Prospective study on success rates of fitting simultaneous multifocal contact lenses in relation to physiological circumstances

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Introduction:

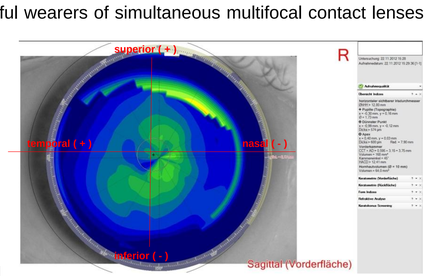
To supply elderly people with multifocal contact lenses gets more and more important. Soft simultaneous contact lenses are the most popular in this category of presbyopic contact lenses (10.7% of 62.543 Ths. Euro in the first four month of 2011 in the German market[1]). But a successful fitting is not guaranteed in every case. One reason of a non-successful fitting could be a individual cortical effect known as visual selectivity[2]. In addition to this effect, physiological structures of the anterior eye could have an influence, too. Based on studies of *Parendeau et.[2] al* and *Rehnert*[3] some physiological structures were tested on a significant effect.

Purpose:

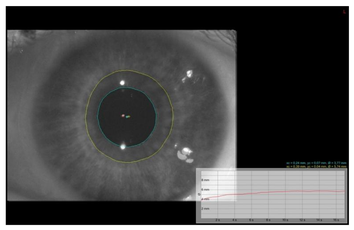
The purpose of this study was to prove influence of decentration on the eye fitted contact lens, the anterior chamber depth (ACD) and the amplitude of pupillary light reflex (APLR) on the fitting of simultaneous multifocal contact lenses with a “near-in-centre” design

Methods:

All parameters were measured at successful wearers of simultaneous multifocal contact lenses (10x female, 10x male, (54.9±6.3) years). Both, amplitude of pupillary light reflex and the anterior chamber depth were determined with the 3D Rotating Scheimpflug Camera & Topography System SIRIUS (Bon Optic Distribution company)

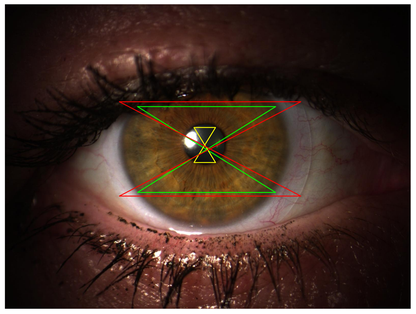


▲ Fig.1: Topography of a right eye with SCL and important information e.g. ACD and pupil diameter on the right side



◄ Fig.2: Pupillography with the measured pupil diameter, the centre of the pupil, the centre of fixation (red cross) and the scotopic and fotopic decentration of fixation (yellow: scotopic, blue: fotopic) over the graph of the pupil diameter as a function of time

The contact lens decentration was measured based on slit lamp pictures by using hourglass shaped symbols and the virtual measuring device MB-Ruler (MB Softwaresolutions).



► Fig.3: For defining the centre of contact lens (red), cornea (green) and pupil (yellow) positioned hourglass shaped symbols in a slit lamp picture

Additionally, the subjects had to evaluate the visual performance for both far and near vision, and the general comfort of the worn contact lenses by setting a dash on a variable score .

Results:

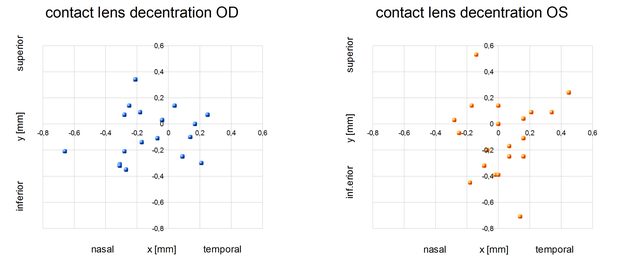
The contact lens decentration was OD (-0.14±0.23)mm, OS (+0.03±0.19)mm in horizontal direction and (-0.08±0.26)mm in vertical orientation on both eyes. Comparing to related studies the contact lens decentration is significantly different ($p<0.001$, $\alpha=0.05$)[3,4,5,6]. Furthermore, an ACD of (2.67±0.35)mm was determined. The APLR was (1.96±0.49)mm.

Parameter	OD [mm]	OS [mm]
dia. pup.* fotopic	2.75 ± 0.44	2.65 ± 0.34
dia. pup.* scotopic	4.68 ± 0.53	4.64 ± 0.78
APLR	1.93 ± 0.46	1.99 ± 0.51
CL-decentration X	-0.14 ± 0.23	0.03 ± 0.19
CL-decentration Y	-0.08 ± 0.26	-0.10 ± 0.28
ACD	2.67 ± 0.34	2.66 ± 0.36

* dia. pup.: pupil diameter

◄ Tab.1: Average and simple standard deviation for the right and left eye

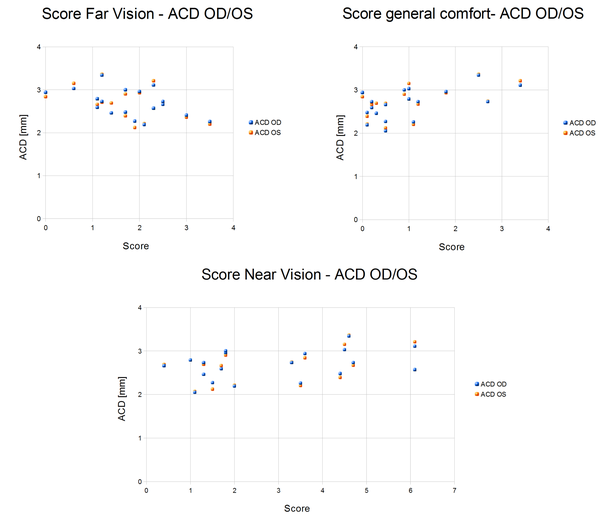
▾ Fig.4: Contact lens decentration for both eyes (the origin equates the vertex of the cornea, the axis of abscissae shows the horizontal and the axis of ordinates the vertical decentration)



The participants evaluated the visual performance of their simultaneous contact lenses for far vision with 1.78±0.86 points, for near vision 2.88±1.78 points and for the general comfort with 1.00±0.99 points on a scale from 0 to 10. An assessment of the visual performance showed a significant correlation of pupillary light reflex OS for far vision (r=-0.536, R^2=0.287, p=0.015, α=0.05) and near vision (r=-0.572, R^2=0.327, p=0.008, α=0.05).

▲ Fig.5: Height of the evaluation score depending on the amplitude of pupillary light reflex

Additionally, there is a significant relation between the far vision performance and the ACD on both eyes (OD: r=-0.465, R^2=0.216, p=0.039; OS: r=-0.474, R^2=0.225, p=0.035; α=0,05). Concerning the near vision performance there is no significant influence detectable, but it shows an inverse trend with a monotone increasing regression.



► Fig.6: Height of the evaluation score depending on the anterior chamber depth

Conclusion:

The results shows, that a minimal horizontal and vertical contact lens decentration could be an important factor on a successful fitting with simultaneous contact lenses. Concerning to the significant relation to the far vision performance, the ACD has a highly potential influence, too. Furthermore, an APLR up to 1.5mm can be beneficial, because the average amplitude exceeds the necessary amplitude of 1.1mm by 78%.

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