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Slowing Myopia Progression with Lenses

Corneal reshaping may be a future alternative for slowing myopia progression in children.

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Every eyecare practitioner has had at least one parent ask with a desperate voice, "What can we do to keep my child from becoming as nearsighted as me?" Choosing new parents is obviously not an option. Short of that, there's little evidence of any treatment options that will significantly slow the progression of myopia in children.

Bifocal spectacles minimally slow myopia progression in children, even in myopes who have nearpoint esophoria. Pirenzepine, a selective muscarinic antagonist geared toward slowing myopia progression without causing mydriasis or cycloplegia, hasn't been brought to market despite promising initial results reported in 2004. Atropine, while shown to be the most effective agent for slowing myopia progression in children, causes side effects that render it an option that's rarely considered.

Final Word on Spherical GPs

Two contact lens treatments have been touted as possible deterrents to myopia progression. Clinicians have considered alignment fit GP contact lenses for myopia control since the late 1950s. Several preliminary studies indicated that alignment fit GP contact lenses may slow myopia progression in children.

However, results from two randomized clinical trials recently concluded that GP lenses don't significantly slow the axial growth of the eyes, which indicates that the contact lenses don't have a permanent effect on myopia progression.

The Contact Lens and Myopia Progression (CLAMP) Study (2004) found that providing children with alignment fit GP contact lenses flattened their corneal curvature by about 0.50D within two months. Children who wore GP contact lenses for three years had corneas that returned to the baseline curvature, but soft contact lens wearers' corneas steepened 0.31D beyond baseline. This difference in corneal curvature between the two treatment groups at the end of the study accounted for approximately half of the treatment effect and wasn't expected to be permanent.

The axial growth of the eyes was similar for the two treatment groups: 0.81mm for the GP contact lens group and 0.76mm for the soft contact lens group. Based on these find-

ings, we shouldn't fit children with GP contact lenses solely to slow the progression of myopia.

Another randomized clinical trial recently conducted in Singapore also found no difference in axial growth between GP lens wearers and spectacle wearers. Both groups progressed in myopia just over –1.25D in 2 years; the difference wasn't statistically significant.

Both of these randomized clinical trials found that GP lenses don't slow the axial growth of the eyes of myopic children. GP lenses offer several benefits to children, such as excellent oxygen supply to the cornea, good vision for low to moderate amounts of astigmatism and easy application and removal. But they don't slow myopic eye growth and shouldn't be touted as doing so.

Corneal Reshaping

The most promising myopia control treatment currently is corneal reshaping contact lenses. Tom Reim, OD, and colleagues first reported the potential myopia control of corneal reshaping contact lenses in 2003. Based on refractions and contact lens base curve changes, they figured that corneal reshaping contact lens wearers had experienced about –0.67D of myopia progression over three years. Typically we would expect approximately –1.50D of myopia progression over the same amount of time. This represented a significant reduction in myopia progression over a long period, but the lack of appropriate ocular measurements and control subjects lent credence to the need for a more rigorous examination of myopia control with corneal reshaping contact lenses.

The results after the first of two years of the CRAYON study indicate slowed axial growth with corneal reshaping contact lenses.

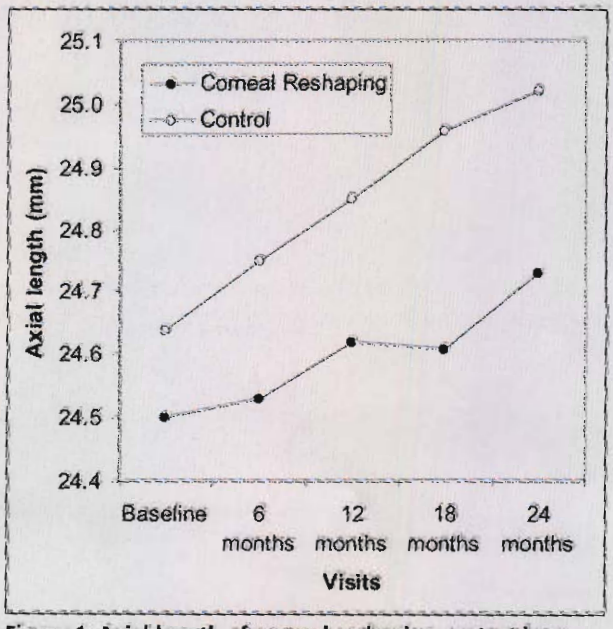

Figure 1. Axial length of corneal reshaping contact lens wearers and single vision spectacle wearers (control) at each visit.

