

Ortho K: Exciting new tomorrow, or death throes of an old idea?

In recent years there has been much debate about orthokeratology and the industry is divided as to its advantages. **Bruce Evans** reports on the European Ortho K Symposium, and hears about some interesting new developments

I was glad to be a reporter for a day and write about the European Ortho Keratology (Ortho K) Symposium. I viewed this task as a sort of therapy, as I think I might be a manic depressive – at least when it comes to Ortho K. Whenever I am in the company of Ortho K experts I have become enthusiastic about Ortho K. It seems to make so much sense to wear a high Dk RGP lens overnight and then need no contact lenses during the day.

With modern contact lenses, the main reason why some wearers still cannot achieve comfortable wear is tear film/drying issues. So, why not wear the lens when the eye is closed, not open?

But then, when I leave the company of Ortho K enthusiasts, I start to have doubts. Is there really any advantage to putting a lens in before sleeping, instead of after waking? How about the risk of microbial keratitis from overnight wear? Is repeated corneal moulding safe in the long-term?

And then the conspiracy theories take over. As soft lenses predominate, is it just the RGP industry trying to find work for their lathes? Why should any myope who can afford Ortho K not spend their money on laser surgery?

The European Ortho K Symposium had two parallel tracks, an essentials track to introduce Ortho K and an advanced track for those who already knew something about the subject. I opted for the advanced track, hoping to find some concrete facts to end my manic depressive cycle.

CHILDREN: THE NEW TOMORROW OF ORTHO K

Professor Patrick Caroline gave the first talk on myopia control, arguing that there was, beyond doubt, a myopia control effect to Ortho K.

His literature review noted that, although accommodation appears to play a role in myopia progression, studies have failed to provide support for multifocal spectacles as a method of myopia control in children. Caroline's review also concluded that normal daily wear of RGP contact lenses does not slow axial length elongation



Myopia control in children may represent the future of Ortho K

in myopia. But two published trials have demonstrated an effect of Ortho K at significantly slowing the increase in vitreous chamber depth in myopic children.

Based largely on data from Earl Smith's lab, Caroline argued that it was the peripheral retina, rather than the fovea, that played a role in emmetropisation. Evidence from as far back as 1933 indicates that myopes typically exhibit relative hypermetropia in the periphery, which may cause axial length growth.

Ortho K, through creating negative curvature of field, slows the progression of myopia. Caroline believed that, given measurements of the pupil size and axial length, it should be possible to design a custom Ortho K lens for a myopic child that would control axial length growth more precisely than present lenses. Soft lenses could, he thought, also be designed along these principles to control myopia.

He also argued that the shape of the cornea in Ortho K caused it to act to some degree like a multifocal, so reducing accommodation which may also help to slow myopia. He felt that the optimum time for using Ortho K to control myopia was between eight to 10 years. Caroline suggested that before long there may be two types of Ortho K lenses – adult

lenses with the largest optical aperture possible, and children's lenses designed for optimum myopia control.

The next speaker, **Dr Pauline Cho** from the Hong Kong optometry school, also chose a paediatric theme, speaking on 'Kids, tweens and teens: Who to fit and when'. In Hong Kong, 80 per cent of Ortho K patients are children and the popularity of Ortho K is due to myopia control. The motivation for this is easily understood – in local schools the prevalence of myopia is between 85 to 88 per cent. In Cho's clinic, children are not treated before the age of six years, although they are sometimes treated at much younger ages by local practitioners.

At the clinic, the median pre-Ortho K Rx is -3.50, but her patients range from -0.75 to -8.75D. People with the higher refractive errors are just hoping to reduce the thickness of their spectacles as the practitioners only expect to correct up to 4D of myopia. Maximum reduction occurs in 14 to 30 days. In one-third of cases, insertion and removal is conducted by parents.

The two main non-visual complications in the clinic are discharge in mornings and lens binding, each happening with almost half of patients. Visual complaints are rare and Ortho K is very popular, with over 90 per cent of patients wanting to continue. She stressed the need to assess both monocular and binocular VA.

