

Clinical Safety and Efficacy of Orthokeratology Contact Lenses with Toric Peripheral Curves: A Review of the Literature

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INTRODUCTION

Undercorrected refractive errors remain one of the leading and increasing cause of global blindness and vision impairment, with myopia and astigmatism among the main causes of distance vision disturbance. A high proportion of children with myopia also have astigmatism¹⁻⁵

Orthokeratology (OK) is a treatment approach to correct refractive errors by temporarily reshaping the corneal surface using specialized, rigid gas permeable, contact lenses that are worn overnight to temporarily and reversibly flatten the corneal centre, based on the principals of reverse geometry and hydrostatic forces. The goal of OK treatment is a change in corneal power, resulting in a change in overall ocular refraction leading to clear unaided vision upon OK lens removal.^{2,6,7}

OK treatment offers an alternative to surgical approaches, or daily spectacle or contact lens wear.^{2,7} Treatment may delay myopic progression and the approach is becoming increasingly popular for myopia control in younger patients.^{2,6}

OK lenses may also temporarily correct moderate-to-high astigmatism (> 1.25 D), although asymmetry of the corneal curve in these patients may disrupt lens fit and efficacy. Spherical OK lenses may correct pre-existing astigmatism by ~50%, without reliability in either direction; lenses with a toric peripheral curve can improve the fit in astigmatic eyes by correctly applying the forces necessary for corneal flattening.^{2,5,6,8,9}

While there are established benefits of OK treatment, including avoidance of surgery or need for daily correction, and slowing progressive vision deterioration, there have been reports of increased risk of infection, especially in children and adolescents less able to maintain hand and lens hygiene.^{2,6,7} Other reported complications include low-grade corneal staining, corneal epitheliopathy, bubbles and dimples, and optical light scattering and aberrations, which can affect visual function, and cause discomfort.^{2,6}

OBJECTIVES

To assess the clinical safety and efficacy of OK lenses with toric peripheral curves, based on a review of literature published in the last decade.

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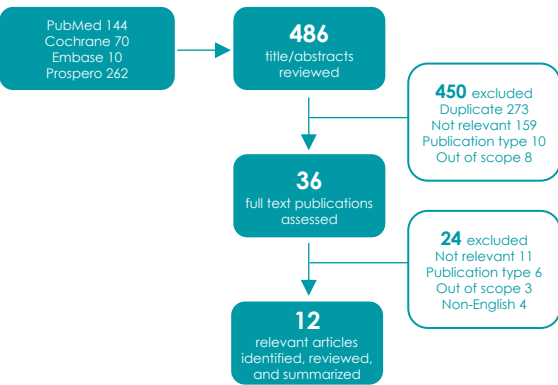
METHODS

A literature search of PubMed, Cochrane Online Library, Prospero International Prospective Register of Systematic Reviews and Embase was performed using 11 search terms (Table 1) and the data restricted to relevant publications between January 2012 and August 2022 (Figure 2).

Table 1. Search terms used to interrogate published literature database

<ul style="list-style-type: none">• (oprifocon) AND (toric OR astigmatism) AND (Contact Lens)• (corneal refractive therapy) AND (toric OR astigmatism)• (Corneal refractive therapy) AND (toric OR astigmatism OR dual axis) (Equalens II) AND (toric OR astigmatism) AND (orthokeratology)• (orthokeratology OR ortho-k) AND (toric OR astigmatism)• (Vision Shaping Treatment) AND (toric OR astigmatism)• (Accelerated ortho-k) AND (toric OR astigmatism) AND (Complications) OR (Adverse Events) OR (Safety) OR (Performance)• (orthokeratology) AND (toric OR astigmatism) AND (Contact Lens) AND (Complications) OR (Adverse Events) OR (Safety) OR (Performance)• (ortho-k) AND (toric OR astigmatism) AND (Contact Lens) AND (Complications OR Adverse Events OR Safety OR Performance)• (reverse geometry) AND (toric OR astigmatism) AND (Contact Lens) AND (Complications) OR (Adverse Events) OR (Safety) OR (Performance)• (Extended Wear OR Continuous Wear) AND (toric OR astigmatism) AND (Rigid Gas Permeable) OR (RGP) OR (Gas Permeable) OR (GP) AND (Complications) OR (Adverse Events) OR (Safety) OR (Performance)
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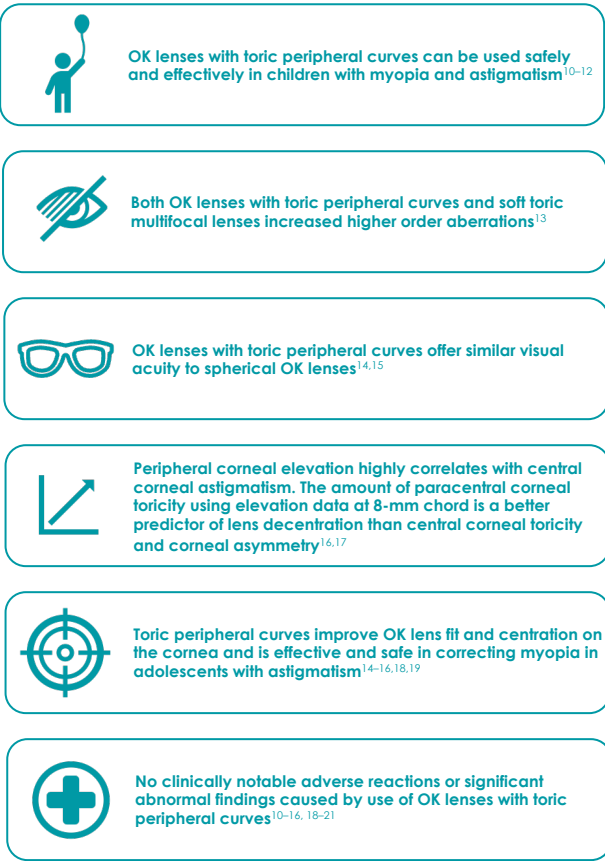
Figure 2. Publications identified and refined during the literature search



ABBREVIATIONS: CED, corneal elevation difference; OK, orthokeratology.

RESULTS

Figure 3. General summary of 12 key publications



The scope ranged from individual case reports to prospective randomized studies, in children and adolescents (age 6–39 years). Prospective studies on clinical performance of OK lenses with toric peripheral curves in myopic participants with corneal astigmatism established efficacy in reducing myopia and refractive cylinder with no clinically significant adverse events.

Three studies assessed the clinical performance of spherical vs toric peripheral curve OK lens designs, in myopic children with moderate-to-high corneal astigmatism. After 12 months of follow-up, mean corneal astigmatism in the toric group decreased significantly. Lens position showed stability in the toric group but decentration was found in the spherical group; changes in visual acuity showed mixed results.

One prospective study stratifying participants by corneal elevation difference (CED) suggests use of OK lenses with toric peripheral curves should be recommended for eyes with CED ≥30 µm at an 8mm chord; a further study suggests central corneal astigmatism is highly correlated to peripheral corneal elevation and may be a better measure for clinical use.

CONCLUSIONS

Published literature suggests that OK lenses with toric peripheral curves are effective in treating patients with both myopia and astigmatism, with favorable safety profiles.

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