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Comparing reading performance in toric vs. best-sphere correction of patients with astigmatism: preliminary results

Sotiris Plainis,

Gleni A and Tsilimbaris MK

Laboratory of Optics and Vision (LOV), University of Crete

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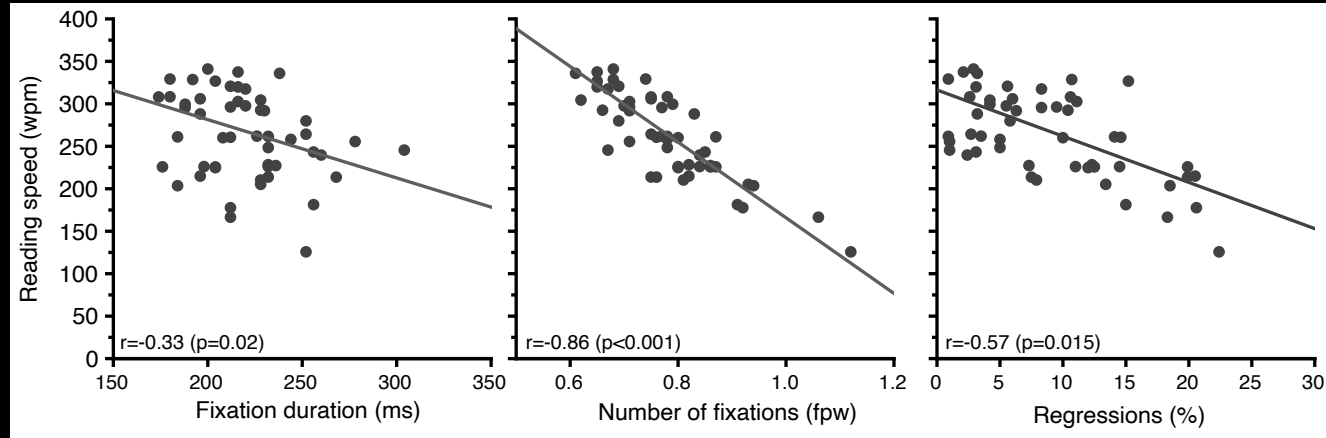
Functional vision measures and reading performance

- Standard test of VA offers limited value as an endpoint for evaluating functional vision – usually **overestimates** visual performance.
- Alternative visual function measures have been utilised (e.g. contrast sensitivity, reading acuity, reading speed)
- **Reading efficiency** is a robust predictor of academic success and vision-related quality of life.
- **Difficulty in reading** remains the **most common** (60%) complaint among low vision patients.
- **Reading performance** could form a primary outcome **of functional vision** in clinical trials.

Reading skill and eye movements

- When reading, eyes make a sequence of **fixations** and small but fast **saccades** that accurately “guide the eyes” such that new information falls on the fovea.
- Information is acquired only during eye **fixations** (the period of time when the eyes are relatively still) which typically last 200-250 ms
- A characteristic reading signature emerges from the number of **fixations**, the **regressions** (backward saccades) and **fixation duration**.

N=53, age 46-62, best-corrected for near



Aim of the study

- To investigate the effect of toric vs. best sphere contact lens (CL) correction in patients with low astigmatism, by evaluating reading speed and oculomotor indices.
- To assess “adaptation” and/or “fatigue” effects following 10 minutes of sustained reading.



Methods

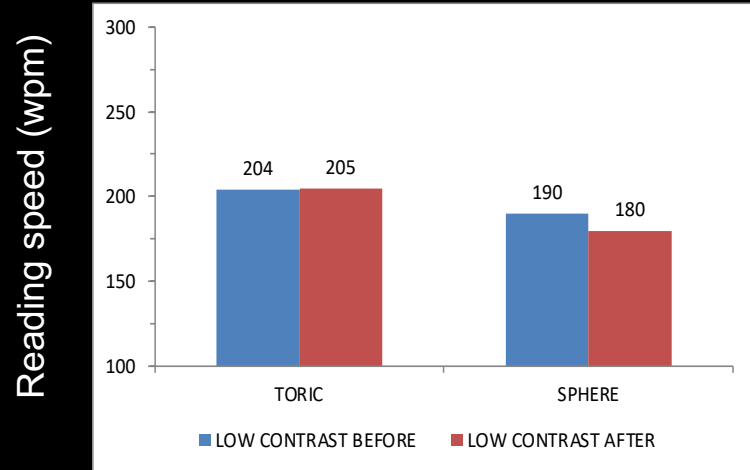
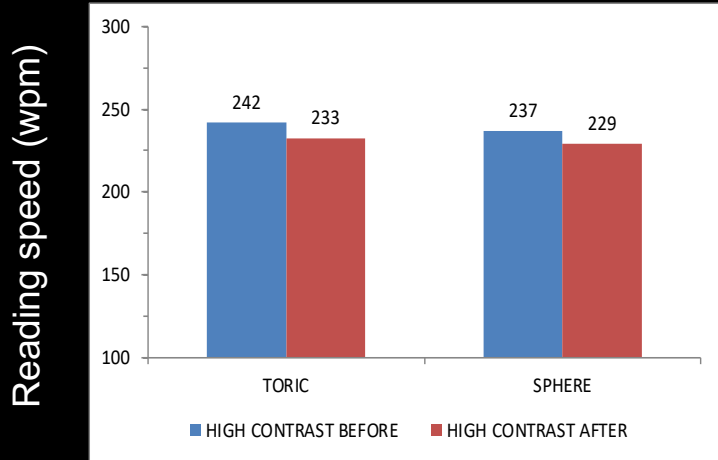
- N=19/25 (age 30 \pm 8 yrs, range 18-42) – myopic astigmatism (cyl: -1.00 \pm 0.37 D)
- Silent reading - IReST paragraph (~140 words, 0.4 logMAR at 40 cm)
- Infrared 500 Hz eye tracker (EyeLink II, SR Research Ltd).
- Binocular near reading performance: **Toric** vs. **sphere** lens
- Two contrast levels (**100% vs. 10%**), **before** vs. **after** 10 min of sustained reading
- Data analysis included computation of reading speed, number of fixations, fixation duration, and percentage of regressions (*also fixation duration parameters μ and τ*)



