ACCOMMODATION RESPONSE AND SPHERICAL ABERRATION DURING ORTHOKERATOLOGY WEARING

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INTRODUCTION

The relationship between accommodation and myopia has already been described. Myopic patients accommodate less than is necessary to focus; this minor accommodation is known as accommodative lag. An increase of accommodative lag in myopic patients could cause a peripheral hyperopic defocus, and consequently the increase in axial length and the progression of myopia.

The main objective of this study is to evaluate the accommodative response changes in myopic children who wear overnight orthokeratology lenses for three months.

METHODS

A prospective, randomized and longitudinal study has been performed. Fifty subjects (30 women and 20 men) were recruited from the Optometry Clinic of the Faculty of Optics and Optometry (University Complutense of Madrid, Spain). Mean age was 12.00 ± 2.53 years (range 8-17 years). Inclusion criteria were myopia in progression during the last year and best spectacle-corrected visual acuity (BSCVA) of 20/25 or better. All subjects were fitted with Paragon CRT™ contact lens (Paragon Vision Sciences, Mesa, AZ) in HDS 100 material (paflufocon D, Dk = 100 barrer) according to manufacturer guidelines. Refraction without cycloplegia, high and low uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA), accommodative lag, corneal and total wavefront aberration were performed. All measurements were performed, in the same daytime for each subject, at baseline (PRE), 1 day (after the first night of lens wear), 1 week, 1 month and 3 months.

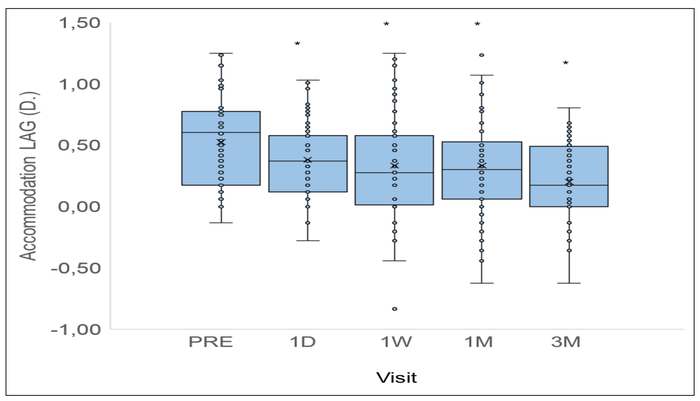
RESULTS

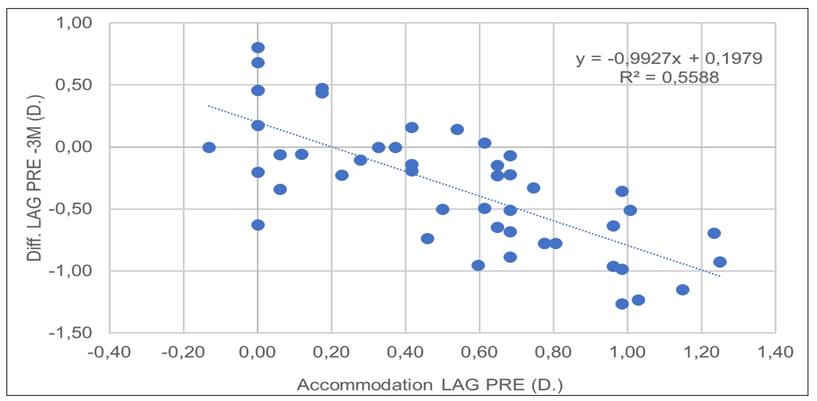
The final spherical equivalent was reached after one week of OK, remaining stable during the rest of the study and being very close to plano. BCVA low contrast was worse after the first night of wearing (1.5 lines less), slightly improving the following visits but maintaining less visual acuity than baseline (p value < 0.05). the UDVA low contrast was statistically worse during the OK wearing compared with BCVA LC before the treatment (p value > 0.05).

