HOW ACCURATE IS ACCOMMODATION THROUGH BIFOCAL SOFT CONTACT LENSES?

5596

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INTRODUCTION

Based on the premise that the development of myopia is associated with poor accommodation during near tasks, both bifocal spectacles and progressive addition lenses have been investigated in several studies as a means to slow the rate of progression. The purpose of this study was to investigate the effect of bifocal soft contact lenses on the accommodation of young adult emmetropes and myopes. The effect of bifocal contact lenses on accommodation was compared to that of single vision distance contact lenses and single vision near contact lenses. Bifocal contact lenses are a potential alternative to progressive addition spectacles as a myopia control treatment.

METHODS

A Grand-Seiko refractometer was used to measure the accommodation responses of 35 young adult subjects (mean age: 22.8 ± 2.54 years); ten were emmetropic (mean spherical equivalent refractive error: -0.09 ± 0.42 D) and 25 were myopic (mean spherical equivalent refractive error: -3.06 ± 1.36 D). Accommodation was measured for 4 different target distances: 100 cm, 50 cm, 33 cm and 25 cm, with each of 3 different types of corrections: single vision distance contact lenses (SVD), bifocal contact lenses (BF; +1.50 D add) and single vision near contact lenses (SVN; +1.50 D added to the distance prescription). The SVN lenses were included as a comparison as it is likely that the effective add of the BF lenses varied between subjects.

A maltese cross was used as the accommodation target. Binocular and monocular measurements were made with the SVD and SVN lenses. Monocular measurements only were made with the BF lenses because the power of the lens is not uniform. For monocular measurements, the dominant eye viewed the target and measurements were made on the non-dominant eye through an infrared filter (700 nm) used to occlude the eye being measured. Accommodation responses were measured with :

- SVD lenses on both eyes
- SVN lenses on both eyes
- BF lens on one eye (viewing the target) and SVD lens on the other eye (being measured)

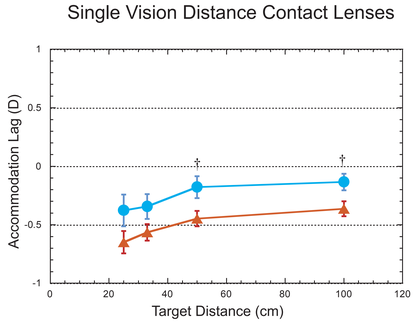
The lag of accommodation was calculated for each target distance from the accommodation demand and the accommodation response, adjusting for the compensation offered by the lenses. For example, at 50 cm:

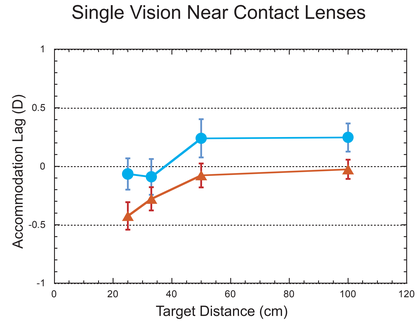
- SVD lag = -2.00 D - accommodation response
- SVN or BF lag = -0.50 D - accommodation response

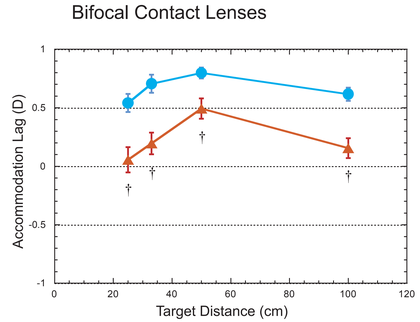
Positive values indicate over accommodation and negative values indicate under accommodation.

RESULTS

Single vision near and bifocal contact lenses reduce accommodation lag

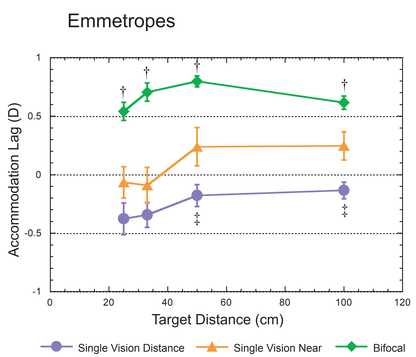


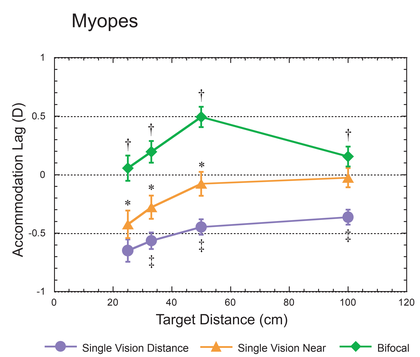




†□ denotes significant differences (p < 0.05)

Emmetropes show less lag/more lead than myopes





†□ denotes significant differences for SVD vs BF and SVN vs BF
‡□ denotes significant differences for SVD vs SVN
□ (Tukey-Kramer $\alpha_{FW} = 0.05$)

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‡□ denotes significant differences for SVD vs SVN
*□ denotes significant differences for SVN vs BF
□ (Tukey-Kramer $\alpha_{FW} = 0.05$)

†□ denotes significant differences (p < 0.005)
□ (Aspin-Welch unequal variance t test)

CONCLUSIONS

There were 3 main outcomes:

- myopes tend to accommodate less than emmetropes
- BF contact lenses, like SVN lenses, reduce accommodative demand
- all subjects appear to over accommodate with BF contact lenses, at all distances

The latter result may represent an artifact of the lens design because the SVN lenses resulted in leads of accommodation for 2 distances only. While BF contact lenses are an effective method of reducing accommodative effort, whether they also improve the accuracy of accommodation remains to be resolved.

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