EXPERIMENTAL AND THERAPEUTIC MEDICINE 31: 55, 2026

Long-term effects of orthokeratology on moderate myopia progression in children: A 3-year prospective study

YIBAO LI[1], RUI ZHANG[1], YU SU[2] and RONGFENG LIAO[1]

[1]Department of Ophthalmology, The First Affiliated Hospital of Anhui Medical University, Hefei, Anhui 230022, P.R. China;
[2]Department of Ophthalmology, Anhui Women and Children's Medical Center, Hefei, Anhui 230001, P.R. China

Received June 27, 2025; Accepted November 7, 2025

DOI: 10.3892/etm.2025.13051

Abstract. Myopia is a global health concern, with an increasing prevalence in pediatric populations. Orthokeratology (OK) lenses have been explored as a non-invasive intervention that may slow axial elongation and improve refractive outcomes in children with myopia, potentially through peripheral retinal defocus remodeling. The present prospective cohort study evaluated the impact of OK lens wear on axial length, refractive error and visual parameters in myopic children over a 3-year period. A total of 188 myopic children <18 years of age (100 males; 88 females; mean age, 12.5±2.1 years), with baseline spherical equivalent refractive errors ranging from -1.00 to -6.00 D were enrolled. Participants were fitted with OK lenses and monitored at 1 week, 1 month and every 3 months thereafter to monitor compliance, assess lens fit and address any adverse events. Axial length increased from 24.12±0.63 mm at baseline to 24.70±0.12 mm over 36 months (mean elongation, 0.58 mm; P<0.01). Refractive error improved from -3.25±1.05 to -2.82±0.18 D (mean change, +0.43 D; P<0.01). Patient compliance levels were categorized according to adherence and adverse effects: High (n=120), moderate (n=50) and low (n=18). Compliance significantly influenced outcomes, with highly compliant participants having a lower mean axial elongation (0.35±0.07 mm) compared with that of participants with the lowest compliance (0.72±0.12 mm; P<0.01). Adverse events were infrequent, including corneal staining (n=15; 8.0%), lens intolerance (n=10; 5.3%) and conjunctival redness (n=20; 10.6%). The mean resolution time of these adverse effects ranged from 3.2 to 6.0 days. These findings indicate that OK lenses significantly improved refractive error and visual acuity in children with myopia. Compliance was identified as a critical factor influencing treatment efficacy. Therefore, it is suggested that OK should be considered an integral component of moderate myopia management protocols for pediatric patients.

Correspondence to: Dr Rongfeng Liao, Department of Ophthalmology, The First Affiliated Hospital of Anhui Medical University, 218 Jixi Road, Hefei, Anhui 230022, P.R. China
E-mail: rongfengliao7@gmail.com

Abbreviations: OK, orthokeratology; D, diopters; UDVA, uncorrected distance visual acuity; BCVA, best-corrected visual acuity; SD, standard deviation; HOAs, higher-order aberrations; TZD, treatment zone decentration

Key words: axial length, myopia control, orthokeratology, pediatric ophthalmology, refractive error, visual acuity

Introduction

Myopia, also known as nearsightedness, is a refractive condition in which distant objects are seen in low definition due to light focusing anterior to the retina (1). The prevalence of myopia has risen substantially worldwide, particularly among children and adolescents (2). It has been estimated that ~50% of the global population will experience myopia by 2050 (2,3). In addition, it is estimated that as many as 10% of cases might be classified as being high myopia, characterized by major ocular complications, including retinal detachment, glaucoma, myopic maculopathy and choroidal neovascularization. These complications are associated with a high risk of irreversible vision loss, highlighting the need for aggressive management to control the progression of myopia in childhood, when ocular growth and development are most active (4).

Several factors may explain why the prevalence of pediatric myopia is increasing. Among environmental factors, reduced exposure to natural light and increased engagement in near-work activities, such as screen use and reading, have been cited, and genetic predisposition also plays a key role (5). Children with myopic parents are at an elevated risk of developing myopia, with a study demonstrating a compounded risk when both parents are myopic (2). Axial elongation, the main structural correlate of myopia severity, is driven by an interplay between genetic and environmental factors. In addition to promoting myopia progression, axial elongation increases the risk of sight-threatening complications, making it an important target for myopia control interventions (6,7).

