Evaluation of different methods to select the parameters of soft customized contact lenses

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Introduction

Traditionally soft CLs parameters are selected considering central corneal curvature measured with keratometers or topographers and HVID[1]. Although several studies have confirmed that the selection of optimal BCRs does not correlate with central corneal curvature[2,3]. For this to improve the choice of the first lens to try or to order empirically it has been suggested that the sagittal height of the anterior segment can be used to calculate the sagittal depth of a soft contact lens with a better result[4-6]. Ocular sagittal height, indeed, is governed not just by central corneal curvature but also by corneal diameter, corneal eccentricy, peripheral corneoscleral profile and scleral curvatures[7,8].The purpose of the study was to evaluate the effectiveness of two methods, one considering SimKs and HVID and another one considering the lens suggested by an algorithm included in the software of Eye Surface Profiler, to select the parameters of a monthly customized soft contact lenses (CSCLs).

Methods

Thirty-four corneas with indication for CSCLs were selected for the study. As indication we considered one of the following conditions: HVID <11.30 and >12.30 mm, average SimKs <7.30 and >8,30 mm and corneal astigmatism >3,00 D. In every eye SimKs, HVID and anterior segment sagittal height were measured using a Fourier transform profilometer (Eye Surface Profiler-Eaglet eye, Roermond, NI) which provides anterior corneal and scleral surface data up to 20 mm diameter and can supply up to 250,000 data points for analysis[9]. For the study was used a trial set of monthly soft CLs in SiHy material (Saphir RX, Markennovy, Madrid, Spain) with 6 different overall diameters (OAD) from 13,50 to 16,00 mm with 0,50 mm steps and 6 different BCs from 8,00 to 9,50 mm with 0,30 mm steps (Table 1). To use a more thick lens we considered for every lenses a power of +1,50D with a central thickness of 0,17 mm The first contact lens to try was selected using the parameters suggested by profilometer calculated considering for OAD HVID+2,90 mm and for BCR the lens with a sagittal depth of 350µm higher in respect of the sagittal height of the anterior segment calculated considering a chord equal to OAD (Fig.1). After insertion at least 30 min to settle the CLs were given before to do the assessment considering: horizontal centration, post-blink movement in upgaze, horizontal version lag and push-up speed of recovery following digital displacement. When the first lens was not fit properly BCR and/or OAD were modified until to find the best relationship between the lens and the anterior segment. The parameters of final lenses were correlated with those obtained for the "first lens to try" considering the manufacturer indications using to select the OAD HVID+3,00 mm and for BCR the rules in Table 2 and the "first lens to try" suggested by the profilometer software.

BCR \ OAD	13,50	14,00	14,50	15,00	15,50	16,00
8,00	3410	3730	4050	4440		
8,30	3230	3520	3810	4160	4550	
8,60	3060	3340	3610	3930	4280	4690
8,90	2920	3170	3430	3730	4050	4400
9,20	2790	3030	3270	3550	3850	4190
9,50		2900	3130	3390	3670	3990

Table 1: Sagittal depth of Safir RX considering Base Curve Radius and Over All Diameter

OAD	13,50	14,00	14,50	15,00	15,50	16,00
Range BCRs	8,00-9,20	8,00-9,50	8,00-9,50	8,00-9,50	8,30-9,50	8,60-9,50
BCR	Km+0,10	Km+0,30	Km+0,50	Km+0,70	Km+0,90	Km+1,10

Table 2: Indications for Base Curve Radius selection

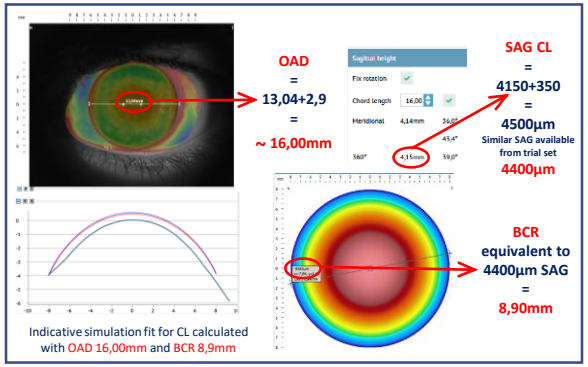

Figure 1: Contact lens selection considering profilometer software algorithm.

Results

Data were analyzed using IBM SPSS Statistics (version 22, Armonk, USA) and the relationship between the variables were assessed with Pearson's correlation. A significantly higher Pearson correlation was found between OAD of the final lenses and OAD obtained from HVID r=0,896 (p<0.01) with a difference of 0,014±0.26mm (AVE±SD) compared to OAD suggested by profilometer r=0,801 (p<0.01) with a difference of -0,30±0.35mm (Fig.2). Before to do the correlations for the BCR if OAD of the final lens was changed BCR of suggested lens was modified increasing its value of 0,30 mm for every OAD increase of 0,50 mm or vice versa. In this case an higher correlation was found between the values of final lens BCRs and those suggested by profilometer r=0,952 (p<0.01) with a difference of -0,06±0.14 mm compared to BCRs obtained from SimKs r=0,712 (p<0.01) with a difference of 0.08±0.310mm (Fig.3).

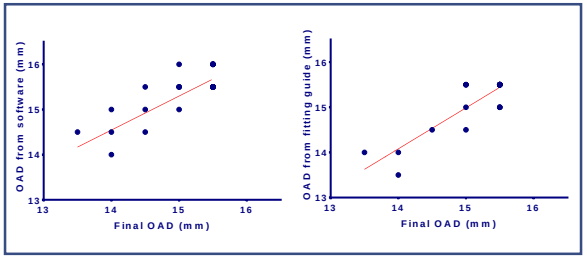

Figure 2. Correlation between OAD of "final lens" and OAD of "first lens to try"

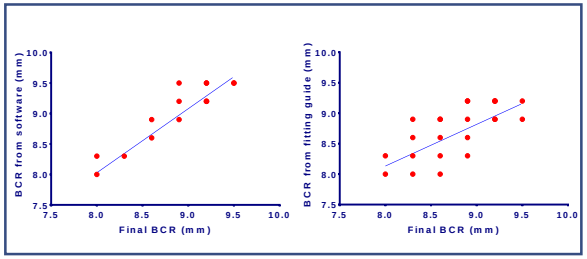

Figure 3. Correlation between BCR of "final lens" and BCR of "first lens to try"

Conclusions

From these results there was a higher correlation between BCR of best fitted contact lens and BCR of first lens to try suggested from profilometer algorithm compared to that obtained using the SimKs and fitting guide. These differences can be justified by the higher amount of information on anterior segment morphology obtained with profilometer. In some cases the OAD suggested by profilometer was overestimated for this it is suggested to confirm the OAD considering the HVID measured before to order the lens. Since CSCLs , especially those with a frequent replacement modalities, normally are not fitted using a trial set but following an empirically approach to reduces the costs in term of lenses and chair time it is important to order the CL parameters as precisely as possible. For this the information related to the anterior segment height obtained using the profilometer and the relative algorithms included inside its software can support the ECPs to select in a more effective way the contact lens parameters not only in case of irregular corneas, as for example with scleral lens designs, but also to fit soft contact lenses considering that more than 25% of soft CL wearers can obtain benefit from the fitting of a CSCL[10].

Contact

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