Cho reported on the latest follow up of her LORIC myopia progression study, which showed that after three to three-and-a-half years, the reduction in axial length growth is maintained. She noted that Ortho K has a better long-term effect at reducing axial length growth than atropine. Cho summarised the use of Ortho K for myopia control as evidence-based practice. But, Cho cautioned, data showed that 47 per cent of wearers had one or more indications of microbial contamination of lens or case. Accordingly, she went into some detail about the patient information and consent that are required. Both of these presentations engaged the audience who spoke with excitement about the potential of being able to offer their patients a positive approach to controlling myopia.

FITTING DETAILS AND RISKS

Caroline Christie and **Ron Beerten** gave a useful presentation on upgrading existing Ortho K wearers.

Modern Ortho K lenses, compared with

older designs, have larger treatment areas and can give better centration. It was noted that it can be difficult to fit existing Ortho K wearers with newer designs because details of their existing lenses and original corneal topography may be unavailable. Old Ortho K lens could be hard to measure, so checking the parameters may not be feasible. Corneal topography can take some time to return to normal when the patients stop wearing Ortho K lenses, which may need to be done before the patient is refitted.

It was noted that there was often low grade staining after the first night of Ortho K, which was acceptable. It was recommended that practitioners prescribe ocular lubricants before and after lens removal in the morning.

In a case study, a patient wearing Ortho K lenses complained of transient visual loss. The problem turned out to be unrelated to Ortho K, but instead a posterior segment problem. This was a salutary reminder never to forget the rest of the eye. It was noted that even though Ortho K works for dry eye, some tear film is needed for overnight wear and any lid margin disease should be dealt with before Ortho K. Frequent replacement helps prevent CLPC. Progent is an intensive cleaner that is used twice weekly and destroys prions. Christie strongly urged practitioners not to try to repolish Ortho K lenses, but rather to fit planned replacement six-monthly lenses. Cases should also be replaced every six months.

The speakers stressed that, as a general rule, it was best when refitting Ortho K wearers to have a washout period of no contact lens wear until the topography has returned to baseline. In some cases a useful approach can be to refit one eye at a time since it can take many weeks or even months for the cornea to return to its normal shape.

A question and answer session returned to the issue of myopia control. Experimental data was said to indicate that atropine worked well at controlling myopia, but when stopped, the myopia then rapidly increases. It was noted that it was not yet clear if this also happens



A packed audience listens to the presentations

with Ortho K. Cho is finding it difficult to research this as patients don't want to stop wearing their Ortho K lenses.

There was some concern about the use of preservatives in solutions since, in Ortho K, the eyes are closed shortly after lenses are inserted. Some speakers suggested it may be best to rinse the lenses with unpreserved sterile saline before insertion.

Another useful tip was to give the patient a copy of baseline corneal topography in case they need a refit or cataract surgery in the future. One member of the audience suggested that, in dealing with an irregular cornea from Ortho K, then fitting normal spherical RGP lenses, seems to help the cornea rapidly to return to its usual shape. It was noted that an incidental benefit for early presbyopes is that the Ortho K cornea can provide a slight 'near add effect' and obtain better near vision without the loss of distance vision. But it was cautioned that, with older patients, it can take longer for the Ortho K procedure to work.

RISK FACTORS IN ORTHO K

Cho delivered a second presentation on risk factors in Ortho K. In addressing concerns over safety, Cho argued that the answer relied on practitioner and patient factors.

Non-compliance was the major risk factor. Studies show that 40 to 91 per cent

of contact lens patients are non-compliant. Cho summarised a study of 50 reported cases of microbial keratitis in Ortho K.¹

The cases were mainly *Pseudomonas* but also some *Acanthamoeba* and the main reason was believed to be the use of tap water. In a study currently underway, suction holders are proving to be a common source of contamination, but multi-dose artificial tears are also a problem. Cho therefore recommended unit dose drops, and wherever possible avoiding the use of accessories. If suction holders must be used then they should be kept clean.

Cho said that, especially with children, have the patient to demonstrate what they do when they handle their lenses. She stressed the need for hand washing instructions, paying attention to cleaning the finger tips. Lenses or accessories should not be kept in the bathroom or fridge and the case should be cleaned every day.