Orthokeratology (OK) is a corneal reshaping therapy in which the patient wears specially designed rigid gas-permeable lenses overnight, and has emerged as a promising approach for myopia control (8). These lenses temporarily reshape the corneal epithelium, allowing for clear unaided vision during the day. More importantly, OK lenses are postulated to reduce the extent of axial elongation by peripheral retinal defocus remodeling (9). The underlying mechanism is the establishment of a peripheral myopic defocus that counteracts hyperopic defocus-induced axial elongation. Numerous clinical studies and meta-analyses have shown that OK lenses significantly slow axial elongation growth compared with that achieved using conventional corrective treatments such as single-vision glasses or contact lenses (1-10).

Other ocular parameters, such as refractive error, contrast sensitivity and higher-order aberrations, are also altered when OK lenses are used. It is hypothesized that the peripheral myopic defocus caused by OK lenses is the main mechanism by which retinal growth signals are modulated and the progression of myopia is reduced. However, the underlying mechanism remains incompletely understood. Considerable variability in treatment outcomes among patients has been reported (11,12). This may be attributed to factors including differences in lens design, patient age, the initial refractive error of the eye, biomechanical properties of the cornea, and compliance with the wear schedule and protocols. In addition, some concerns remain regarding the long-term safety and efficacy of OK lens wear, particularly concerning corneal health and infection risk (12).

Despite considerable research, substantial knowledge gaps persist regarding the comprehensive effects of OK on visual and structural ocular parameters. Most existing studies focus on short-term refractive outcomes, while few long-term studies have evaluated the impact of OK on axial elongation and other important metrics. Furthermore, heterogeneous study designs, variable follow-up times and inconsistencies in the reporting of outcomes limit the comparability of the findings. A previous study has contextualized OK as a pivotal modality within the expanding spectrum of noninvasive, lens-mediated ocular therapies, aligning with broader innovations in nanoparticle-based drug delivery systems (13).

The present prospective cohort study aimed to assess the effect of OK lens wear on visual parameters, refractive error and axial length in children with myopia over an extended follow-up period. Changes in these parameters were evaluated in detail to provide evidence-based insights into the role of OK as a myopia control intervention and to contribute to the optimization of pediatric myopia management strategies.

Materials and methods

Study design and setting. The single-arm prospective cohort study was conducted over 3 years, from February 1, 2020 to February 28, 2023. The study took place at The First Affiliated Hospital of Anhui Medical University (Hefei, China) and Anhui Women and Children's Medical Center (Hefei, China), both of which specialize in pediatric ophthalmology.

Study population. The study enrolled myopic children <18 years of age who were seeking vision correction and met the inclusion criteria. Eligible participants had a spherical equivalent refractive error between -1.00 and -6.00 diopters (D) and astigmatism ≤1.50 D. Exclusion criteria were any history of ocular surgery, active ocular disease, systemic conditions affecting vision or poor compliance with lens wear. Participants with contraindications to OK, such as irregular corneas or severe dry eye, were also excluded. Recruitment was carried out using convenience sampling from patients presenting to the clinic for refractive correction.

Sample size estimation. The sample size was calculated to ensure adequate statistical power for detecting a significant difference in axial length changes between baseline and follow-up. Based on previous studies, the expected effect size for axial elongation reduction was set at 0.25 mm per year, with a standard deviation (SD) of 0.40 mm. Using a two-tailed a of 0.0 and a power of 80, the required sample size was calculated using the following formula: $n=2 \times (Z_{\alpha/2} + Z_{\beta})^2 \times \sigma^2/\Delta^2$ in which: $Z_{\alpha/2}$ is 1.96, corresponding to a 95% confidence interval, Z_{β} is 0.84, providing 80% power; σ is 0.40 mm as the assumed SD; and Δ is 0.25 mm, representing the minimum detectable difference. The calculated sample size was 156. Based on an anticipated dropout rate of 20%, a total of 188 participants were enrolled in the study.

Intervention. Participants were fitted with OK lenses specifically designed for myopia management. Lens fitting was performed by experienced practitioners following a standardized protocol to ensure optimal centration and alignment. Lenses were worn overnight for ≥8 h and removed upon waking. Participants were provided with detailed instructions on lens handling, cleaning and storage. Follow-up visits were scheduled at 1 week, 1 month and every 3 months thereafter to monitor compliance, assess lens fit and address any adverse events.

