Perceptual Training on Mobile Devices Is Effective for Overcoming the Effects of Aging on the Human Eye

Tova Ma-Naim1, Uri Polat1,2, Maria Lev1, Oren Yehezkel2,3, Anna Sterkin1,2

1 Faculty of Medicine, Goldschleger Eye Research Inst, Sheba Medical Center, Tel Aviv University, Israel 2 Ucans, Inc., New York 3 School of Optometry and Helen Wills Neuroscience Institute, UC Berkeley, Berkeley, CA, USA

Introduction

What is presbyopia?
Presbyopia, the Greek word for aging eye, is an age-related near vision impairment:
• the first-reported effects of presbyopia occur between 42–44 years of age
• everyone is affected by the age of 51
• common solution is reading glasses or bifocals

Presbyopia causes a decline in contrast sensitivity and processing speed.
Perceptual learning improves vision and restores visual deficits (Polat et al., 2004, 2008, 2009; Fahle 2002; Sagi & Tanne, 1994).

Our recent study used structured perceptual learning to improve near vision by improving contrast sensitivity, discrimination and processing speed, with no changes in either of the optical functions: pupil size, accommodation or depth of focus!

Methods

Training improves temporal and spatial processing.

PC & iPhone users.
Divided into two subgroups.
1. Early Presbyopic Stage
2. Advanced Presbyopic Stage

Contrast sensitivity

Reading speed gain

Eye age gain
Despite the expected deterioration, the biological “eye age” has decreased from 50.5 to 41.9 (8.6 years)

RESULTS

Early Presbyopic Stage

Advanced Presbyopic stage

Electron ica

iPhone users are Early Presbyopic Stage subgroup and had better initial visual function, and very similar vision to the young control group after the training.

Contrast sensitivity improved significantly in all spatial frequencies.

Eye functions

No changes in either of the eye functions, from 33 cm, 40 cm and 3 m

Effective sensitivity range

Age gain
The mean visual acuity was reduced from 6 to 5.9 logMAR, equivalent to 4–5 years of additional use of presbyopic glasses, which is similar to the young control group after the training.
The biological “eye age” has decreased from 37 to 32.

Effective range

The biological “eye age” has decreased from 37 to 32.

Conclusions

• Our training method is effective in improving visual functions in people with presbyopia by enhancing the image representation in the brain
• Smartphones and mobile devices can be used as an effective solution for training near visual functions
• There is enough plasticity in the adult brain
• Collinear facilitation induces cortical plasticity that improves neural processing
• Perceptual learning can overcome and/or delay the unwanted effects of presbyopia
• Perceptual changes occur due to changes in the brain and not in the optics of the eye

REFERENCES


