Corneal reshaping and myopia progression

J J Walline, L A Jones, L T Sinnott

The Ohio State University College of Optometry, Columbus, Ohio, USA

Correspondence to: Dr J J Walline, 338 West Tenth Avenue, Columbus, OH 43210-1240, USA; walline.1@osu.edu

Accepted 25 February 2009
Published Online First 4 May 2009

ABSTRACT

Background/aims: Anecdotal evidence indicates that corneal reshaping contact lenses may slow myopia progression in children. The purpose of this investigation is to determine whether corneal reshaping contact lenses slow eye growth.

Methods: Forty subjects were fitted with corneal reshaping contact lenses. All subjects were 8 to 11 years and had between −0.75 D and −4.00 D myopia with less than 1.00 D astigmatism. Subjects were age-matched to a soft contact lens wearer from another myopia control study. A-scan ultrasound was performed at baseline and annually for 2 years.

Results: Twenty-eight of 40 (70%) subjects wore corneal reshaping contact lenses for 2 years. The refractive error and axial length were similar between the two groups at baseline. The corneal reshaping group had an annual rate of change in axial lengths that was significantly less than the soft contact lens wearers (mean difference in annual change = 0.16 mm, p = 0.0004). Vitreous chamber depth experienced similar changes (mean difference in annual change = 0.10 mm, p = 0.006).

Conclusion: Results confirm previous reports of slowed eye growth following corneal reshaping contact lens wear.

Approximately 100 million people in the USA are myopic,[1] and the majority of these patients became short-sighted during childhood.[2] Patients with low myopia are able to wear thinner spectacle lenses that are more comfortable and cosmetically more appealing, they have more predictable refractive surgery results,[3] and they have a lower risk of retinal detachment,[4] glaucoma and chorioretinal degeneration[5] than patients with high myopia. Therefore, slowing the progression of myopia during childhood could have a positive effect on a large number of people.

Orthokeratology contact lenses were originally fitted in the late 1960s and continued through the 1980s. Results with the orthokeratology contact lenses were often incomplete and unpredictable,[6] so orthokeratology was rarely performed until the new millennium. New materials with higher oxygen permeability and reverse geometry contact lens designs allowed short-sighted patients to wear orthokeratology (now commonly called corneal reshaping) contact lenses during sleep to temporarily flatten the cornea and provide consistently clear vision throughout the day without wearing glasses or contact lenses. Several studies have shown that adults[7–9] and children[10 11] can experience clear vision throughout the day if they wear the corneal reshaping contact lenses during sleep. Watt and Swarbrick summarised all of the cases of microbial keratitis related to orthokeratology that have been reported in the literature.[12] They found that approximately half of the cases occurred in children younger than 16 years, and three-quarters of the cases were reported in East Asia. However, the number of people wearing orthokeratology contact lenses is unknown, so the rates of microbial keratitis associated with orthokeratology cannot be calculated for comparison to soft or gas-permeable contact lens wear.

Preliminary data indicate that corneal reshaping contact lenses may slow myopia progression. The first report of corneal reshaping contact lenses slowing myopia progression was published by Reim and colleagues.[13] In a retrospective chart review of 253 eyes examined 1 year after initiating corneal reshaping contact lens wear and 164 eyes examined after 3 years of corneal reshaping contact lens wear, the authors included changes in refractive error and base curve of the contact lens to measure myopia progression. Over a period of 1 year, the refractive error progressed an average of −0.06 D, and the refractive error progressed −0.37 D over 3 years. Both values represent slower myopia progression than has been reported for single vision spectacle wearers, approximately −0.50 D per year,[14 15] but there were no control subjects to provide comparative data.

A case report published by Cheung *et al* measured the axial growth from one child who wore a corneal reshaping contact lens in one eye and no contact lens in the other eye because it was essentially emmetropic.[16] Over a period of 2 years, the uncorrected eye grew 0.34 mm axially, and the eye with a corneal reshaping contact lens grew 0.13 mm. Although this was the first direct measure of slowed eye growth following corneal reshaping contact lens wear, the evidence was anecdotal.

The first controlled trial comparing axial growth of subjects fitted with corneal reshaping contact lenses to a retrospective cohort of single vision spectacle wearers was reported by Cho and colleagues.[17] Over a 2-year period, the corneal reshaping contact lens wearers' eyes grew an average of 0.29 (SD 0.27) mm, and the spectacle wearers' eye grew 0.54 (0.27) mm (p = 0.01). This study provided the first evidence from a controlled trial that indicated corneal reshaping contact lenses slow the growth of the eye, but the subjects were not fitted using a standardised protocol.

All three of these studies indicate that corneal reshaping contact lenses may slow the growth of the eye, but they suffer from limitations that make interpretation of the results difficult, such as lack of an adequate control group,[13 16] indirect measurement of refractive error progression[13] and being fitted by a variety of eye care practitioners from the community.[17] However, confirmation of the study by Cho and colleagues may provide sufficient evidence to