The OK lenses used in the present study featured a reverse geometry design with four-zone architecture, including a central optical zone, reverse curve, alignment zone and peripheral curve, optimized for overnight wear and corneal reshaping. All lenses were made of high-Dk materials to ensure adequate oxygen permeability during closed-eye conditions. Lens parameters, including base curve, diameter and sagittal depth, were customized based on corneal topography and refractive error. To minimize the influence of lens-induced corneal flattening on axial length measurements, all AL assessments were performed after a minimum washout period of 24-48 h without lens wear, as recommended in previous studies (1,2,3,5,7,10). This protocol ensured that transient corneal changes did not confound biometric outcomes (2).

Outcome measures. The primary outcome measure was change in axial length, assessed using low-coherence optical biometry, for example using an IOLMaster device (IOLMaster 500; Carl Zeiss Meditec AG). Secondary outcomes included changes in spherical equivalent refractive error, measured via cycloplegic autorefraction, and visual parameters such as uncorrected distance visual acuity (UDVA) and best-corrected visual acuity (BCVA). Corneal topography was performed at each visit to monitor changes in corneal shape and ensure lens stability.

Data collection. Baseline data included demographic information, ocular history and comprehensive ocular examination results. Measurements of axial length, corneal curvature and refractive error were performed at baseline and each follow-up visit using standardized equipment and procedures. Adverse events, including corneal staining, conjunctival redness and

Table I. Visual parameters as baseline and 36-month follow-up.

	Baseline		36-month follow-up				
Visual parameter	Mean	SD	Mean	SD	Mean change	t-value	P-value
Spherical equivalent refractive error, D	-3.25	1.05	-2.82	0.18	0.43	10.28	<0.01
Axial length, mm	24.12	0.63	24.70	0.12	0.58	-66	<0.01
Uncorrected distance visual acuity, logMAR	0.48	0.22	0.12	0.12	-0.36	20	<0.01
Best corrected visual acuity, logMAR	0.08	0.25	0.05	0.01	-0.03	41	0.03

Parameters were evaluated by clinicians blinded to the study. Paired t-test was used for statistical analysis. SD, standard deviation; D, diopters; logMAR, logarithm of the minimum angle of resolution.

lens intolerance, were recorded and managed according to established OK safety guidelines (2). Outcomes were evaluated by clinicians blinded to the study. The level of compliance with OK lens wear in children was evaluated based on a combination of behavioral, clinical and follow-up adherence parameters: High compliance was defined as ≥90% adherence to wear time, full attendance at follow-ups, proper hygiene, and no missed logs or adverse event reporting; moderate compliance was defined as 60-89% adherence, and occasional missed visits or minor lapses in hygiene/logging; and low compliance was defined as <60% adherence, frequent missed visits, poor hygiene or unreported adverse events (2,9).

Statistical analysis. Data were analyzed using SPSS software, version 27.0 (IBM Corp.). Data are presented at the mean ± SD. Descriptive statistics were used to summarize demographic and baseline characteristics. Paired t-tests were employed to compare changes from baseline to 36-month follow-up (14). Bartlett's test was performed to check the uniformity of SDs for normally distributed continuous variables. Repeated measures analysis of variance (ANOVA) with Bonferroni correction was used to analyze axial length changes over multiple time points. One-way ANOVA with post hoc Tukey's test was used to analyze axial length changes among compliance groups. Mixed-effects regression models were used to evaluate the longitudinal effects of OK on axial length while adjusting for potential confounders such as age, baseline refractive error and compliance. P<0.05 was considered to indicate a statistically significant result. Forest plots were drawn using metaanalysisonline.com (ELIXIR Hungary) (15) using the setting ‘random effect model’, method ‘inverse’, summary measures ‘standard mean difference’ and between study heterogeneity estimator ‘DerSimonian-Laird’. I^2>50% was considered moderate heterogeneity.

Results

Study participants. The study window was from February 1, 2020 to February 28, 2023, a total of 37 months. All 188 children completed a full 36-month follow-up and none dropped out.

