THE EFFECT OF DIOPTRIC BLUR ON READING PERFORMANCE
MONOCULAR vs. BINOCULAR NEAR VISION

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1. Background
Reading is often used as a surrogate measure for other activities of daily living, which are less easily measured, and characterises functional vision (1). Although the effect of uncorrected refractive error (2) or induced blur (3) on spatial vision, i.e. letter acuity and contrast sensitivity, is well established, little is known about the systematic impact of blur on reading performance (4). The purpose of this study was to investigate the effect of dioptic blur on reading performance, in a group of normally sighted presbyopes.

2. Methods
Sixteen healthy presbyopes (mean age: 59 ± 8 years; mean addition: 2.21±0.34 D) participated in the study. Reading performance was evaluated using three versions of high-contrast Colenbrander cards (5) in Greek language (Precision Vision, US).

i. In-focus: Wearing best spectacle spherico-cylindrical correction for near (40cm).
ii. -0.50 D blur: induced by negative lenses over the best near correction (corresponding to 0.50D under-correction for near)
iii. 1.00 D blur: induced by negative lenses over the best near correction (corresponding to 1.00D under-correction for near)

For each condition, participants read aloud sentences on one of these charts, from large to small print. Reading time for each sentence was recorded and converted to:

i. Reading acuity: the smallest print in logMAR that the participant can read
ii. Maximum reading speed: the participant’s reading speed when reading is not limited by print size
iii. Threshold print size: the print size that corresponds to an 80% of the maximum reading speed and

iv. “Newsprint” reading speed: the participant’s reading speed at 0.4 logMAR (average newsprint) print size.

Measurements were counterbalanced. Pupil size (under binocular viewing) was measured with an infra-red camera. General Linear Model, ANOVA and post hoc analysis Bonferroni were performed using IBM SPSS Statistics 19.

3. Reading Speed as a function of letter print size

Reading Speed remains fairly constant for large print sizes, gradually decreasing as print size was getting smaller. Maximum Reading Speed is minimally affected by blur (p=0.19). No difference between binocular and monocular reading exists (p=0.50)

4. “Newsprint” Reading Speed

Newsprint Reading Speed was significantly affected by dioptic blur (p=0.007)

No statistically significance difference between binocular and monocular vision was found (p=0.16)

5. Reading Acuity

There was a significant difference in Reading Acuity:

- with dioptic blur (p=0.001)
- with dioptic blur – monocular vision (p=0.008)
- between binocular – monocular vision (p=0.008)

6. Threshold Print Size

Threshold Print Size was significantly affected:

- with dioptic blur (p<0.001)
- between binocular – monocular vision (p=0.02)

7. Conclusions

Defocus blur (corresponding to under-correction for near vision) adversely affects reading performance:

- Reading Acuity is adversely influenced
- Threshold Print Size is increased in order to have comfortable reading
- Reading Speed for “newspaper” letter print is reduced

These effects reach statistical significant level for amounts optical blur > 0.50D.

Binocular vision ameliorates the effect of blur on reading performance.

Preliminary analysis shows that the effects of blur on reading acuity and threshold print size are also influenced by the amount of addition needed for each participant but not by his pupil size.

9. References

5. Precision Vision (www.precision-vision.com)

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