

# STRATEGIES OF MYOPIA CONTROL

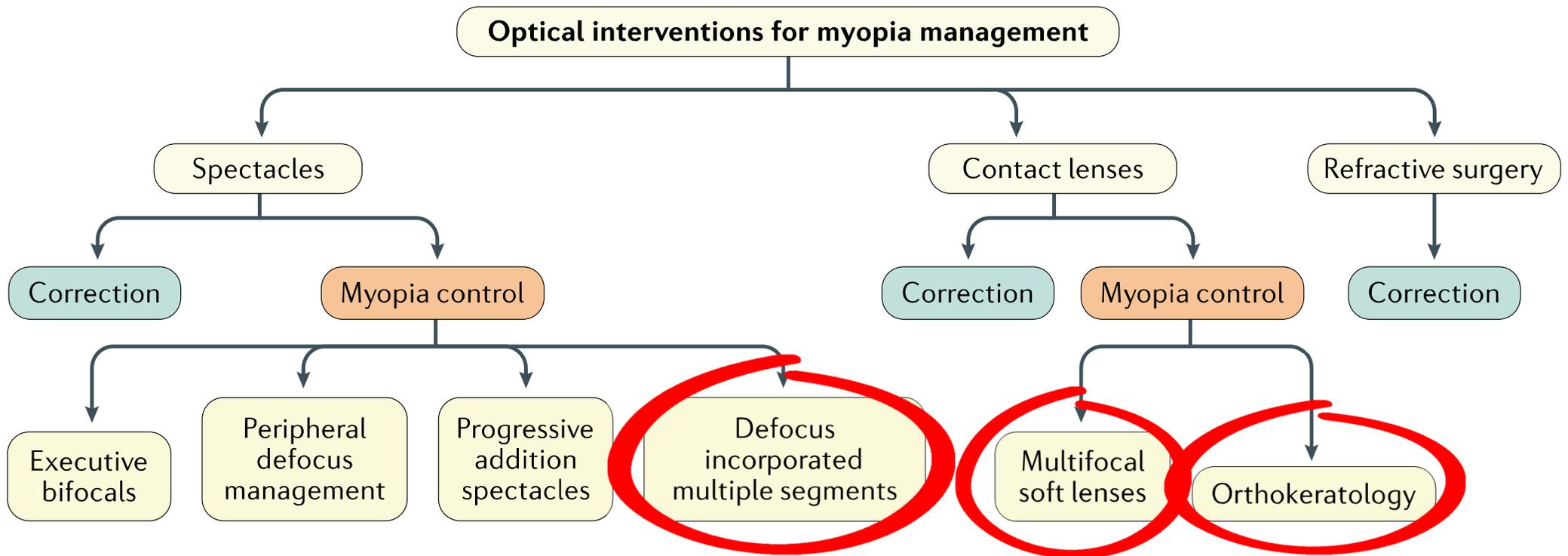
## Contact lenses, including Orthokeratology

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## Orthokeratology and Adolescent Myopia Control

This study set out to determine whether overnight wear of an orthokeratology lens would affect the progression of myopia in young people.

March 1, 2003



ORTHO-K AND MYOPIA

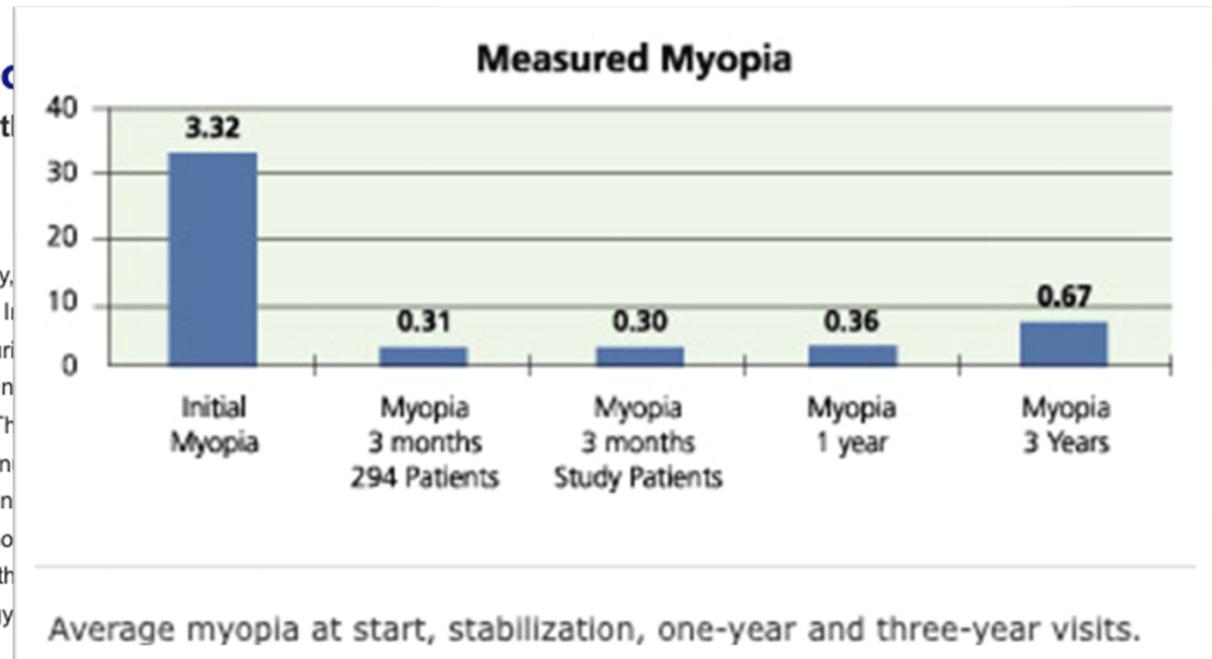
## Orthokeratology and Adolescent Myopia Control

This study set out to determine whether overnight wear of an orthokeratology lens would affect the progression of myopia in young people.

By Thomas R. Reim, OD, Max Lund, OD, and Richard Wu, OD

Ever since the 1960s, rigid contact lenses have been found to control myopia. Initially, this was based on anecdotal evidence with few controlled clinical studies to either confirm or refute these claims. In a study of 1,000 patients, he found that none of the patients showed any increase in myopia during the study period. More controlled studies have since been reported. Governson reported an increase in myopia of 0.48D over a three-year period using daywear gas permeable (GP) contact lenses. The control group of spectacle wearers progressed by 1.53D. A more recent study by Koo reported an annual increase of 0.48D for the GP group and 0.78D for the control group. Both studies suffered from a 50 percent dropout rate, with comfort as the major reason. Some of the myopia reduction was attributed to an orthokeratotic effect on the central cornea being flattened. Koo found a measurable amount of axial length growth in the control group, so some mechanism is taking place, which is unrelated to the corneal orthokeratotic effect. The overnight wear of DreamLens for orthokeratology would have a similar effect.

