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EFFECTS OF CENTER-DISTANCE MULTIFOCAL SOFT CONTACT LENSES WITH DIFFERENT OPTICAL ZONES AND ADDITIONS ON HOAs, ACCOMMODATION AND NEAR PHORIA IN MYOPIC YOUNG ADULTS.

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INTRODUCTION

An off label use of soft multifocal contact lens was investigated in several studies for its possible role on myopia control.[1-5] More effective results were found with centre distance design(CD)[1-3] for its possible role inducing peripheral myopic defocus,[2,3,7-10] increase of positive spherical aberration,[4] reduction of LAG of accomodation[11] and a near phoria shift in exo direction[5]. It is important to remember that multifocal contact lenses are designed to guarantee the best effect on presbyopic eyes and their performance can be different in young eyes with bigger pupillary diameter[1] and lower positive spherical aberration.[16]

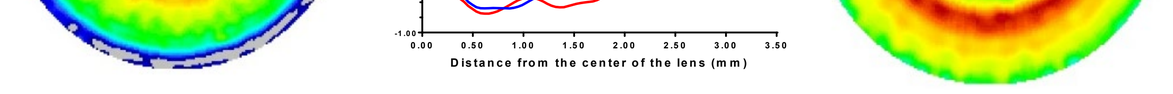
PURPOSE

The purpose of this study was to investigate the effects of a CD soft multifocal contact lens with different additions and central optical distance zones (CODZ) on:

- *high order aberrations (HOAs)*
- *Strehl ratio*
- *high and low contrast visual acuity*
- *near phoria*
- *accommodative response*

METHODS

Fifteen young adults (range age 20–26 yrs) with refractive error, similar in both eyes, of -0.50 to -5.00D a refractive astigmatism less than 0,75D, a LAG of accommodation >0,50D and a pupillary diameter bigger than 6 mm in dim light were selected. Using a Hartmann-Shack aberrometer (KR-1W Wavefront Analyzer, Topcon) ocular wavefront aberrations were measured in RE along the line of sight and RMS of coma (C(3,-1) and C(3,1)), spherical aberration (SA) (C(4,0)) and HOAs for a pupillary diameter of 4 mm and 6 mm considered for the study. With the best compensation of refractive error obtained with a single vision soft CL with aspheric optics to reduce the SA induced by the lens (MyDay, CooperVision) baseline objective optical quality and high (HCVA) and low (LCVA) contrast visual acuity were evaluated. Objective optical quality was measured for a pupillary diameter of 4 mm using a double pass instrument (HD Analyzer, Visiometrics) considering the Strehl ratio (SR). HCVA and LCVA (25% Michelson) were evaluated in dim light with a logMAR Bailey-Lovie test chart white letters on a black background to increase the pupillary diameter during the measurements. We measured also at 33 cm the binocular accommodative response using the Nott dynamic retinoscopy and the near phoria using a modified Thorington card. All measurement were repeated using a custom made soft multifocal CL (RELAX, SwissLens) with two different integrated additions (+1.50/+2.50D) introduced by a peripheral polynomial progression and two CDOZ (3.50/4.50 mm). All lenses were realized in GM3 58% (Contamac Ltd), OAD 14.2 mm, BC 8.60 mm with the distance power selected to obtain best HCVA.



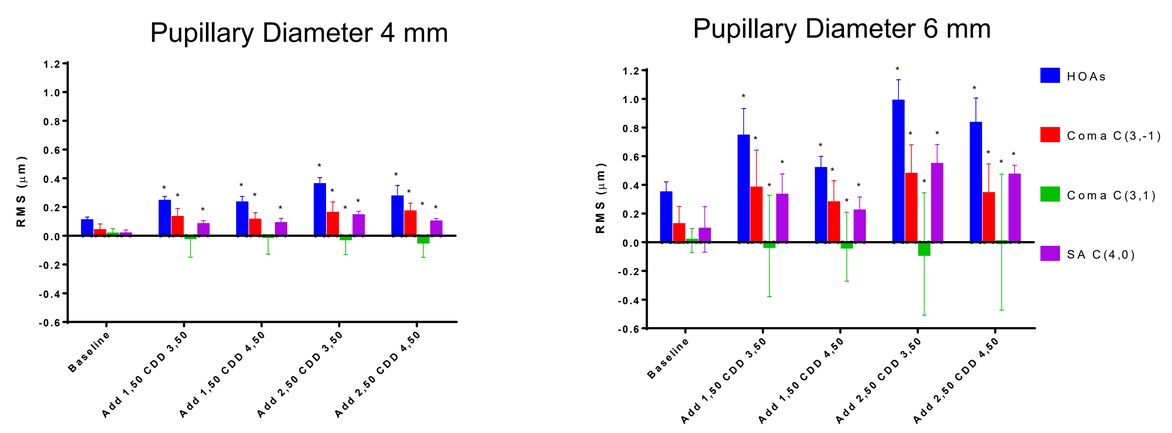
ADD 2,5 D CDOZ 3,5 mm | **Optical profile** | **ADD 2,5 D CDOZ 4,5 mm**

Power maps and optical profiles of contact lenses under study obtained with the Contest Plus instrument (Rotlex)

