

# Contact Lens Update

CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

## CLEAR Orthokeratology

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*Vincent SJ, Cho P, Chan KY, et al. CLEAR – Orthokeratology. Cont Lens Anterior Eye 2021;44:240-69*

The CLEAR orthokeratology (ortho-k) paper reviews the practice of ortho-k, including its history, mechanisms of refractive and ocular changes, current use in the correction of refractive error and myopia control, and standard of care.<sup>1</sup>

Having outlined how ortho-k evolved from fitting PMMA lenses flatter than corneal curvature in the 1950's to modern ortho-k that utilises reverse geometry designs to stabilise lens fit and accelerate change to corneal shape and with it refraction, the report reviews initial lens fit selection and assessment of changes to corneal topography to assess lens induced change from overnight wear. Toric ortho-k lens designs are identified to in general improve refractive outcome and lens centration where corneal astigmatism exceeds 1.50D. Perceived clarity of vision, determined from quality-of-life questionnaires, finds ortho-k to be comparable to other types of contact lens, spectacles and LASIK.

There is considerable reported literature on how corneal shape temporarily alters in response to ortho-k lens wear. Whether ortho-k is fit to correct hyperopia or myopia, most refractive change occurs after the first night of lens wear with targeted effect achieved within 1-week. Change to refraction is in response to change in anterior corneal profile, which occurs as a result of alterations in corneal thickness profile rather than corneal bending., Central corneal thinning and paracentral corneal thickening occur in myopic ortho-k and the reverse profile in hyperopic ortho-k. Secondary effects of ortho-k have been reported as the development of pigmented arcs and observance of fibrillary lines. The latter are thought to be a visual representation of the sub-basal and epithelial nerve plexus when viewed through the slit-lamp, which changes orientation over time in response to ortho-k lens wear. Corneal changes induced by ortho-k reverse on ceasing wear, with change to refraction and corneal thickness typically resolving within a few weeks, with the additional physiological changes like fibrillary lines likely requiring longer.

The safety of ortho-k in relation to microbial keratitis (MK) forms a central theme in the report. While prevalence of MK is difficult to reliably assess due to less common use of ortho-k compared to other contact lens modalities, the current consensus suggests that the risk of MK with ortho-k is slightly higher than from daily wear of soft lenses, with the CLEAR authors using this to suggest that patients should be made aware of alternative modalities to ortho-k where available. However, the vast majority of reported adverse events from ortho-k wear were not considered as serious, with non-compliance, such as topping up used solutions and continued wear during discomfort being identified as common culprits. Consequently, vigilance in assessing compliance and repeated instruction to avoid contact with tap water offer pathways towards improving safety from ortho-k lens wear. Lens

binding and the visual sign of sodium fluorescein (NaFI) staining is also covered, with presence of NaFI staining in the absence of adverse event being considered as common, particularly while adapting in the first few weeks of lens wear. The reported evidence supporting that alteration to lens design and steps to reduce lens binding, such as application of a wetting agent before lens removal, can help resolve persistent NaFI staining. In concluding on ortho-k safety, the research on response to use of different lens cleaning regimens is summarised.

A large part of the report is dedicated to use of ortho-k for slowing myopia progression in children. Studies reporting on quality-of-life questionnaires indicate that overall, children tend to prefer ortho-k to other vision correction modalities except for lens handling, while responses from caregivers suggest ortho-k as the most popular choice for children in their care. Measuring change to myopia progression is given considerable review highlighting disparities that occur between change in refraction and axial eye length in response to ortho-k wear, and how both measures vary between individuals. Likewise, the latest research in myopia control efficacy from ortho-k and in comparison to other myopia management treatments is covered in depth, emphasising improved efficacy from starting wear at earlier age and that patients should be monitored closely against myopia progression rebound when ceasing ortho-k lens wear in children and young adults. Mechanisms for how ortho-k slows progression of myopia are covered including the role of ortho-k induced change to peripheral defocus, higher-order aberrations and accommodation. Furthermore, the relationship between pupil size and treatment zone diameter, and how this has been shown to influence myopia progression is reviewed.

When considering the future of ortho-k, the CLEAR Orthokeratology paper recognises that despite the considerable evolution of ortho-k over the past thirty years, it still only accounts for 2% of all contact lens fits globally. Advanced levels of required education, necessary in office instrumentation and increased chair time voiced as the likely main contributing factors, alongside reluctance to prescribe for overnight wear in children, and most ortho-k lens designs being considered as 'off-label' when prescribed for myopia control. This being the case, it is changes outside of the scope of lens design that need to be rectified to increase uptake of ortho-k. Examples exist that help eye care practitioners feel more confident in the use of ortho-k for myopia control with the report mentioning certain lens designs being approved for such use in Europe, and more recently, following the report's publication, the announcement of FDA-approved ortho-k lens designs for myopia control in the US. In terms of ortho-k lens design, the recent increase in use of ortho-k for myopia control leads the CLEAR authors to conclude that future development will concentrate on increasing ortho-k's efficacy for slowing myopia progression.

### REFERENCES:

1. Vincent SJ, Cho P, Chan KY, *et al.* CLEAR – Orthokeratology. *Cont Lens Anterior Eye* 2021;44:240-69.