Contact Lens  
SPECTRUM

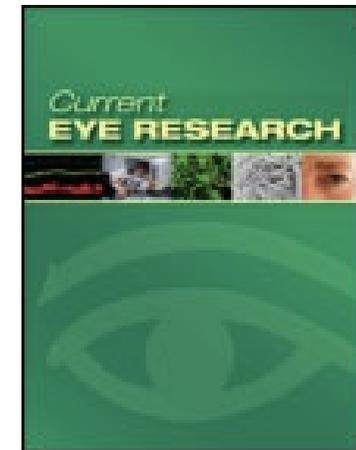


# The Longitudinal Orthokeratology Research in Children (LORIC) in Hong Kong: A Pilot Study on Refractive Changes and Myopic Control

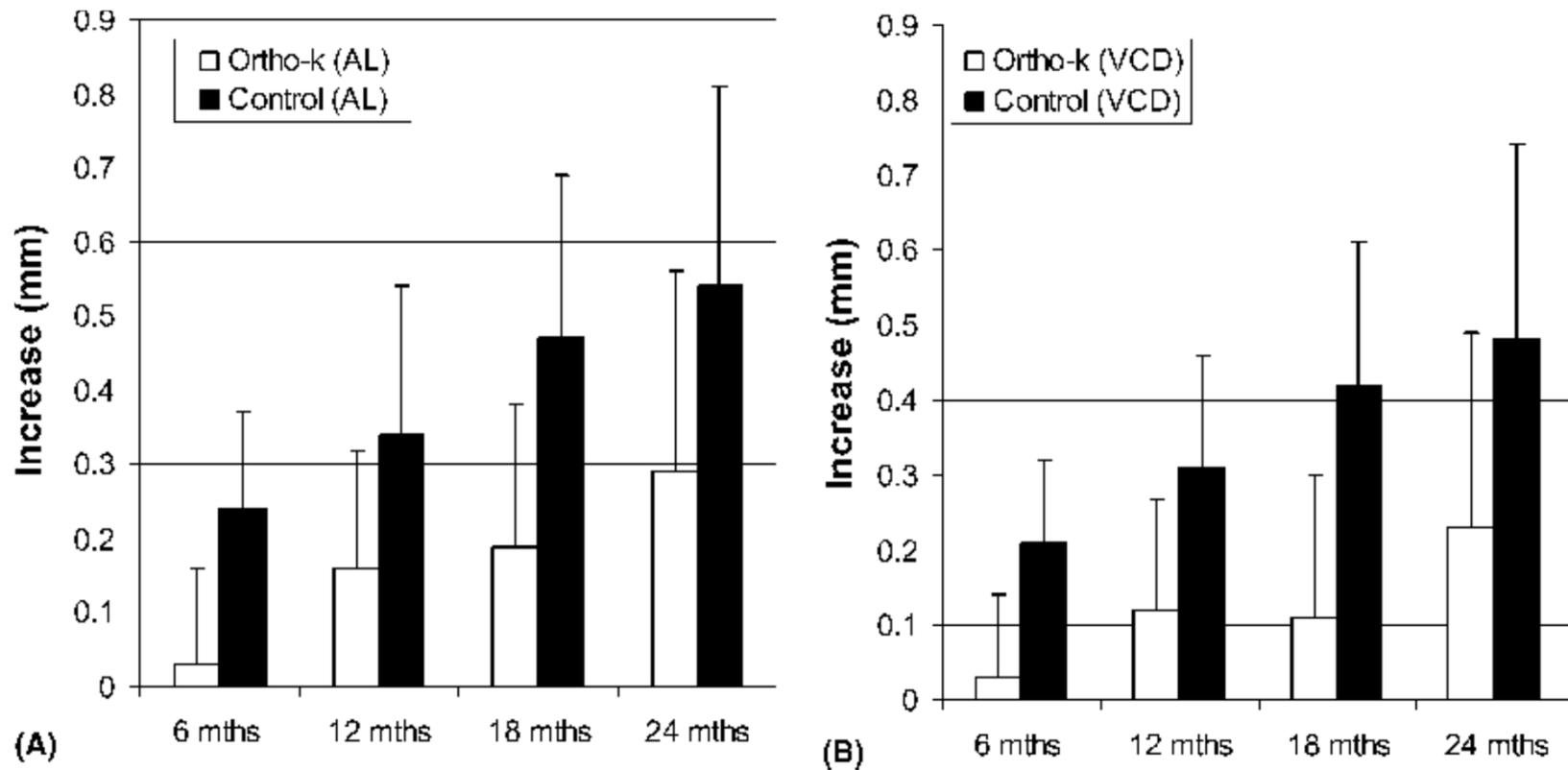
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**ABSTRACT** *Purpose:* Myopia is a common ocular disorder, and progression of myopia in children is of increasing concern. Modern overnight orthokeratology (ortho-k) is effective for myopic reduction and has been claimed to be effective in slowing the progression of myopia (myopic control) in children, although scientific evidence for this has been lacking. This 2 year pilot study was conducted to determine whether ortho-k can effectively reduce and control myopia in children. *Methods:* We monitored the growth of axial length (AL) and vitreous chamber depth (VCD) in 35 children (7–12 years of age), undergoing ortho-k treatment and compared the rates of change with 35 children wearing single-vision spectacles from an earlier study (control). For the ortho-k subjects, we also determined the changes in corneal curvature and the relationships with changes of refractive errors, AL and VCD. *Results:* The baseline spherical equivalent refractive errors (SER), the AL, and VCD of the ortho-k

