The influence of short-term intraocular pressure elevation on peripapillary choroidal thickness in young adult myopes and emmetropes

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PURPOSE

• Myopia results in changes to the eye’s biomechanical properties, particularly within the posterior pole, where the ocular tunicas are thought to become thinner and may be more easily deformed by normal ocular forces such as intraocular pressure (IOP).1
• Acute elevations in IOP have been shown to increase axial length2 and optic cup dimensions,3 and decrease choroidal thickness4; structural changes which are also associated with myopia.
• High resolution optical coherence tomography (OCT) has allowed for investigation of biomechanical changes in the optic nerve5 and peripapillary choroid6 in vivo in response to IOP elevation in older glaucomatous eyes, but the effects in younger myopes have not been assessed.
• This research examines the influence of brief IOP elevation on peripapillary choroidal thickness (PPChT) in young adult myopes and emmetropes using Spectralis enhanced depth imaging OCT.

METHODS

• 39 participants (20 myopes, 19 emmetropes, mean age 21 ± 2yrs) had measures of IOP and PPChT taken before, during, and after a short period of mechanically induced-IOP elevation.
• Following a 10min distance viewing task, baseline IOP measurements (taken with rebound tonometry) and chorio-retinal images of the peripapillary region were obtained.
• Transpalpebral ophthalmodynamometry was then performed, with 30-35Pa of pressure applied to the globe for 2-3min while IOP measures and OCT scans were repeated (Figure 1).
• The ophthalmodynamometer was then removed and a final set of IOP measures and OCT scans were obtained.

RESULTS

• Ophthalmodynamometry gave a significant (p<0.05) mean increase in IOP (+12 ± 4mmHg), which was greater in the emmetropes (+14 ± 4mmHg) compared to the myopes (+11 ± 3mmHg), and then a reduction in IOP below baseline levels following removal of the probe (Figure 2A).
• Mean PPChT decreased significantly (~7 ± 4µm, p<0.001) during IOP elevation, with the emmetropes exhibiting significantly (p<0.05) greater mean choroidal thinning (~9 ± 5µm) compared to the myopes (~6 ± 4µm) (Figure 2B).

CONCLUSIONS

• When examining the change in PPChT based on annular distance from Bruch’s membrane opening (BMO), the 1.0 (~8 ± 4µm) and 1.5mm (~9 ± 5µm) annuli thinned significantly more than the 0.5mm annulus (~5 ± 6µm) during IOP elevation (p<0.05) (Figure 3).
• Analysis of covariance revealed a significant negative association between the changes in IOP and PPChT (p<0.001, r² = 0.623, slope β = −0.53), with no significant difference in the rate of change in PPChT with IOP between refractive groups.
• Short periods of mechanically-elevated IOP are associated with significant decreases in PPChT in young adults, which are greater with increasing distance from BMO.
• Since choroidal thinning has been reported to precede the development of permanent axial elongation and myopia in both humans7 and animals,8 it is possible that increased IOP during emmetropization may play a role in the myopia development process.
• Longitudinal investigation of ChT and IOP prior to myopia onset and progression is necessary to establish a link with permanent eye growth.

REFERENCES