RESULTS

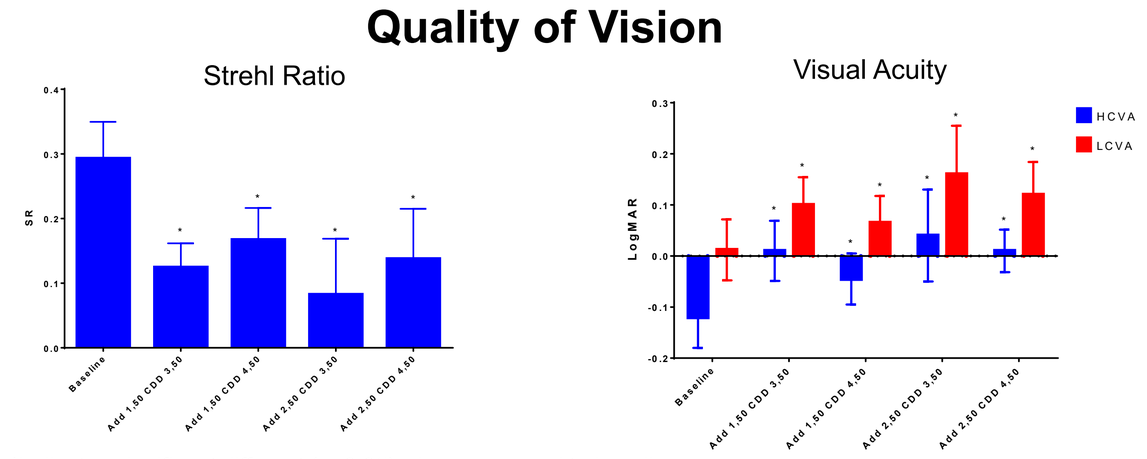
The subjects had an average age of 22.5±2.3 (mean ±SD) years, in their right eyes an average SE of -2.45±1.42D and an average pupillary diameter of 7.05±0.25 mm. To assess the effects introduced by CLs evaluated in respect to baseline a Student t-test for paired data was used and a p-value <0.05 was considered statistically significant. The baseline HCVA and LCVA were -0,12±0,08 logMAR and -0,01±0,05 logMAR respectively. All CLs reduced their values for both ADD and CDOZ. From baseline SR reduced significantly (p<0,05) from 0,29±0,26 with every CL used with a higher effect with CDOZ 3,5 mm. A positive shift of vertical coma and SA with CLs was found with both pupillary diameter considered. For 4 mm pupillary diameter the higher effect was associated to CCD 3,5 and add 2,50D CL. For 6 mm pupillary diameter the higher effect was associated to CDOZ 4,5 and add 2,50D. The baseline near phoria and LAG of accomodation were +0,75±3,38Δ and -1,00±0,25D respectively. An exophoric shift of near phoria and a reduction of LAG of accommodation was found just with 2,50D add.

HOAs



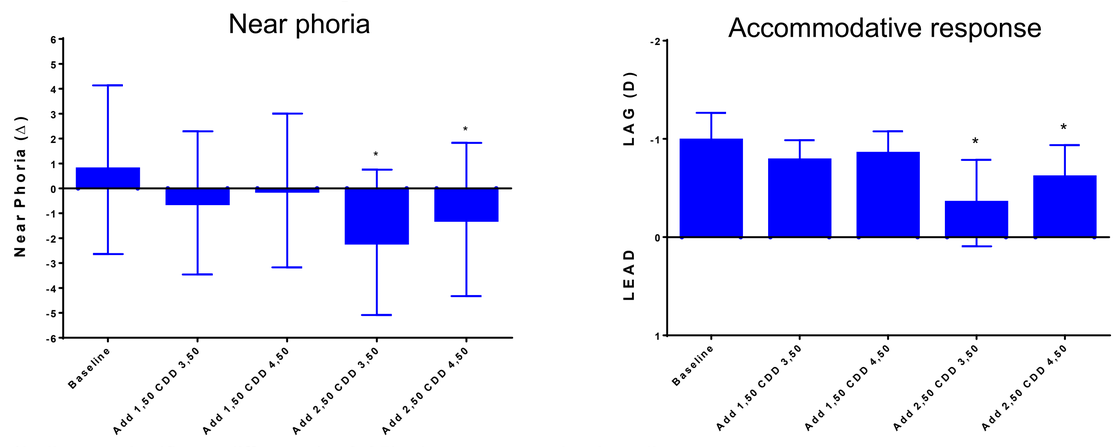
*indicates significant different (p<0,05) when compared to baseline

Quality of Vision



*indicates significant different (p<0,05) when compared to baseline

Heterophoria and Accommodation



*indicates significant different (p<0,05) when compared to baseline

CONCLUSIONS

The effect of CLs tested on HOAs is associated with pupillary diameter, its increasing positive power in periphery introduces a positive SA shift, and its optic zone position in respect to line of sight can justify the increase of coma aberration. Higher addition are effective to introduce more positive SA, exophoric shift of near phoria in and a reduction of LAG of accommodation. CDOZ has also a role in these effects and its reduction increase HOAs, positive SA and exophoric shift and accommodative response but has a negative effect on the quality of vision. To consider the possible use of this CL design for myopia control to obtain the best balance between visual quality, increase of positive SA, with possible effects on accommodative response and near phoria we suggested the use of 2,50D add with 4,5 mm CDOZs

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Disclosure

Giancarlo Montani have not commercial, financial or other relevant interest(s)/relationship(s) in product evaluated
Pascal Blaser is a SwissLens employee and inventor of optimized Hyperopic Defocus Control (HDC) Design on RELAX

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