Baseline visual parameters. The study included 188 participants, 100 (53.2%) males and 88 (46.8%) females. The mean age of the participants was 12.5±2.1 years. At baseline (Table I), the mean spherical equivalent refractive error was -3.25±1.05 D, the mean axial length was 24.12±0.63 mm, and the UDVA was 0.48±0.22 logarithm of the minimum angle of resolution (logMAR). These parameters confirmed the enrollment of moderately myopic participants suitable for OK intervention.

Compliance and axial length changes. As shown in Fig. 1, 120 (63.8%), 50 (26.6%) and 18 (9.6%) children had high, moderate and low levels of compliance. Participants with high compliance exhibited the lowest mean change in axial length (0.35±0.07 mm), while participants with low compliance exhibited the highest mean change (0.72±0.12 mm). Participants with medium compliance exhibited a mean change of 0.53±0.1 mm. Differences between the high and moderate compliance groups and between the high and low compliance groups were statistically significant (P<0.05), emphasizing the importance of adhering to lens wear protocols.

Changes in axial length over time. The mean increase in axial length was 0.15±0.05 mm at 6 months and reached 0.58±0.12 mm at 36 months. Statistically significant changes in mean axial length were observed over time, highlighting a progressive increase in axial length over time during OK lens wear (P<0.05; Fig. 2). Evaluations of axial length changes were performed at 6, 12, 24 and 36 months for all 188 patients using a random effects model with the inverse variance method (Fig. 3). The summarized mean raw (MRAW) was 0.36 with a 95% confidence interval of 0.19-0.53. Significant heterogeneity was detected (P<0.01), suggesting variable effects in magnitude and/or direction. The I^2 value indicates that 99.9% of the variability among the four time points of evaluation arises from heterogeneity over the time of OK use, rather than random chance. The analysis confirmed that the axial length increased over time.

Visual parameter changes. UDVA improved significantly from 0.48±0.22 to 0.12±0.12 logMAR by month 36, with a mean change of -0.36 logMAR (P<0.01). The refractive error

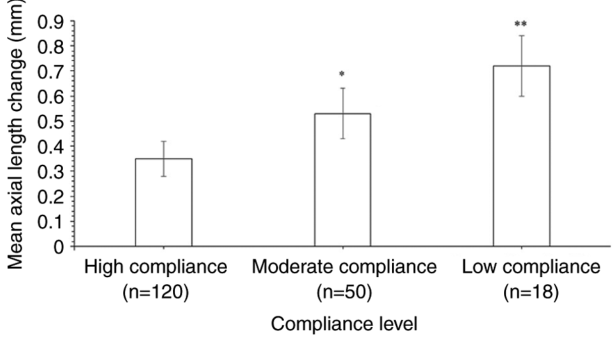

Figure 1. Axial length changes in patients with different levels of compliance. *P<0.05; **P<0.01 vs. the high compliance group.

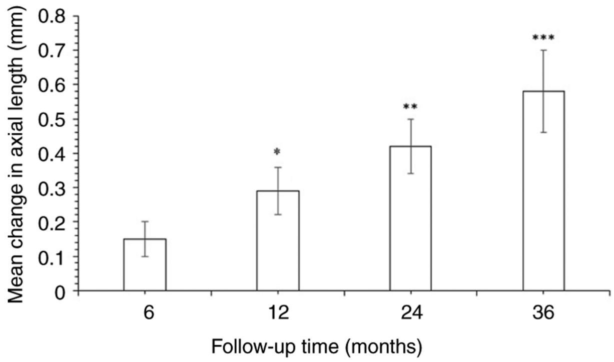

Figure 2. Changes in longitudinal axial length observed during follow-up. *P<0.05; **P<0.001 and ***P<0.001 vs. the 6 months group.

also improved by +0.43 D (P<0.01) over this period. BCVA improved significantly from 0.08±0.25 to 0.05±0.01 during month 36. These results demonstrate that OK lenses improved vision and effectively managed refractive error (Table I).

