The effect of an cycloplegic agent on the objectively and subjectively determined refraction

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Purpose
Cycloplegic agents are effective in the reduction of myopia, while the exact mechanism is unknown. One theory on their mode of action is the reduction of the tonic accommodation in myopes during distance vision. The aim of the study was to prove the presence as well as the amount of tonic accommodation in myopes and non-myopes using objective and subjective methods.

Methods
• 44 subjects with a mean age of 25.4 ± 3.4 years participated in the study course, with 26 subjects classified as myopes (mean subjective SE -2.45 ± 1.45D) and 18 subjects classified as non-myopes (mean subjective SE 0.9 ± 1.5D)
• Refractive errors were measured subjectively and objectively before and after an cycloplegic agent was administered (3 drops of 1% Cyclopentolat with ten minutes in between).
• Subjective refraction (using letters as optotypes in a distance of 5m) was performed by using a trial frame and trial lenses with a 4mm artificial pupil and following the rule “maximum plus power for best visual acuity”
• Three readings of the objective refraction were obtained using the ZEISS i.Profiler plus (Carl Zeiss Vision GmbH, Germany) and the median reading was used to calculate the refraction from the Zernike polynoms for a pupil diameter of 4mm.
• Objectively and subjectively measured refractive errors were evaluated for changes in the spherical error (S), the power vectors M (spherical equivalent), J0, J45 and the blur strength B (difference in power matrix between post- and pre-cycloplegic refraction).

Results

Objective measurements
• More hyperopic refractions were observed for S, M and B in myopes (n=26) and non-myopes (n=18)
• For both groups, changes in objectively determined J0 and J45 were minor and lacked statistical as well as clinical significance.

Subjective measurements
• A statistical and clinical significant shift towards more hyperopia was observed in non-myopes (n=18) for S, M and B
• Observed changes in myopes (n=26) towards a more hyperopic refraction were statistical significant for S, M and B – but lacked clinical significance

Discussion
• Hyperopic changes in the objectively determined refraction, when assessed under cycloplegia, where reported before and are most likely caused by instrument myopia.
• When refraction was assessed subjectively, significant changes were observed for S, M and B in non-myopes, these (young) persons seem to be used to accommodate during distance vision.
• In the myopic group, observed changes in the subjective refraction for S, M and B were statistical significant but lack any clinical relevance (since the changes are less than 0.5D) – also individual changes were up to 1D.
• The effect of an cycloplegic agent should be taken into account when interpreting refraction measurements for the prescription of spectacles, planning a wavefront-guided laser ablation or cataract surgery.

Next Steps
Individual changes towards more positive readings in myopes (range 0.25D – 1D) give evidence that some subjects show a tonic accommodation during distance vision, therefore we will further study the plasticity of accommodation in myopes and compare the findings to non-myopes.

References

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