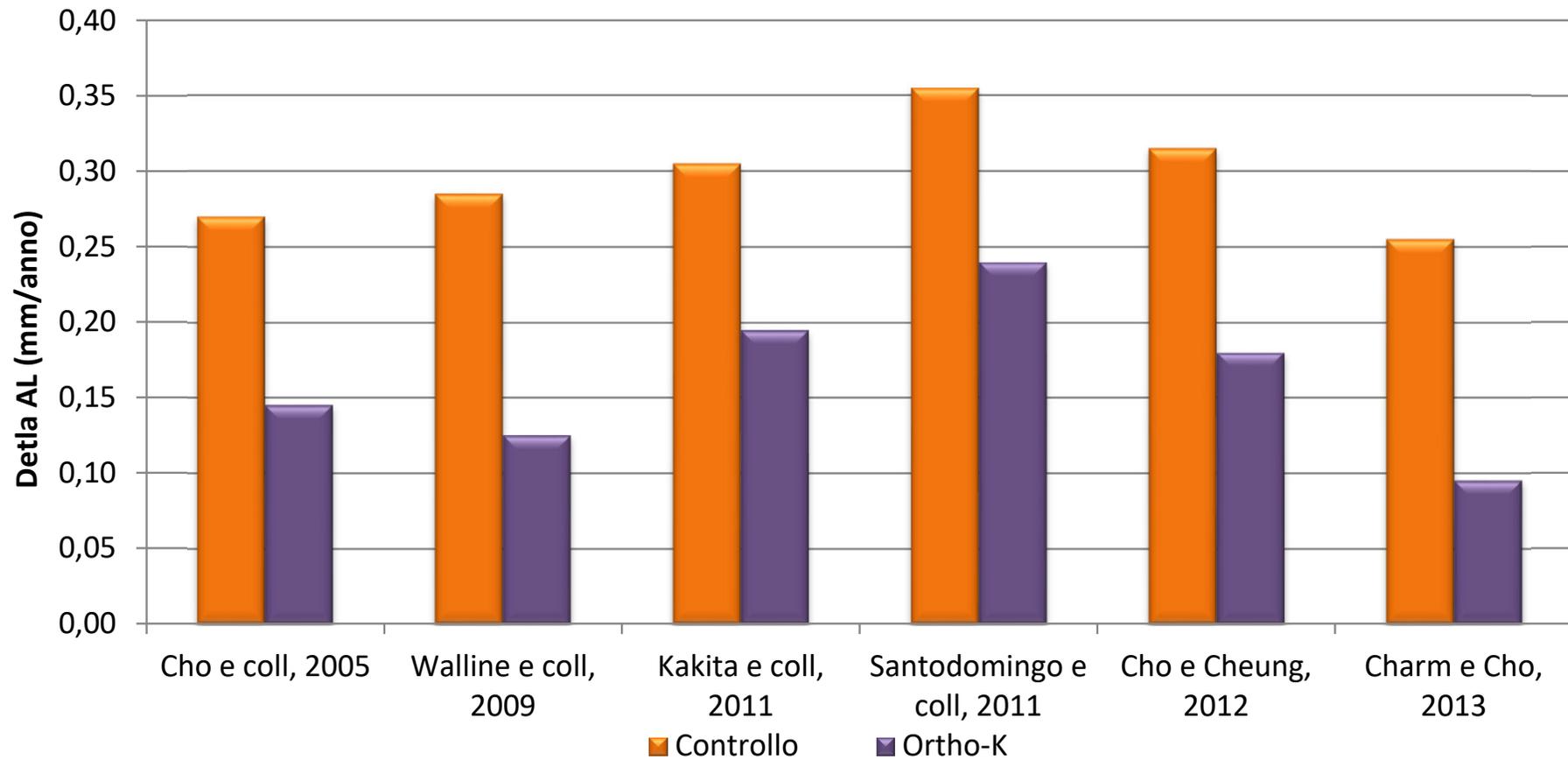


Volume 30, 2005



**FIGURE 1** Changes in the (A) axial length (AL) and (B) vitreous chamber depth (VCD) at each stage of the study of 35 orthokeratology (Ortho-k) and 35 spectacle-wearing (Control) subjects. Each vertical bar represents 1SD.

# Axial length change



*Review Article*

# **Efficacy and Acceptability of Orthokeratology for Slowing Myopic Progression in Children: A Systematic Review and Meta-Analysis**

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Antonio Calossi,<sup>5</sup> Haisi Chen,<sup>1,3</sup> Xuexi Li,<sup>2</sup> and Qinmei Wang<sup>1,3</sup>**

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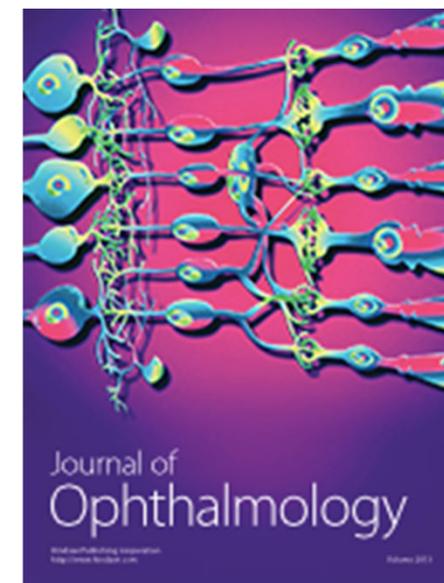
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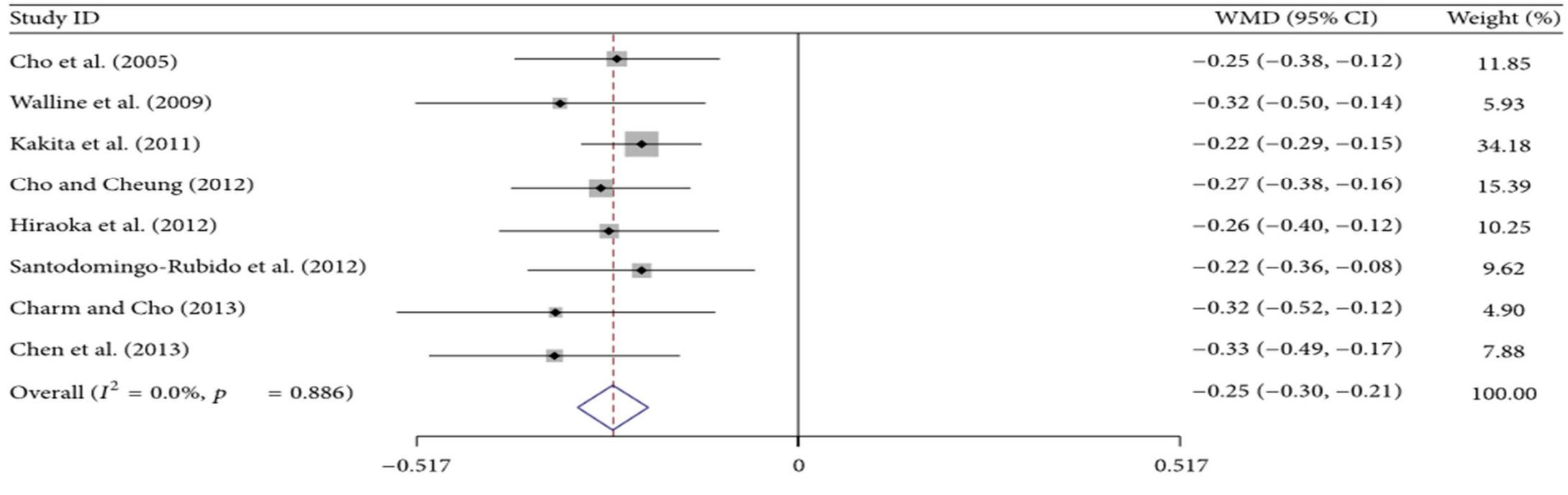
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**Background.** To evaluate the efficacy and acceptability of orthokeratology for slowing myopic progression in children with a well conducted evidence-based analysis. **Design.** Meta-analysis. **Participants.** Children from previously reported comparative studies were treated by orthokeratology versus control. **Methods.** A systematic literature retrieval was conducted in MEDLINE, EMBASE, Cochrane Library, World Health Organization International Clinical Trials Registry Platform, and ClinicalTrials.gov. The included studies were subjected to meta-analysis using Stata version 10.1. **Main Outcome Measures.** Axial length change (efficacy) and dropout rates (acceptability) during 2-year follow-up. **Results.** Eight studies involving 769 subjects were included. At 2-year follow-up, a



