In the last decade, myopia has been increasingly referred to as an epidemic. The definition of myopia according to the Oxford English dictionary as ‘a temporary prevalence of a disease’. While the research has been inconclusive about whether or not myopia is in fact an epidemic, there appears to be evidence that myopia is on the rise, particularly in the east Asian countries, including China, Hong Kong, Singapore and Taiwan. The increase in the prevalence of myopia has been shown to have multifactorial reasons, which are a combination of genetic and environmental factors. There is well documented evidence that high myopia can lead to several pathological conditions, including glaucoma, cataracts and retinal detachments, which suggests that slowing down the progression of myopia is crucial in preventing myopia related pathology.

The Theory....

Early researchers in the contact lens field believed that myopic progression occurred due to corneal steepening during development and there were a few publications that loosely claimed rigid lenses could slow down the progression of myopia, although this was probably found in cases where the cornea was flattened due to the rigid lens. Modern rigid lens designs tend not to cause corneal flattening or spectacle blue. This theory was disregarded when it was found that myopic progression is actually due to axial elongation that occurs during development instead of emmetropization. Recent literature reveals that the main cause of axial elongation is peripheral hyperopic defocus, where when the myope is corrected with spectacles or regular contact lenses, while the central image is may be on the retina, the peripheral rays of light focus behind the retina, causing peripheral hyperopia, as demonstrated in (Figure 1).

Peripheral form deprivation due to peripheral hyperopic defocus, stimulates elongation of the axial length. This was demonstrated in primates, where once the peripheral blur was eliminated, the eye became emmetropic, even in cases where the fovea was ablated. This indicates the magnitude of the role of peripheral defocus in myopic progression and based on this evidence, one could conclude that eliminating peripheral hyperopic defocus may slow down the progression of myopia. Myopia control with cycloplegic treatment, particularly atropine, has been shown to eliminate peripheral hyperopic defocus and is very effective in slowing down the progression of myopia, however, the adverse effects of cycloplegic drugs, including photosensitivity and blurred vision make it an impractical option.

Corneal Reshaping for Myopia Control

The role of corneal reshaping in myopia control started with anecdotal evidence from practitioners who were regularly fitting children with orthokeratology or, as more commonly
referred to as late, corneal reshaping therapy. They found that those undergoing corneal reshaping progressed slower than those wearing spectacles only or regular soft or rigid contact lenses. A case study published by Cheung et al. featuring a patient undergoing unilateral corneal reshaping revealed a 0.13mm increase in the axial length (A-scan readings), over a period of two years, as the eye undergoing corneal reshaping compared to fellow eye, of which the axial elongation was significantly more, 0.34mm, which was also reflected in the change in refractive error, where there was a 0.75D increase in the spherical equivalent power. The theory behind this phenomenon is that the mid-peripheral steepening of the cornea as a result of the central flattening in corneal reshaping, creates peripheral myopic defocus. Creating an “image shell”. This myopic defocus does not stimulate axial elongation as hyperopic defocus does, due to the peripheral rays focusing slightly anterior to the retina (Figure 2).

Cho and colleagues were the first to carry out a non-randomised controlled trial, the LORIC study, a pilot study where the change in axial length (AL) and the change in vitreous chamber depth (VCD) were monitored over a period of two years in 35 children undergoing corneal reshaping and were compared to a control group of 35 children wearing only spectacles for the correction of myopia. The results showed a significant difference in the change in AL as well as VCD, where there was a considerable increase in the control group. The limitation of this study was that it was not carried out under a standardized protocol, however, it did provide enough evidence to justify a randomized controlled trial. The CRAYON pilot study, carried out by Walline and colleagues, compared the change in AL in children undergoing corneal reshaping to a control group of children wearing regular soft contact lenses. The children in both groups were randomly assigned. The VCD and AL were both measured using the IOL Master. The CRAYON study demonstrated that axial elongation was slowed by 55%, which was a similar result to the LORIC study (46%). Several similar studies have been conducted since, in various parts of the world and have yielded similar results.

Although the results were variable, ranging from 30% to 57% reduction in eye growth rate in children undergoing corneal reshaping compared to the control groups, all the studies concluded that corneal reshaping can significantly slow down the progression of myopia. In the ROMIO study (2012), Cho and colleagues also revealed that axial elongation is faster in children of 7 or 8 years of age, therefore corneal reshaping therapy would be most effective at this age. A previous case study, featuring a six year old girl undergoing corneal reshaping for myopia control, demonstrated that withdrawal from corneal reshaping at this age increases the rate of axial elongation.

The safety of corneal reshaping is frequently questioned by practitioners. Modern rigid lens materials providing excellent oxygen permeability allow safe overnight wear of contact lenses, without virtually no incidence of hypoxia related complications. Studies have shown that the incidence of microbial keratitis was most common in East Asian countries, where Pseudamonas and Acanthamoeba were the primary micro-organisms causing the infections. It was concluded that the reasons behind these incidences included poor adherence to care regimes, as well as use to tap water to rinse the lenses. Like any other contact lenses, a combination of proper instruction from the eye care practitioner as well as strict adherence to the prescribed care regimen minimizes the risk of complications.

**Soft Contact Lenses for Myopia Control**

The role of soft contact lenses in myopia control is increasingly being investigated. Dual focus designs in soft lenses appear to have a similar effect to corneal reshaping on peripheral hyperopia. The central zone of the contact lens corrects the refractive error while concentric rings around the central zone create approximately 2 dioptres of peripheral myopic defocus. This can be achieved with a centre-distance design multifocal contact lens with a high add. Three randomized controlled trials have demonstrated that this design in soft contact lenses do have some effect in slowing down the progression of myopia, although soft contact lenses for myopia control have not been researched as extensively as corneal reshaping at this stage.

**Conclusions**

Very little epidemiological research has been carried out in India, investigating the prevalence of myopia, particularly in the urban population, however, anecdotal evidence may show that myopia is on the rise, albeit not as severely as in East Asian countries. The literature has provided conclusive evidence that myopia control is effective. Walline describes this form of practice as ‘myopia management’, which seems to be an appropriate path to follow. More research is required in India to investigate myopic trends, but in the mean time, we can certainly start managing the myopic patients we have.
References