Adverse events during follow-up. Adverse events included corneal staining 15 (8.0%), lens intolerance 10 (5.3%) and conjunctival redness 20 (10.6%) (Fig. 4). The mean resolution time of adverse effects ranged from 3.2 to 6.0 days. Although these events were relatively infrequent, careful monitoring was necessary to ensure their timely resolution. The mean resolution times of the three adverse events were analyzed in a total of 45 patients (Fig. 5) using a random effects model with the inverse variance method. The summarized MRAW was 4.54 with a 95% confidence interval of 2.85-6.24. Significant heterogeneity was detected (P<0.01), indicating inconsistency in the magnitude and/or direction of resolution times. The I^2 value indicates that 95.7% of the variability in the mean resolution time of the three adverse events was attributable to heterogeneity rather than random chance.

Changes in axial length and refractive error over the follow-up period. Paired t-test analysis revealed significant changes in both axial length and refractive error over the 36-month follow-up period (Table I). The mean axial length increased from 24.12±0.63 mm at baseline to 24.70±0.12 mm at the 36-month follow-up, with a mean change of 0.58 mm (P<0.01). Similarly, refractive error improved from -3.25±1.05 D at baseline to -2.82±0.18 D at 36 months, showing a mean improvement of +0.43 D (P<0.01). These findings indicate that OK lenses are associated with changes in structural and refractive outcomes over the study period.

Independent factors influencing axial length changes. A mixed-effects regression analysis provided additional insights into the factors influencing changes in axial length (Table II). Age was inversely associated with axial elongation, with a coefficient (β) of -0.02±0.01 (P<0.01), suggesting that younger participants experienced greater increases in axial length. Baseline refractive error was positively associated with axial elongation, with a β-coefficient of 0.15±0.04 (P<0.01), indicating that children with higher baseline myopia experienced greater axial growth. Compliance level was a strong predictor of changes in axial length, with high compliance associated with reduced elongation, with a β-coefficient of -0.18±0.05 (P<0.01). These results highlight the importance of baseline characteristics and adherence to OK lens protocols on axial length progression.

Discussion

The findings of the present study demonstrated that OK lenses effectively slowed axial elongation and enhanced refractive outcomes in children with myopia over 36 months, with the greatest benefits observed among those who consistently adhered to the prescribed lens-wearing schedule. These results suggest that OK lenses may be a valuable tool for mitigating myopia progression and reducing the potential risk of long-term complications, such as retinal detachment and glaucoma. Mixed-effects regression highlighted the importance of considering individual factors, such as age and baseline refractive error, when tailoring treatment strategies. Future research should focus on the optimization of lens designs, enhancement of adherence strategies, and investigation of the long-term ocular health implications of prolonged OK lens use.

Although numerous studies have demonstrated the efficacy of OK in the management of myopia progression (16-19), few have extensively studied its safety in pediatric populations (17-21). Previous studies suggest that the annual incidence of ocular adverse events associated with OK lens use may be ~20% in children (20-23). However, a major limitation of these studies is that no standardized definition exists for what constitutes an adverse event, and safety assessments are often narrow in scope, being confined to a limited range of complications. Given the frequent use of OK lenses for myopia management (1), and their long-term application, which often spans several years throughout childhood and adolescence (4,21) and may extend into adulthood (6), robust long-term safety assessments are important.

Regarding adverse events and safety, the present study revealed that 8.0% of participants experienced corneal staining, 5.3% reported lens intolerance and 10.6% exhibited conjunctival redness, with all adverse events resolving within a mean of 3.2-6.0 days. These findings indicate a relatively low incidence of adverse events, similar to that reported by Santodomingo-Rubido *et al* (18), who reported an overall annual adverse event rate of 13%, with corneal

Table II. Independent factors influencing axial length changes.

Predictor variable	Coefficient β	Standard error	t-value	P-value
Age, years	-0.02	0.01	-2.67	<0.01
Baseline refractive error	0.15	0.04	3.75	<0.01
Compliance level	-0.18	0.05	-3.6	<0.01

Mixed-effects regression analysis was performed.