June 2015

# Axial length change

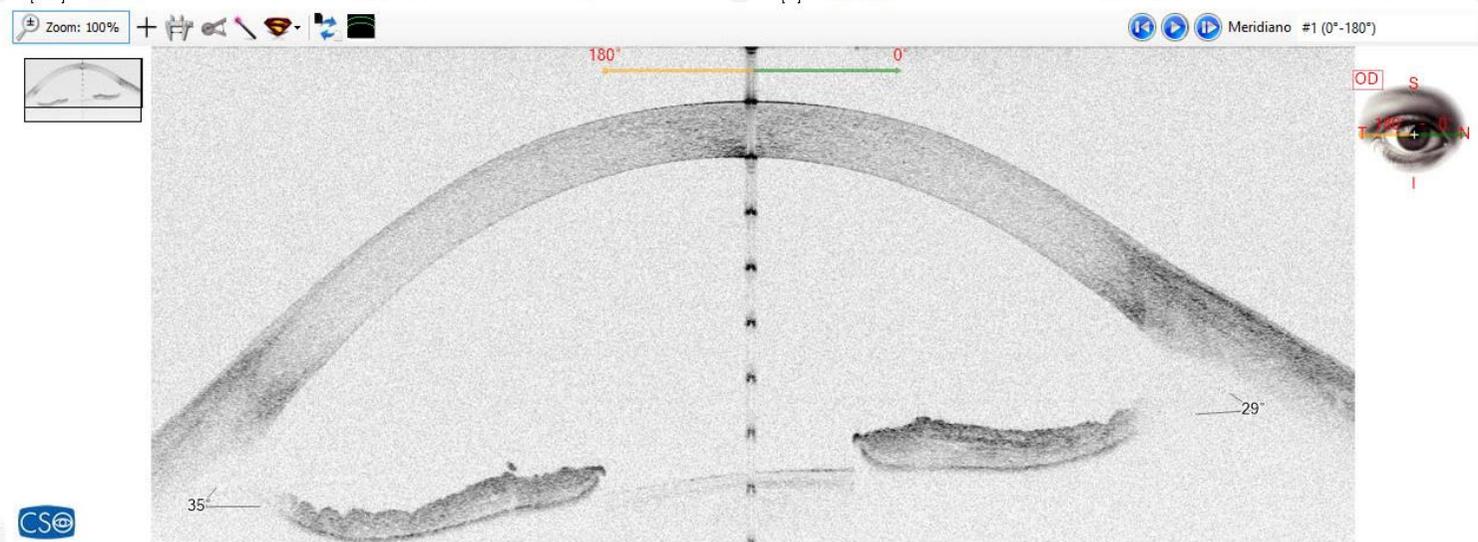
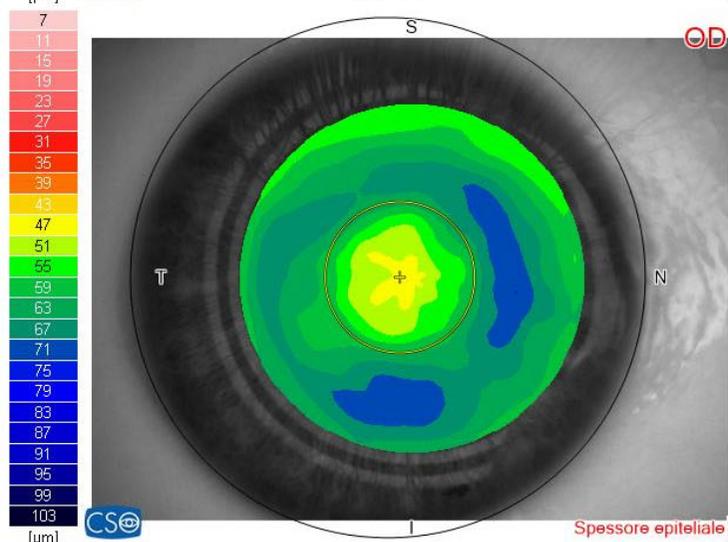
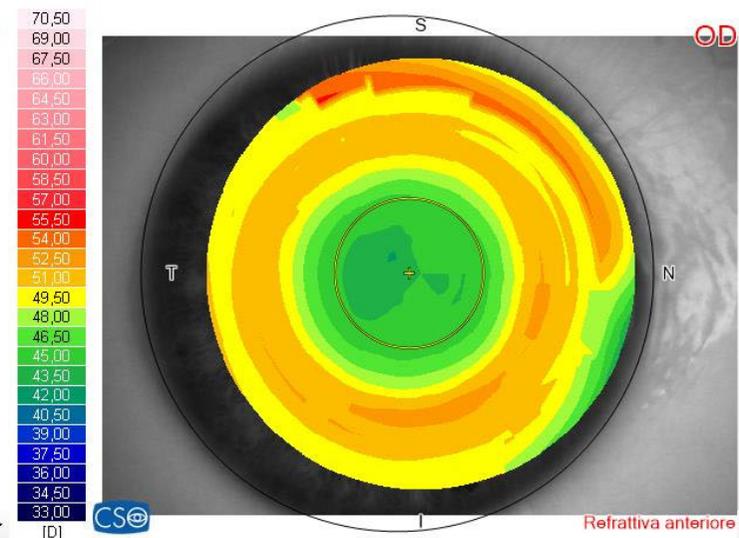
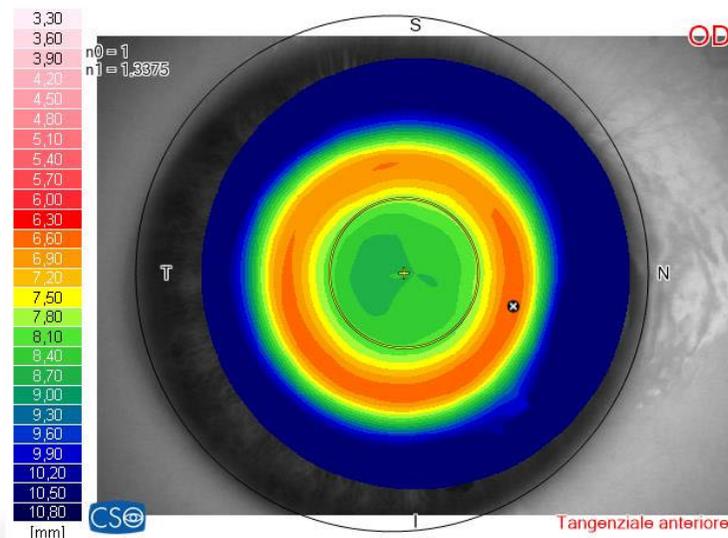
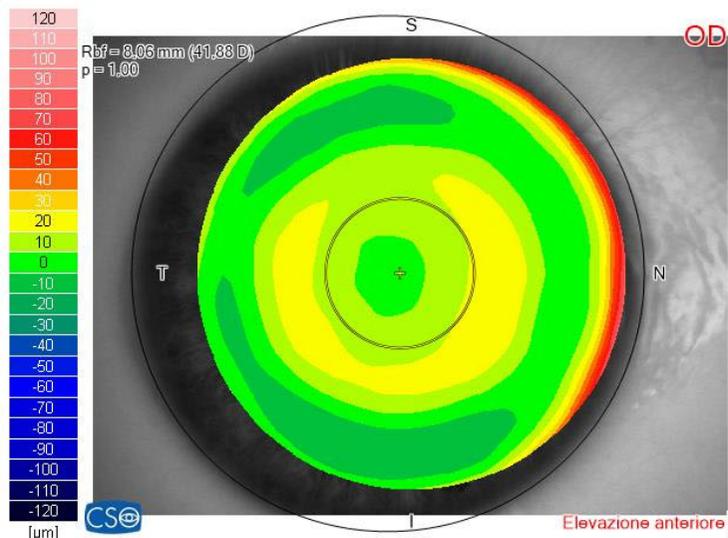


**Figure 2:** Mean difference of axial length change between orthokeratology and control at 2-year follow-up. WMD = weighted mean difference.

