.04 x - 10.40	-1.20
Inner Inferior	0.98	1.00 x – 3.00	-1.70
Inner Nasal	0.96	0.99 x – 2.00	-5.80
Inner Superior	0.98	0.99 x + 1.54	-2.40
Inner Temporal	0.96	0.93 x + 16.20	-4.10
Outer Inferior	0.97	1.01 x + 0.77	2.80
Outer Nasal	0.94	0.97 x + 8.33	1.00
Outer Superior	0.98	0.97 x + 8.09	0.84
Outer Temporal	0.95	0.98 x + 12.10	7.80
Qualitative comparison of MTM on both OCT systems			
Question: Do you think MTM of low-cost OCT prototype is comparable with MTM of CIRRUS? (5: Yes, with high confidence; 4: Yes, with low confidence; 3: Neutral, can’t assess; 2: No, with low confidence; 1: No, with high confidence)			
Answers: 87.5% Yes, 12.5% No			
Question: Do you think by using MTM of low-cost OCT prototype, you get to the same conclusion as using MTM of CIRRUS on fluid leakage of wAMD patient? (5: Yes, with high confidence; 4: Yes, with low confidence; 3: Neutral, can’t assess; 2: No, with low confidence; 1: No, with high confidence)			
Answers: 85% Yes, 15% No			