Ο κάστορας είναι εξαιρετικός κολυμβητής. Μέσα στο νερό μπορεί να κινηθεί με ταχύτητα έως επτά μίλια την ώρα. Η προστασία του από το κρύο περιλαμβάνει ένα δέρμα με χιλιάδες τρίχες και ένα παχύ στρώμα λίπους. Χάρη στα μεγάλα πνευμόνια του μπορεί εύκολα να μείνει κάτω από το νερό για περισσότερα από είκοσι λεπτά. Ο κάστορας δεν είναι μόνο ικανός στο να κόβει δέντρα, αλλά είναι επίσης ένας τεχνίτης έμπειρος στην κατασκευή φραγμάτων. Όταν ο κάστορας κόβει ένα δέντρο, ροκανίζει τον κορμό με τέτοιο τρόπο ώστε το πάνω και το κάτω μέρος του κορμού να συνδέονται μεταξύ τους μόνο σε ένα μικρό σημείο. Όταν η σύνδεση είναι στενή και ο κάστορας έχει κουραστεί, ο άνεμος κάνει τα υπόλοιπα. Ο κάστορας κόβει τα πιο μικρά κλαδιά και τα συγκεντρώνει κοντά στη φωλιά του, η οποία είναι χτισμένη πάνω σε ένα μικρό νησί. Ξεχωρίζει τα πιο χοντρά κλαδιά και τα χρησιμοποιεί ως ξύλο για την κατασκευή φραγμάτων.

Results: reading speed (high/low contrast)

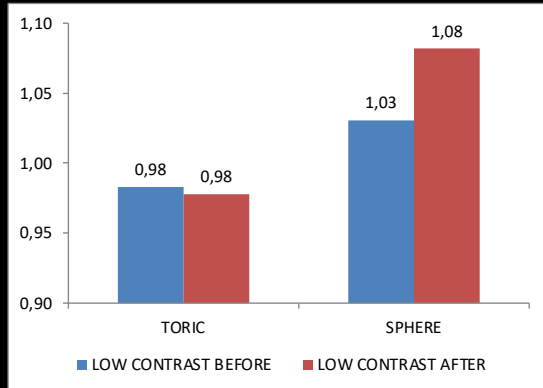
- Reading speed with **toric vs. sphere** correction is statistically significant faster only at **low contrast**
- The effect is **more pronounced** following 10 minutes of sustained reading



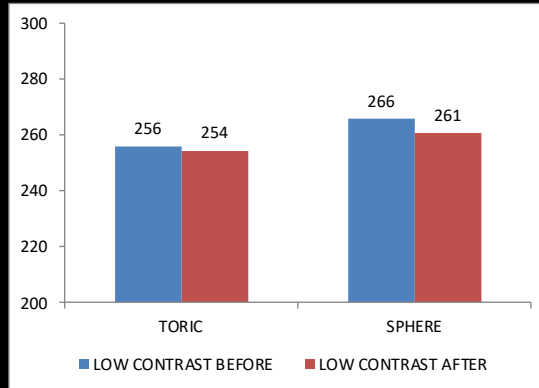
Results: eye movement parameters (low contrast levels)

- The advantage in reading speed of **toric vs sphere** correction at low contrast is mainly due to a statistically significant difference in the **number of fixations**, which is more evident following 10 minutes of sustained reading.

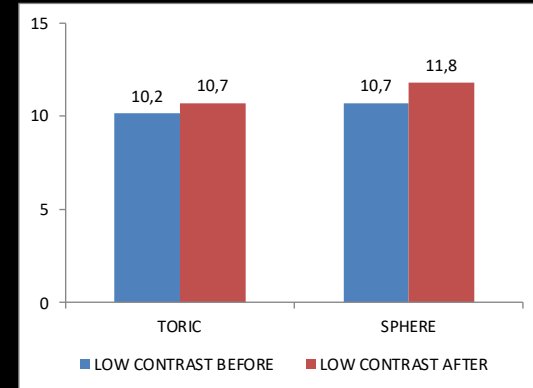
Fixations number (fpw)



Fixations duration (ms)



Regressions (%)



Conclusions

- A statistically significant improvement in reading speed was found in patients with astigmatism **at low contrast** when corrected with toric compared to best-sphere CLs.
- The difference in reading speed between **toric vs sphere correction** is more pronounced following 10 minutes of sustained reading on a tablet and is mainly due to the higher number of fixations with sphere CL correction.
- Evaluating reading performance using eye fixation analysis offers a competent tool of reading efficiency and a reliable clinical measure of functional vision.

sotirisplainis.gr

plainis@uoc.gr