Myopia Control with Orthokeratology Contact Lenses in Spain: Refractive and Biometric Changes

Jacinto Santodomingo-Rubido,[1] *César Villa-Collar,*[2,3] *Bernard Gilmartin,*[4] *and Ramón Gutiérrez-Ortega*[2]

Purpose. To compare axial length growth between white children with myopia wearing orthokeratology contact lenses (OK) and distance single-vision spectacles (SV) over a 2-year period.

Methods. Subjects 6 to 12 years of age with myopia −0.75 to −4.00 diopters of sphere (DS) and astigmatism ≤1.00 diopters of cylinder (DC) were prospectively allocated OK or SV correction. Measurements of axial length (Zeiss IOLMaster), corneal topography, and cycloplegic refraction were taken at 6-month intervals.

Results. Thirty-one children were fitted with OK and 30 with SV. Following 24 months, axial length increased significantly over time for both the OK group (0.47 mm) and SV group (0.69 mm; $P < 0.001$), with a significant interaction between time and group ($P = 0.05$) reflecting a greater increase in the SV group. Significant differences in refraction were found over time, between groups and for the interaction between time and group for spherical (all $P < 0.001$) but not cylindrical components of refraction (all $P > 0.05$). Significantly greater corneal flattening was evident in the OK group for the flatter and steeper corneal powers and for corneal shape factor (all $P \leq 0.05$).

Conclusions. Orthokeratology contact lens wear reduces axial elongation in comparison to distance single-vision spectacles in children. (*Invest Ophthalmol Vis Sci.* 2012;53:5060–5065) DOI:10.1167/iovs.11-8005

The prevalence of myopia in young adolescents has increased substantially in recent decades and has approached 10 to 25% and 60 to 80% in industrialized societies of the West and East Asia, respectively.[1,2] Furthermore, high levels of myopia (i.e., ≤−6.00 diopters [D]) are associated with a range of ocular pathologies, such as vitreous and retinal detachment, macular degeneration, and glaucoma.[3–6] Therefore, myopia can incur significant ocular-related morbidity and substantial healthcare costs.[7,8]

Several treatment therapies have been used in the past with limited success to eliminate or, at least, reduce myopia progression.[9–11] Spectacle intervention does not appear to significantly affect the progression of human myopia.[12] Bifocal and progressive addition spectacle lens wear have shown very modest treatment effects in controlling myopia progression,[13–17] although the effect is enhanced in children with larger accommodative lags in conjunction with near esophoria, short reading distances, and low baseline myopia.[18] A recent study has compared the effect of progressive addition lenses and single-vision lenses on myopia progression in children with high accommodative lag and near esophoria.[19] Whereas progressive addition lenses produced a slowing of progression that reached statistical significance, the effect was not considered to be clinically significant.[19]

Although it has been reported that soft single-vision spherical contact lenses do not affect the progression of myopia in children and young adolescents,[20,21] a recent study has shown that dual-focus concentric, bifocal soft contact lenses can significantly reduce progression in children in comparison to soft single-vision paired-eye control lenses.[22] The dual-focus lenses had a central zone that corrected refractive error and concentric treatment zones that created 2.00 D of simultaneous myopic retinal defocus during distance and near viewing. The basis for the reduced progression was considered to be the presence of sustained peripheral myopic defocus. This principle was further examined in a later study by Sankaridurg et al.[23]; the study used a soft contact lens designed to reduce relative peripheral hyperopic defocus and demonstrated a significant (34%) reduction in myopia progression over a 1-year period in children in comparison to results with spherocylindrical spectacle lenses.

There have been reports over several decades that gas-permeable contact lenses can slow myopia progression in children.[24–28] However, most of these studies have limitations in study design.[29] A well-conducted study showed that the control of myopia progression with gas-permeable contact lenses is attributable to the temporary reduction in myopia induced by corneal flattening.[30] At beginning of this decade, a retrospective study[31] and a case report[32] suggested that modern orthokeratology[33] has the potential to reduce myopia progression in children. These reports were followed by three prospective studies that assessed the effect of orthokeratology contact lens wear on myopia progression in children.[34–36]

Over a 2-year period, Cho et al.[34] assessed axial length changes in 35 Hong-Kong Chinese children 7 to 12 years of age fitted with orthokeratology lenses and compared the rate of change in axial length with a well-matched historical control group of 35 children wearing single-vision spectacles. At the end of 24 months, axial length increased 0.25 mm more in the spectacle lens group compared with the orthokeratology group.

A later study undertaken in the United States by Walline and coworkers[35] compared the growth of the eye in myopic

From the [1]Menicon Co., Ltd., Madrid, Spain; [2]Clínica Oftalmológica Novovision, Madrid, Spain; [3]Universidad Europea de Madrid, Madrid, Spain; and [4]School of Life and Health Sciences, Aston University, Aston Triangle, Birmingham, United Kingdom.

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Corresponding author: Jacinto Santodomingo-Rubido, Menicon Co., Ltd. (Madrid Office), Iglesia 9, Apartamento 106, 28220 Majadahonda, Madrid, Spain; j.santodomingo@menicon.com.