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Contrast imbalance and its impact on stereoacuity in keratoconus? | IOVS

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Contrast imbalance and its impact on stereoacuity in keratoconus?

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Abstract

Purpose : Profound losses in stereoacuity have been documented earlier in bilaterally asymmetric keratoconus. This study determined whether 1) these losses can be explained by imbalances in retinal image contrast between the two eyes, arising from the underlying interocular differences in disease severity (Experiment 1) and 2) correction of the contrast imbalance restores stereoacuity in these subjects to the level of healthy controls (Experiment 2).

Methods : In Experiment 1, the magnitude of contrast imbalance of 50 cases with bilaterally asymmetric keratoconus (11 to 31yrs) with spectacles was determined from the symmetry of interocular rivalry switches of dichoptically-presented orthogonal Gabor patches with 5cpd and 1.5cpd carrier spatial frequency. The stimulus contrast attenuation required in the stronger eye (as judged by greater value of D-index), relative to 100% contrast in the weaker eye, to achieve this symmetry was considered a measure of this contrast imbalance. In Experiment 2, random dot stereoacuity of 40 cases with bilaterally asymmetric keratoconus (16 to 32yrs) was measured at baseline, at the contrast balance point and at 20% below and above the contrast balance point using standard adaptive staircases.

Results : The magnitude of contrast imbalance was positively correlated with increasing interocular difference in D-index ($r=0.74$, $p<0.001$). The magnitude of contrast imbalance was significantly greater for 5cpd than for 1.5cpd stimulus ($p<0.001$). Stereoacuity was positively correlated with the extent of contrast imbalance in these cases ($r=0.47$, $p<0.002$). Contrast balancing improved stereoacuity by a median value of 34.6% (19.0-65.1%), independent of baseline stereoacuity (261.3-1257.3arc sec) or contrast imbalance levels ($r<0.2$, $p>0.26$ for both). Contrast bias towards the weaker eye (239.6-1707.6arc sec) produced a greater loss of stereoacuity than bias toward the stronger eye (181.9-1161.4arc sec) ($p=0.001$).

Conclusions : Contrast imbalance scales with the magnitude of interocular difference in keratoconus severity, more so for higher than lower spatial frequencies. Stereoacuity partially improves with contrast balancing in keratoconus. Results of the contrast biasing

experiment indicate that cyclopean viewing may be weighted more towards the input from the stronger eye in keratoconus, independent of its contrast strength.

This abstract was presented at the 2022 ARVO Annual Meeting, held in Denver, CO, May 1-4, 2022, and virtually.

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