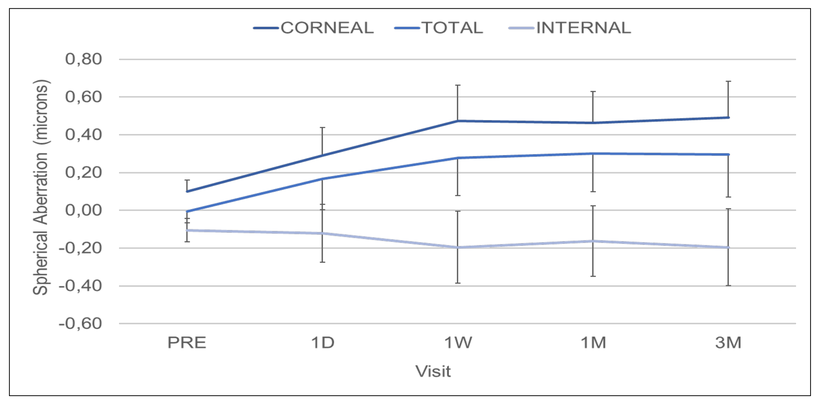
Parameter (mean ± SD)	PRE	1 DAY	1 WEEK	1 MONTH	3 MONTHS	P value
SPHERICAL EQUIVALENT (D)	-3.33 ± 1.60	-1.88± 1.37	-0.64 ± 0.92	-0.47 ± 0.80	-0.30 ± 0.46	<0.001**
	--	<0.001*	<0.001*	<0.001*	<0.001*	
FLAT K (mm)	7.89 ± 0.21	8.02 ± 0.23	8.17 ± 0.24	8.18 ± 0.27	8.19 ± 0.26	<0.001**
	--	<0.001*	<0.001*	<0.001*	<0.001*	
STEEP K (mm)	7.73 ± 0.23	7.86 ± 0.24	8.03 ± 0.25	8.03 ± 0.28	8.04 ± 0.26	<0.001**
	--	<0.001*	<0.001*	<0.001*	<0.001*	
CDVA HC (Log MAR)	-0.03 ± 0.07	-0.03 ± 0.06	-0.04 ± 0.08	-0.04 ± 0.08	-0.06 ± 0.08	0.085
	--	0.712	0.792	0.828	0.054	
CDVA LC (LogMAR)	0.20 ± 0.12	0.35 ± 0.18	0.30 ± 0.17	0.28 ± 0.17	0.31 ± 0.21	<0.001**
	--	<0.001*	<0.001*	<0.001*	<0.001*	
UDVA HC (Log MAR)	0.89 ± 0.35	0.48 ± 0.0.39	0.11 ± 0.25	0.05 ± 0.17	0.01 ± 0.15	<0.001**
	--	<0.001*	<0.001*	<0.001*	<0.001*	
UDVA LC (Log MAR)	1.05 ± 0.33	0.89 ± 0.40	0.49 ± 0.35	0.38 ± 0.35	0.39 ± 0.23	<0.001**
	--	<0.001*	<0.001*	<0.001*	<0.001*	
PHORIA (Δ)	-3.29 ± 4.96	--	--	-2.71 ± 4.64	-2.11 ± 4.26	<0.001**
	--	--	--	0.002*	0.001*	

ACCOMMODATION LAG (mean ± SD)	PRE	1 DAY	1 WEEK	1 MONTH	3 MONTHS	P value
TOTAL GROUP (D) N=50	0.53 ± 0.38	0.38 ± 0.31	0.33 ± 0.43	0.34 ± 0.43	0.20 ± 0.33	<0.001**
	--	0.015*	0.009*	0.021*	<0.001*	
LAG CHANGES GROUP (D)[a] N=37	0.65 ± 0.35	0.41 ± 0.31	0.34 ± 0.46	0.28 ± 0.45	0.10 ± 0.30	<0.001**
	--	0.002*	<0.001*	<0.001*	<0.001*	
LAG NO CHANGES GROUP (D)[b] N=13	0.19 ± 0.24	0.31 ± 0.32	0.32 ± 0.33	0.48 ± 0.33	0.49 ± 0.25	<0.001**
	--	0.398	0.328	0.054	0.002*	

There were a LAG decreasing trend since the first day of OK wearing, being statistically significant from the one-week visit (p value < 0.05). Thirty-seven out of 50 subjects (74%) showed a LAG decreasing meanwhile no changes or slightly LAG increasing were found in only 26% at 3 months of OK wearing. Moreover, a moderate correlation between accommodation LAG at the baseline and the LAG difference between PRE and 3 months visit was found (p value < 0.05; R= 0.748; Pearson correlation test). It means that subjects with higher LAG at the baseline will show greater decreasing LAG. The internal spherical aberration (total – anterior cornea) showed a significant decreasing, being -0.105 ± 0.006 ant baseline and -0.196 ± 0.203 at 1 week of Ok wearing, remaining stable in the following visits (p value < 0.05).







CONCLUSIONS

Three out of four patients presented a decrease in LAG after the use of OK lenses. In addition, the decrease in the accommodative response was greater in patients with a higher LAG at the baseline. A decrease in the internal spherical aberration was found, which together with the LAG change suggests an OK effect on the accommodative response.

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