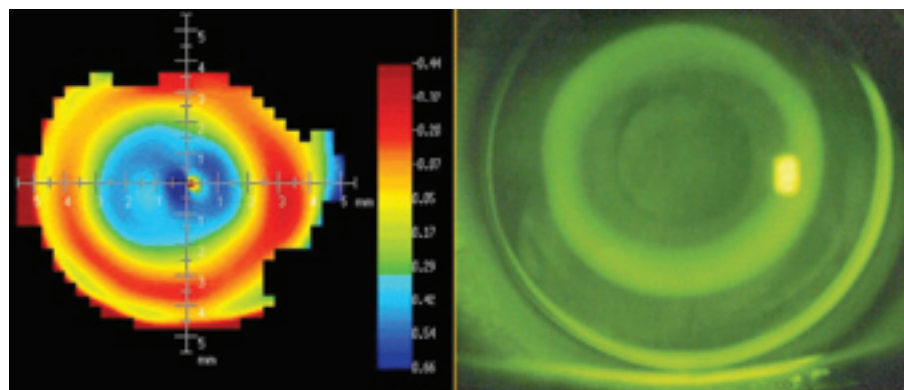
Cho said that it was important to give an emergency number and for practitioners to be able to check their patients within two hours of waking. She reported that lens binding occurs in 30 to 60 per cent of cases and in some studies is the most common problem, although it often resolves shortly after waking.

However, this reporter felt an important question had not been addressed. Cho stressed the importance of informed consent, and yet important information seemed to be missing from her presentation and indeed from much of the literature on Ortho K.

This is the relative risk for microbial keratitis. BCLA members have all received an excellent one-page information sheet which gives useful figures for 'normal' (not Ortho K) contact lens patients of the incidence of microbial keratitis of one in 2,500 for daily wear and five in 2,500 for hydrogel continuous wear.

A quick glance at the scientific literature on Ortho K explains why equivalent information for Ortho K was not provided at the conference.

An excellent review published this year by Helen Swarbrick² notes: 'At this stage, it is premature to comment on the relative



The corneal topography (left) and fluorescein pattern (right) of Ortho K lenses may not be as regular as those illustrated in patients who have to be refitted

risk of microbial keratitis in overnight Ortho K compared with other contact lens-wearing modalities.

'Active efforts are under way internationally to clarify this issue.' In other words, it is a 'don't know'. This is statistically understandable in view of the relatively small number of people worldwide who wear overnight Ortho K. But in this reporter's view, this is a point that must be flagged up in patient consent information: it is not yet clear how the risks of Ortho K for microbial keratitis compares with other modes of contact lens wear.

MARKETING AND FUTURE

The next presentation by **Erik Timmermans** and **Shelly Bansal** was on marketing and promoting Ortho K. The talk included useful tips.

Ortho K was noted to be very good for patients participating in water-based activities. Bansal argued that Ortho K is safer than conventional overnight wear, because the eye has the daytime period without lens wear to recover.

Ortho K was characterised as very much the province of independent practitioners and myopia control as the most exciting opportunity.

Concerning pricing, it was advocated that an initial fitting fee was charged and then a direct debit scheme that separates fees from product, but bundles lenses (including replacement lenses) and solutions.

FUTURE OF ORTHO K

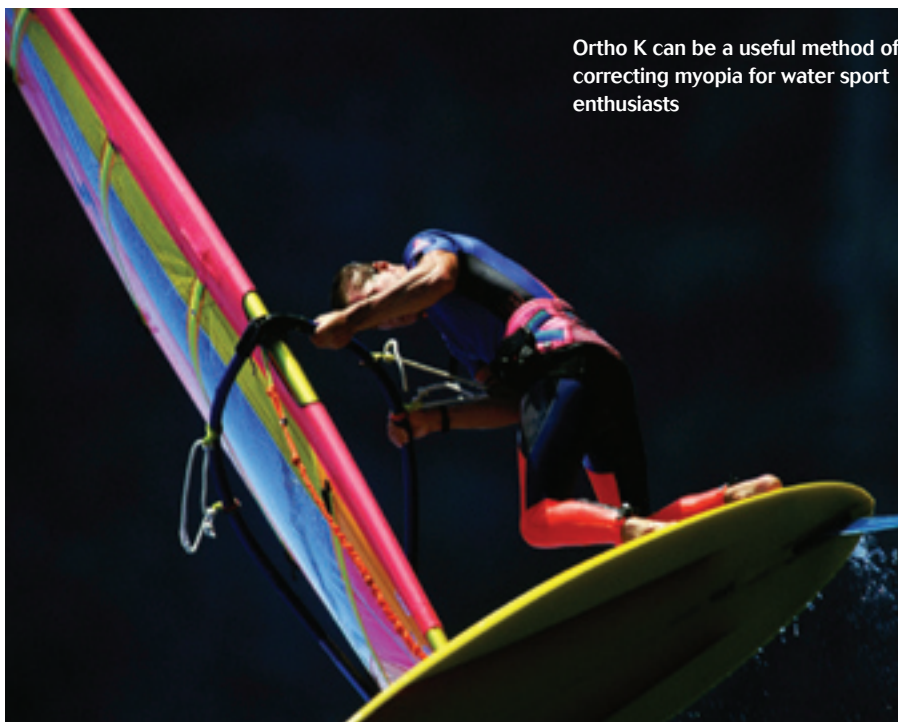
The last presentation, by **Dr Caroline**, discussed the future of Ortho K. Slides demonstrated the effect of Ortho K on epithelial thickness. Ortho K seems to bring about a compression of epithelial cells, likened to the effect of a wedding ring.