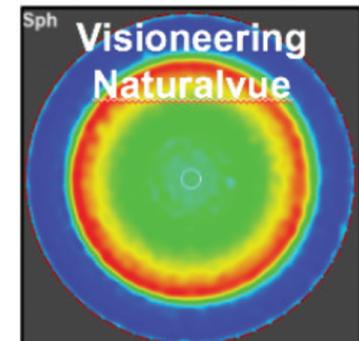
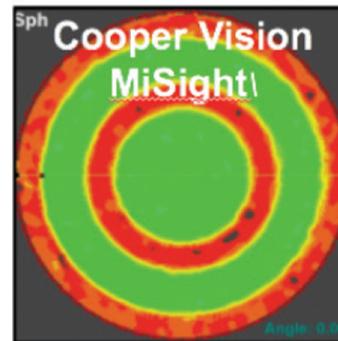
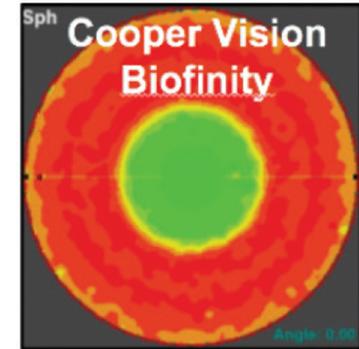
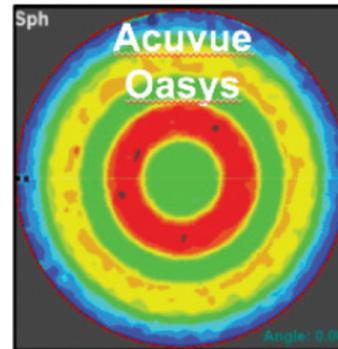
Wen D, Huang J, Chen H, et al. Efficacy and Acceptability of Orthokeratology for Slowing Myopic Progression in Children: A Systematic Review and Meta-Analysis. *J Ophthalmol.* 2015;2015:360806.

# Conclusions

- Orthokeratology is effective and acceptable for slowing myopic progression in children with careful education and monitoring



# Soft contact lenses for MC

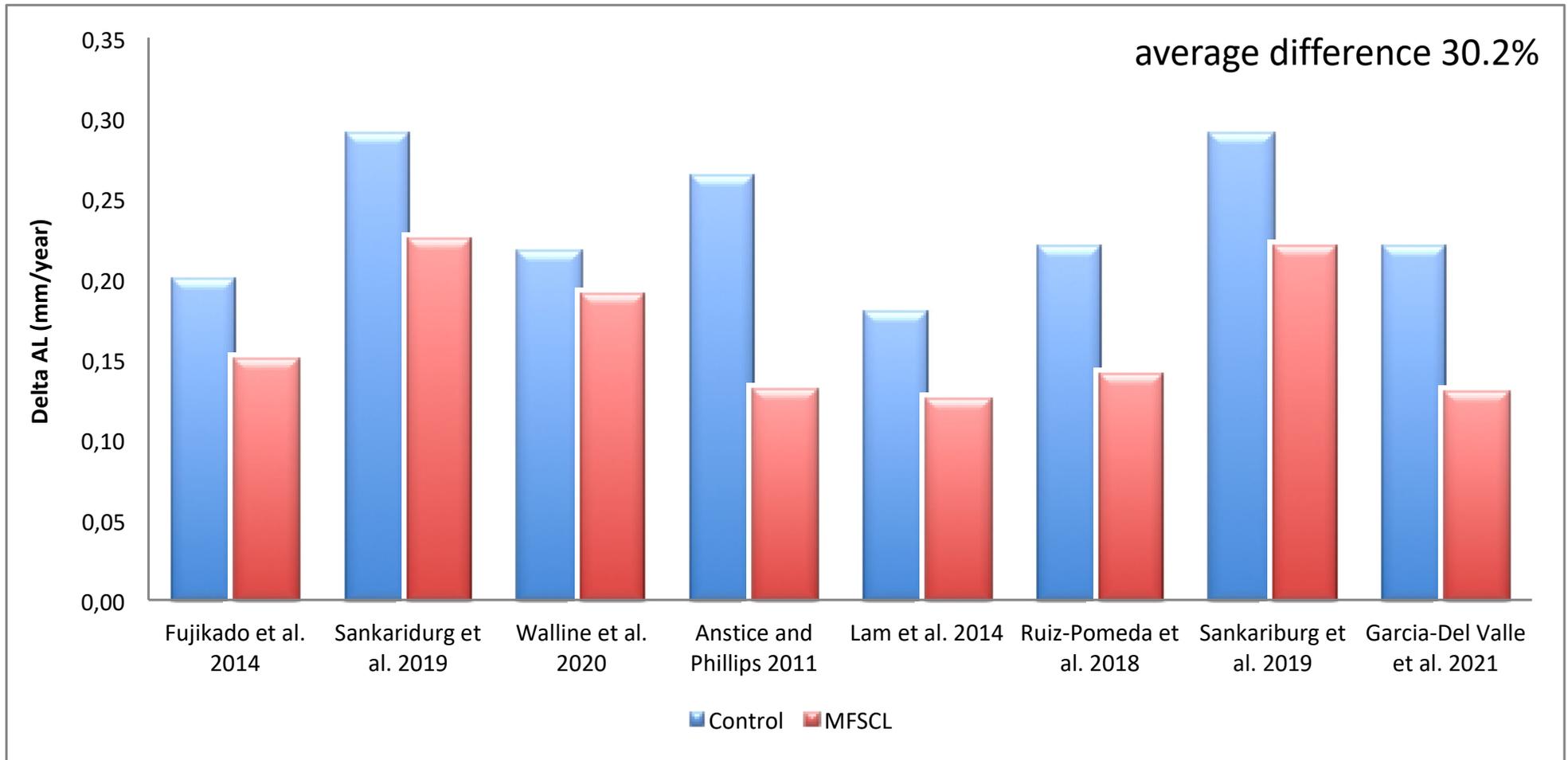


# Soft contact lenses for MC

	Extended Depth Of Focus Contact Lens	Dual-focus Contact Lens	Centre Distance Contact Lens
Rationale	Global Retinal Image Quality that degrades rapidly for all points behind the retina	Simultaneous Defocus	Peripheral Defocus
Design	Optimisation of higher-order aberrations to extend the Depth of Focus	Central correction zone and concentric treatment zones (+2 addition)	Three zones: far, intermediate and near
Replacement	Monthly	Daily	Daily/Monthly
Type	Soft Contact Lens	Soft Contact Lens	Soft Contact Lens
Images (Colours represent the power profile)			

In general, they are designed with a central zone for correcting distance myopia, surrounded by one or more concentric rings with less negative power (+ add)

# Axial length change



Randomized Controlled Trials (RCTs)