Pauline Cho, BOptom, PhD, and colleagues reported the first controlled trial of myopia control with corneal reshaping contact lenses with the Longitudinal Orthokeratology Research in Children (LORIC) Study (2005). They measured the axial growth of the eye with a-scan ultrasound and used a group of historical control subjects with similar measurements to the experimental group, which addressed some issues experienced by the retrospective review conducted by Reim and colleagues. Forty-three children between the ages of 7 and 12 were fit by local eyecare practitioners and measured biannually at the University. Researchers matched the corneal reshaping contact lens wearers based on age, gender and baseline refractive error to a group of single vision spectacle wearers who had participated in a previous myopia control study. At baseline, the subjects had similar average axial lengths, but the axial length of the control subjects changed significantly faster than that of the corneal reshaping contact lens wearers over two years ($p<0.0001$). Figure 1 shows the average axial lengths of the two groups throughout the two-year study.

Several myopia control studies using alignment fit GP lenses show significant treatment effect after the first year of the study, but the effect doesn't continue to build thereafter. Examining Figure 1, you can see that the two lines continue to diverge throughout the entire study, indicating that the treatment effect continues to build with corneal reshaping lenses. This is unique to this mode of myopia control, and may indicate a different mechanism of treatment effect that's more successful at slowing myopia progression. These results are preliminary, so you shouldn't tell patients that corneal reshaping contact lenses

definitely slow myopia progression.

The Corneal Reshaping and Yearly Observation of Nearsightedness (CRAYON) study confirmed the first year of results from the LORIC study. The CRAYON Study compared the axial growth of corneal reshaping contact lens wearers to age-matched subjects who wore GPs or soft contact lenses during the CLAMP Study. The results after the first of two years of the CRAYON Study indicate slowed axial growth with corneal reshaping contact lenses. Table 1 shows a comparison of results. The axial growth was approximately 0.15mm for the corneal reshaping subjects in both studies, which is approximately 57 percent slower than the axial growth of the control subjects.

TABLE 1

	CRAYON STUDY			LORIC STUDY	
Change in axial length (MM)	CR	GP	SCL	CR	SPECTACLES
	0.15±0.22	0.35±0.36	0.35±0.27	0.16±0.20	0.34±0.16

Average (± SD) change in axial length (mm) from baseline for corneal reshaping (CR), gas permeable (GP) and soft contact lens (SCL) wearers (n=29 per group) for the CRAYON Study and the LORIC Study.

Confirmation of the treatment effect, at least during the first year, by a second study lends validation to the idea that corneal reshaping contact lenses may slow myopia progression in children. However, properly designed and conducted randomized clinical trials must be performed before we're able to definitively tell our patients whether corneal reshaping contact lenses slow myopia progression.

We must be cautious when we advise patients about the benefits of corneal reshaping contact lens wear. We know that children as young as 8 years old are able to see clearly while using them and they love to wear them, particularly when they're involved in several recreational activities. They also can care for them appropriately. However, corneal reshaping lenses may only potentially slow myopia progression and the effect may not work for all individuals.

Discussing the Risks

A discussion of the benefits of corneal reshaping contact lens wear wouldn't be complete without a balanced discussion of its risks. Patients will experience blurry vision during the adaptation period, especially late in the day. Some patients will also occasionally experience transient blurry vision, but the vision typically returns to normal within one or two days. If not, you may change the contact lens to re-establish clear vision.