In research on hypermetropic Ortho K, the central corneal epithelium actually gained extra layers of epithelial cells. Over 14 days, significant changes in stromal thickness also occur. The expected complementary results happen in hypermetropic and myopic Ortho K.

Caroline stressed the reversible nature of Ortho K: amazingly the cornea returns to its original shape. Hypermetropic Ortho K dates back to 1960, but is currently under research and has important implications for monovision correction of presbyopia.

Another interesting development is the use of Ortho K for corneal shaping to correct problems left after laser surgery.

Caroline also summarised research using cats that indicates that Ortho K wear does not increase the risk of microbial keratitis occurring in eyes that have been exposed to *Pseudomonas*. He agreed with Cho that patient compliance is the key to safe Ortho K.



Ortho K can be a useful method of correcting myopia for water sport enthusiasts

Beerten concluded the talk on the future of Ortho K. He noted the need to correct higher degrees of myopia than the current limit of about 4.50D, and also higher degrees of astigmatism. It was felt that there was a limit to how much myopia could be corrected as the treatment zone would need to be smaller and this would be likely to cause glare.

Concerning astigmatism, it was currently possible to correct up to 1.50D of with-the-rule astigmatism. Against-the-rule astigmatism is currently thought to be a contraindication, but back-surface toric Ortho K lenses may hold potential for correcting this. He showed promising results that allow Ortho K for low and even moderate astigmatic patients, with-the-rule up to 2.50DC and against-the-rule up to 1.50DC.

He felt that hypermetropia could be corrected up to +2.00DS, but the small treatment zone could cause problems. The 'multifocal' cornea was said to be out of reach at the moment, but he agreed that Ortho K monovision is a viable modality at present.

CONCLUSION

So, at the end of the European Ortho K Symposium, was I cured of my manic depressive condition? Well, I think that I might have been.

They say that knowledge is the key to understanding, and I learned a lot on the day. I was also impressed by the attendance figures: 112 from the UK and 131 from overseas, mainly from continental Europe.

Ortho K undoubtedly requires time and skill from the practitioner, so it is unlikely ever to become a major part of the

commercial retail side of the profession. It is more for practices than for stores.

To those at the conference, this seemed to be perceived as an advantage of Ortho K, not a limitation. But I felt that this was more than just the independent practices trying to find a niche. It seemed to me to be about thoughtful practitioners offering a highly individualised service to their patients and families.

Most UK practitioners I spoke to who practice Ortho K only seem to fit one or two patients a month, although I am sure some fit many more. But the patients who are fitted seem to become very loyal to both the practice and to Ortho K, and become walking advertisements for both.

The Ortho K industry and community must address the issue of statistics on the incidence of microbial keratitis, but this work seems to be under way. With the real hope of future Ortho K lens designs that are tailored to be even better than current lenses at reducing myopia progression, I think that the future for Ortho K practitioners is likely to be busy, if not manic.

Acknowledgment

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Reference list

- 1 Watt K and Swarbrick HA. Microbial keratitis in overnight Orthokeratology: review of the first 50 cases. *Eye Contact Lens*, 2005; 31, 201-208.
- 2 Swarbrick HA (2006). Orthokeratology review and update. *Clin Exp Optom*, 2006; 89, 124-143.

◆ *Bruce Evans is a visiting professor at City University and runs a private practice in Essex*