# Interventions for myopia control in children: a living systematic review and network meta-analysis

✉ John G Lawrenson, Rakhee Shah, Byki Huntjens, Laura E Downie, Gianni Virgili, Rohit Dhakal, Pavan K Verkicharla, Dongfeng Li, Sonia Mavi, Ashleigh Kernohan, Tianjing Li, Jeffrey J Walline [Authors' declarations of interest](#)

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## Abstract ▲

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## Background

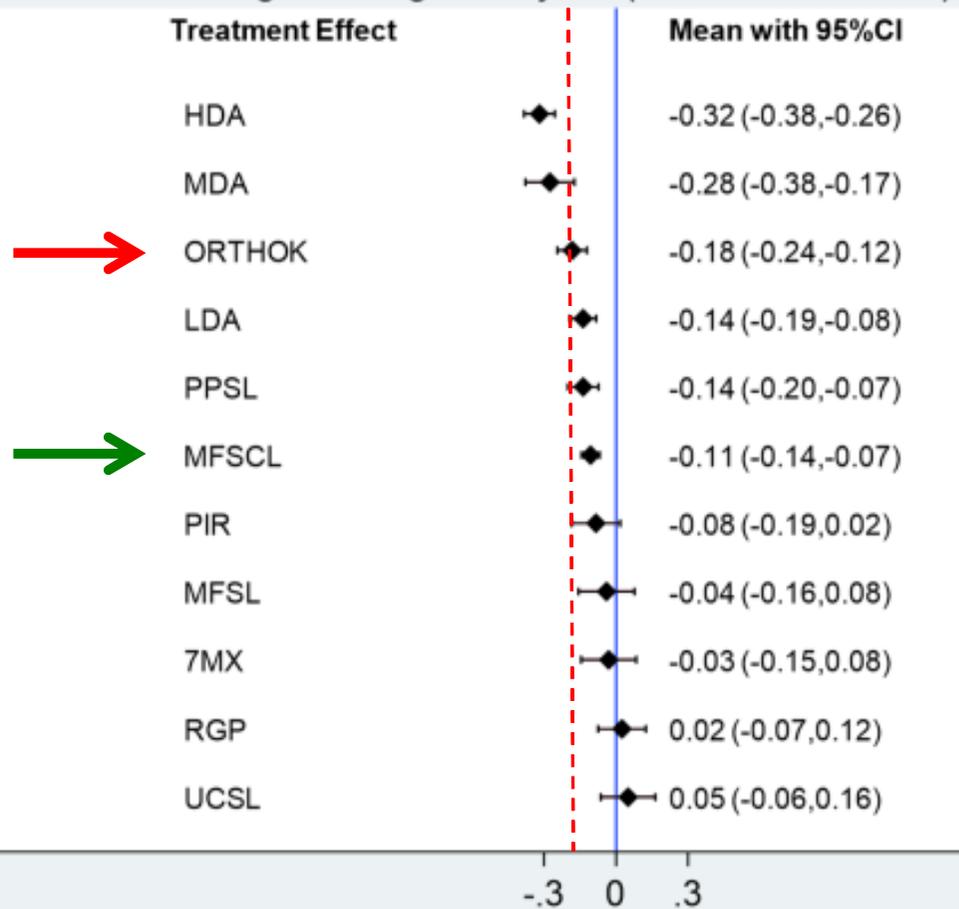
Myopia is a common refractive error, where elongation of the eyeball causes distant objects to appear blurred. The increasing prevalence of myopia is a growing global public health problem, in terms of rates of uncorrected refractive error and significantly, an increased risk of visual impairment due to myopia-related ocular morbidity. Since myopia is usually detected in children before 10 years of age and can progress rapidly, interventions to slow its progression need to be delivered in childhood.

## Objectives

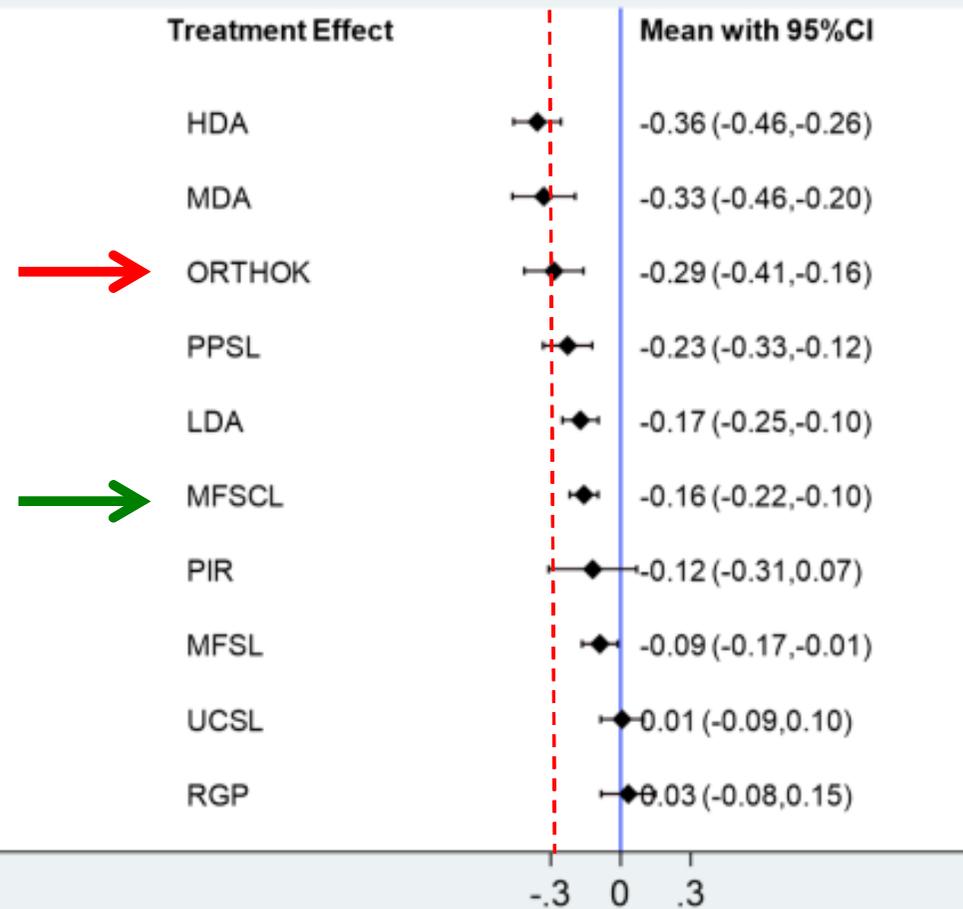
To assess the comparative efficacy of optical, pharmacological and environmental interventions for slowing myopia progression in children using network meta-analysis (NMA). To generate a relative ranking of myopia control interventions according to their



Axial length change at 1 year (reference: CONT)