The most serious potential complication is an eye infection. Although this rarely happens, it can result in severe pain and permanent vision loss. Advise patients that they can reduce the risk of eye infection by properly caring for the lenses, attending all routine office visits and immediately calling the office if any problems occur.

Although no study has established the true risk of microbial keratitis associated with corneal reshaping contact lens wear, a summary of the first 50 cases indicated that 52 percent were experienced by children 14 years and younger. The preponderance of children in the case reports is disturbing, but this finding may be an artifact. Many parents in Asia believe that corneal reshaping contact lenses slow myopia progression, so they've had their children fit with corneal reshaping contact lenses. The large proportion of pediatric microbial keratitis cases may simply reflect the demographics of the corneal reshaping contact lens wearers. In addition, a greater-than-expected proportion of pediatric cases may publish more often than cases involving adults because of the emotional issues associated with problems affecting children. We cannot say that children are at greater risk than adults, but we must still educate parents and children on the particular risks of corneal reshaping contact lens wear.

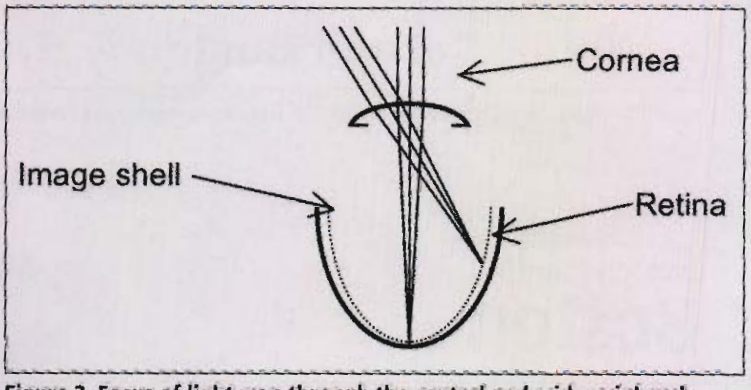

Figure 2. Focus of light rays through the central and mid-peripheral cornea that may signal slowed eye growth.

How Does It Work?

After discussing the potential risks and benefits of corneal reshaping lens wear, you can mention a pos-

sible added benefit of slowed myopia progression, although the jury is still out on that conclusion.

If corneal reshaping contact lenses prove to truly slow myopia progression in children, the important question to answer will be *how* they do it. Perhaps the force that corneal reshaping contact lenses put on the cornea causes the eye to grow more equatorially than axially. This would cause the eye to increase in axial length at a slower rate than you would expect and would slow myopia progression.

An alternate theory stems from evidence presented by Earl Smith, III, OD, PhD, and colleagues that optical signals peripheral to the macula may be responsible for regulating eye growth in primates. If this is true, light focused at the macula by corneal reshaping contact lenses could provide clear vision while peripheral light rays focused through the midperipheral area of steepening in the cornea focus anterior to the retina. These light rays form an image shell that may act as a signal for slowed eye growth (Figure 2). We must further explore these theories and others to gain critical insight into the potential mechanism of myopia control exhibited by corneal reshaping contact lenses.

A Promising Option

Children participate in a wide variety of recreational activities — ranging from dance to football — and they're requesting contact lenses at earlier ages. From several previous studies, we know that children are capable of wearing any modality of contact lens available. We also know that slowing the progression of myopia is very important to many parents. We have only one promising option available to parents at this time, and that option will also provide children with freedom from spectacle or contact lens wear during recreational activities.

Corneal reshaping contact lenses are a great option for this age because children don't drive at night, they wear the lenses only in a controlled environment at home and they can see clearly throughout the day without wearing any vision correction device. It's coincidental that corneal reshaping may also slow the progression of myopia, so why not offer it as a treatment option to your young patients? You can tell those anxious parents who want to keep their child from becoming as nearsighted as themselves, "I just happen to know of one option that your child will love and that may keep him from being as nearsighted: corneal reshaping contact lenses." **CLS**

For references, please visit www.clspectrum.com/references.asp and click on document #139.

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