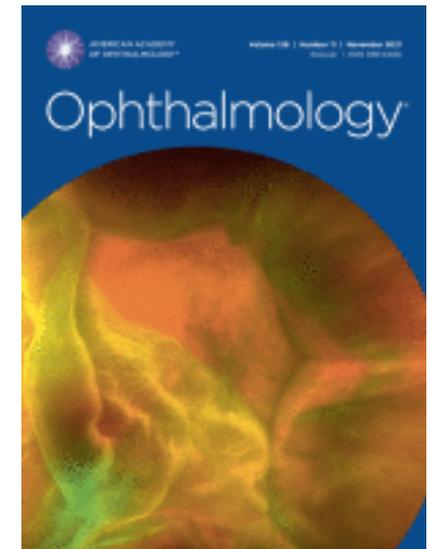
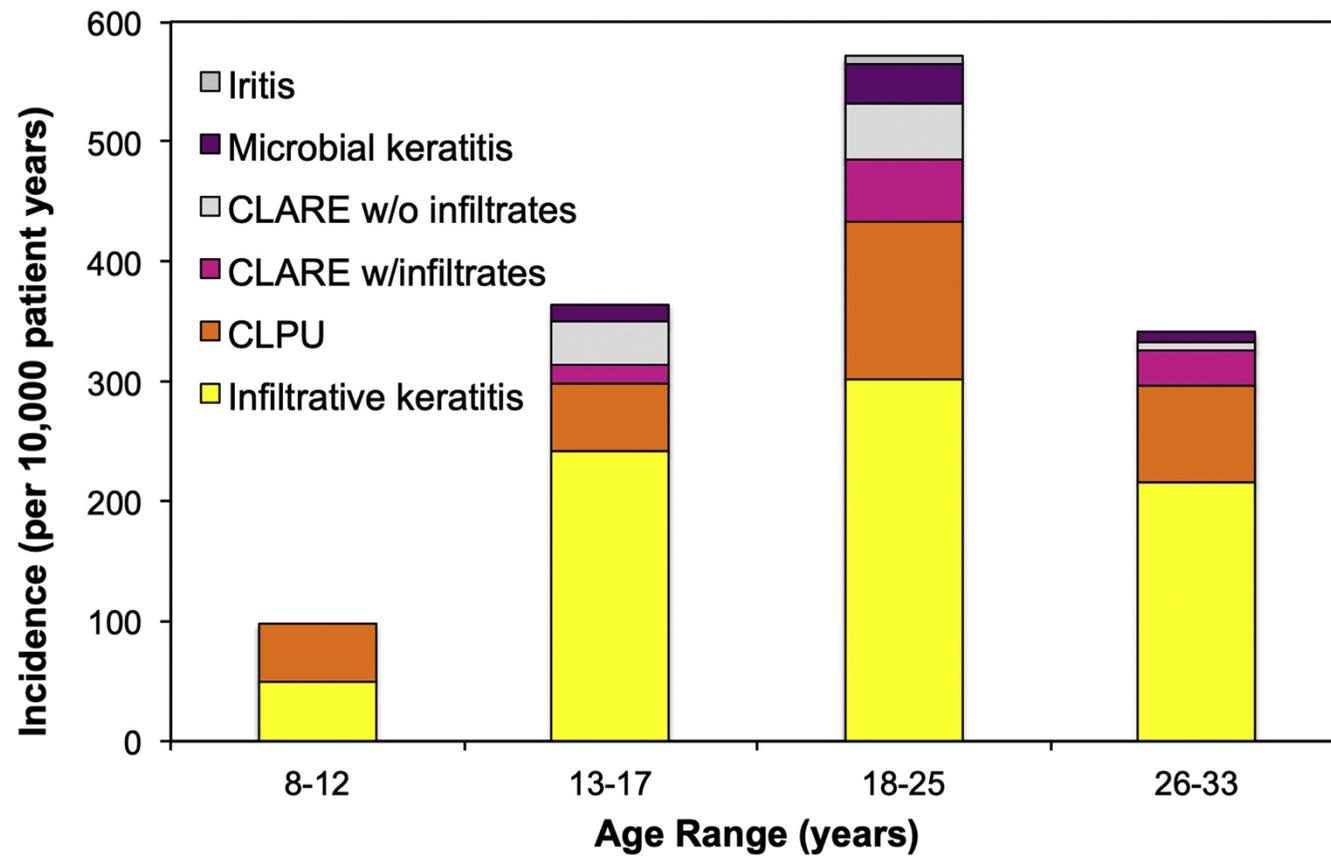


Axial length change at 2 years (reference: CONT)



**7MX:** 7-methylxanthine; **HDA:** high-dose atropine; **LDA:** low-dose atropine; **MDA:** moderate-dose atropine; **MFSCSL:** multifocal soft contact lenses; **MFSL:** multifocal spectacle lenses ; **ORTHOK:** orthokeratology; **PIR:** pirenzepine; **PPSL:** peripheral plus spectacle lenses; **RGP:** rigid gas-permeable contact lenses; **UCSVL:** undercorrected single vision spectacles

What about safety?



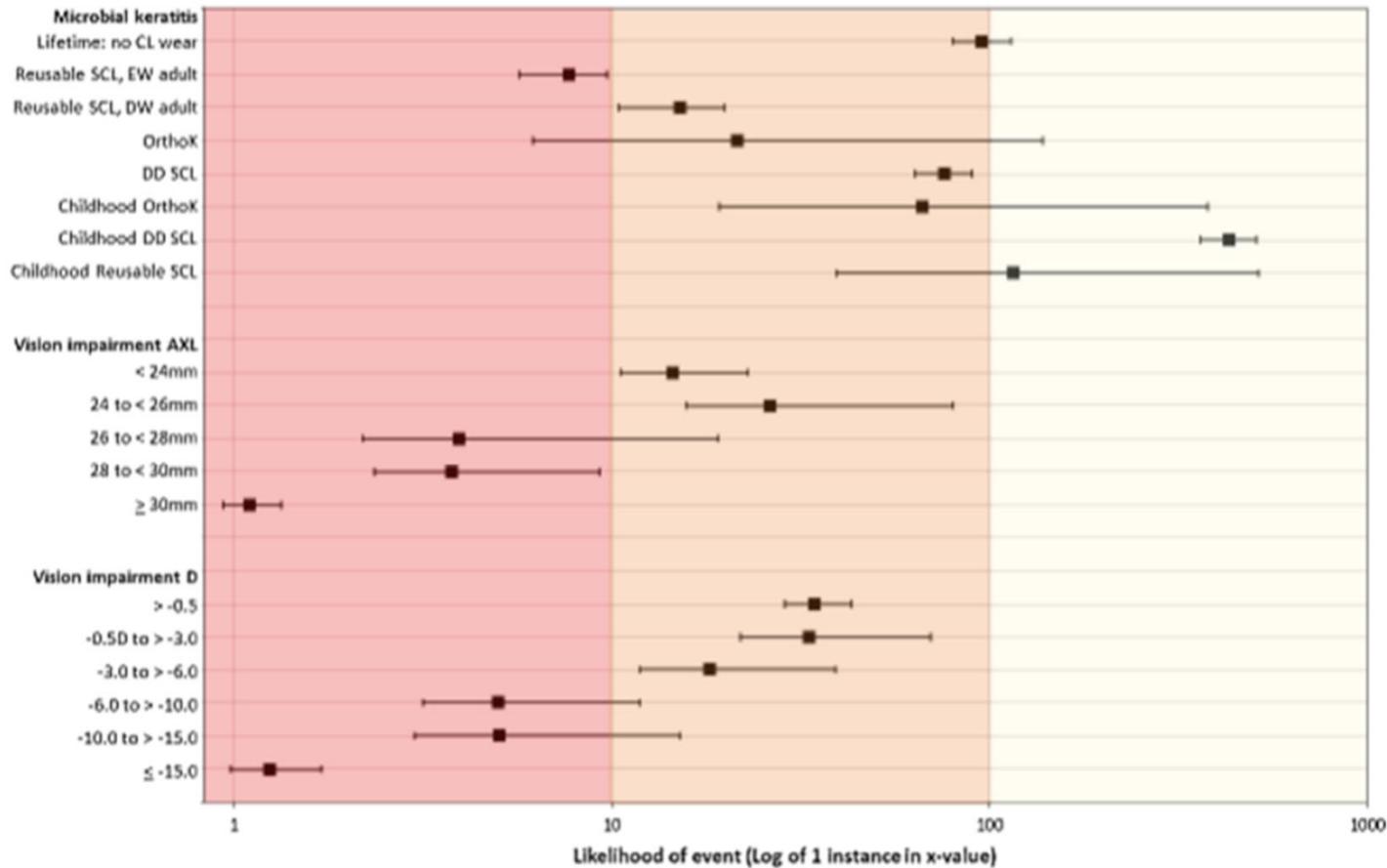
November 2021

Bullimore MA, Ritchey ER, Shah S, Leveziel N, Bourne RRA, Flitcroft DI. The Risks and Benefits of Myopia Control. *Ophthalmology*. 2021;128(11):1561-1579.

# Safety

- The original 2019 IMI report on guidelines and ethical considerations asserted that “children do not have a higher risk than adults of suffering from contact lens-related complications with either OK or soft contact lens wear”.
- Recent studies have largely supported this assertion.<sup>170–174</sup>
- 170. Bullimore MA, Mirsayafov DS, Khurai AR, et al. Pediatric microbial keratitis with overnight orthokeratology in Russia. *Eye Contact Lens*. 2021; 47: 420–425.
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- 174. Woods J, Jones D, Jones L, et al. Ocular health of children wearing daily disposable contact lenses over a 6-year period. *Cont Lens Anterior Eye*. 2021; 44: 101391.





**Fig. 2.** Likelihood of each ocular health event occurring once for an individual, with 95 % confidence intervals presented on a Log scale. All likelihoods are presented over a lifetime, except for three childhood microbial keratitis risks as indicated. The WHO CIOMS classification system for frequency of adverse events (REF) is indicated by coloured shading – red indicates very common (more than 1/10), orange indicates common / frequent (between 1/10 and 1/100) and yellow indicates uncommon / infrequent (between 1/100 and 1/1000). CL = contact lens; SCL = soft contact lens; DD = daily disposable; AXL = axial length; D = dioptres.

# Pediatric Microbial Keratitis With Overnight Orthokeratology in Russia

Mark A. Bullimore, M.C.Optom., Ph.D., Dmitry S. Mirsayafov, M.D., Aslan R. Khurai, M.D., Ph.D., Leonid B. Kononov, M.D., Ph.D., Suzanna P. Asatrian, M.D., Andrei N. Shmakov, M.D., Ph.D., Kathryn Richdale, O.D., Ph.D., and Valery V. Gorev, M.D., Ph.D.

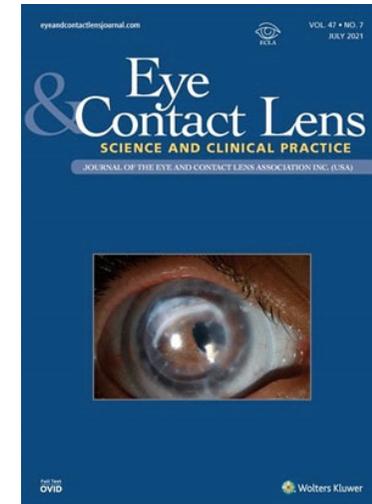
**Objectives:** To estimate the incidence of microbial keratitis in children wearing overnight orthokeratology lenses in Moscow, Russia.

**Methods:** To estimate the number of children wearing overnight orthokeratology lenses in 2018, 1,368 patient records from 13 Doctors Lens clinics were selected at random and extrapolated to the entire patient base. To identify cases of microbial keratitis, all episodes of infiltrative keratitis from Morozovskaya City Children's Clinical Hospital in 2018 were recorded and adjudicated by three experienced ophthalmologists. Incidence was calculated as the number of cases divided by the estimated number of wearers.

**Results:** There were 23,049 overnight orthokeratology fits between 2010 and 2018. Among the 1,368 records surveyed, 1,078 (79%) were younger than 18 years at initial fitting. Based on a 7% or 10% annual discontinuation rate, the estimated number of children wearing lenses in 2018 was 10,307 or 9,422, respectively. During 2018, there were 139 cases of corneal infiltrative keratitis in children and 45 were adjudicated as microbial

(*Eye & Contact Lens* 2021;47: 420–425)

Overnight orthokeratology is the planned, temporary reduction in myopia by the wearing of flat-fitting rigid contact lenses.<sup>1</sup> These rigid gas permeable (RGP) contact lenses possess reverse geometry with the first peripheral curve steeper than the central base curve to improve centration.<sup>2–4</sup> Modern high oxygen transmissible materials minimize hypoxic stress and corneal edema when worn on an overnight basis. Lenses are inserted before bedtime and removed the following morning, resulting in correction-free vision throughout the day.<sup>5</sup> Patients are free to engage in sports and outdoor activities, which may otherwise be difficult to perform wearing spectacles or even daily wear contact lenses. The



July 2021

**Results:** There were 23,049 overnight orthokeratology fits between 2010 and 2018. Among the 1,368 records surveyed, 1,078 (79%) were younger than 18 years at initial fitting. Based on a 7% or 10% annual discontinuation rate, the estimated number of children wearing lenses in 2018 was 10,307 or 9,422, respectively. During 2018, there were 139 cases of corneal infiltrative keratitis in children and 45 were adjudicated as microbial keratitis (32%). Of these, 20 cases were associated with contact lens wear (44%): 15 soft lens wearers (33%) and 5 overnight orthokeratology wearers (11%). Based on the 5 cases and assuming a 7% or 10% discontinuation rate, the annual incidence is 4.9 (95% confidence interval[CI]: 2.1–11.4) or 5.3 (95% CI: 2.3–12.4) per 10,000 patient years.

**Conclusion:** The incidence of microbial keratitis in children wearing overnight orthokeratology is lower than a previous United States study and similar to rates associated with use of daily wear soft contact lenses.

Conclusions: There is sufficient evidence to suggest that OrthoK or Soft CL are safe options for myopia correction and retardation. Long-term success of OrthoK and Soft CL treatments requires a combination of proper lens fitting, rigorous compliance to lens care regimen, good adherence to routine follow-ups, and timely treatment of complications.

[www.surveymonkey.co.uk/r/Myopia2023-Italian](https://www.surveymonkey.co.uk/r/Myopia2023-Italian)



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*Grazie per l'attenzione*