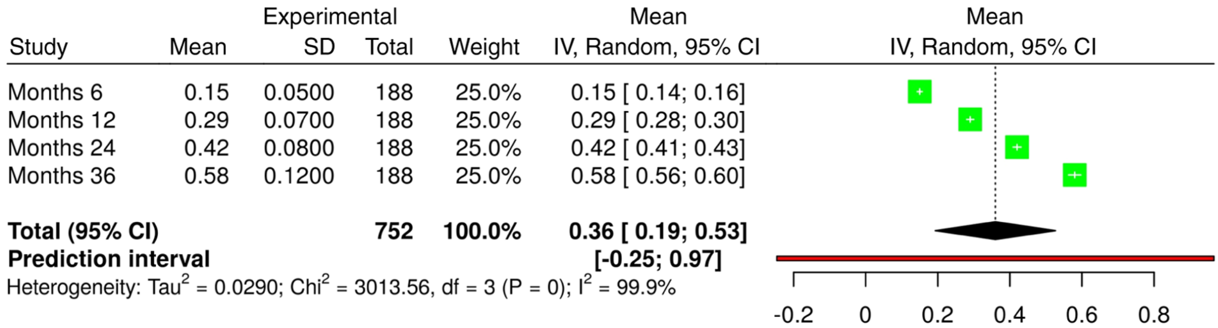

Figure 3. Forest plot depicting changes in axial length at different time points during follow-up. SD, standard deviation; IV, inverse variance; CI, confidence interval.

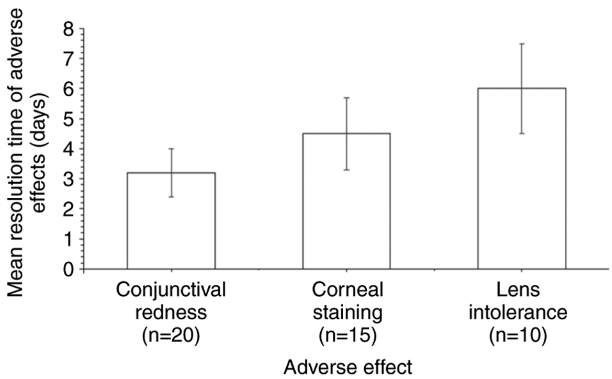

Figure 4. Mean resolution time of various adverse effects.

staining being the most common issue, although the frequency of adverse events was higher than that observed in the present study. Similarly, Hu *et al* (24) reported a 22.7% incidence of corneal adverse events over 1 year, which is also higher than that in the present study. A major limitation of the present study is that, unlike that of Hu *et al* (24), the present study did not evaluate associations between adverse events and individual risk factors such as age, spherical equivalent refraction or history of allergic conjunctivitis. Future studies could stratify adverse events by age, lens type and other relevant factors when identifying potential risk factors.

The present study found a mean axial elongation of 0.58 mm over 36 months, with a slower progression among participants with high compliance (0.35 mm) than in participants with low compliance (0.72 mm). This is consistent with the findings of Zhu *et al* (25), who reported significantly slower axial elongation in patients treated with OK (0.22 mm) compared with that in patients wearing single-vision spectacles (0.35 mm) over 12 months. However, the current study has a longer follow-up duration, and directly evaluated compliance as a factor influencing axial length changes, which Zhu *et al* (25) did not examine.

The significant improvement in mean UDVA from 0.48 to 0.12 logMAR in the present study is consistent with the findings of Hahn *et al* (26), who reported significant improvements in UDVA and reductions in spherical equivalent over 6 months of OK lens wear. However, Hahn *et al* (26) also observed higher-order aberrations (HOAs), particularly spherical aberrations, which were not assessed in the present study.

Compliance emerged as a key determinant in the present study, with high compliance associated with a significant reduction in axial elongation. This is consistent with the findings of Chang *et al* (27), who emphasized the importance of parental knowledge and adherence to OK care protocols for achieving favorable outcomes. While Chang *et al* (27) focused on parental compliance behaviors, the present study assessed compliance directly among pediatric participants and its impact on clinical outcomes.

Notably, the present study did not assess treatment zone decentration (TZD) as a variable, unlike Chu *et al* (28), who reported that decentered OK lenses slowed axial elongation more effectively in children with higher spherical equivalent refraction. This represents a gap in the findings of the study, as TZD may influence the efficacy of OK treatment.

The present study has an adequate sample size and duration of follow-up, with a clear focus on safety outcomes in patients based on 3 years of data. In addition, the topic is important and relatively underexplored in the ophthalmological literature, and the large study group and longitudinal

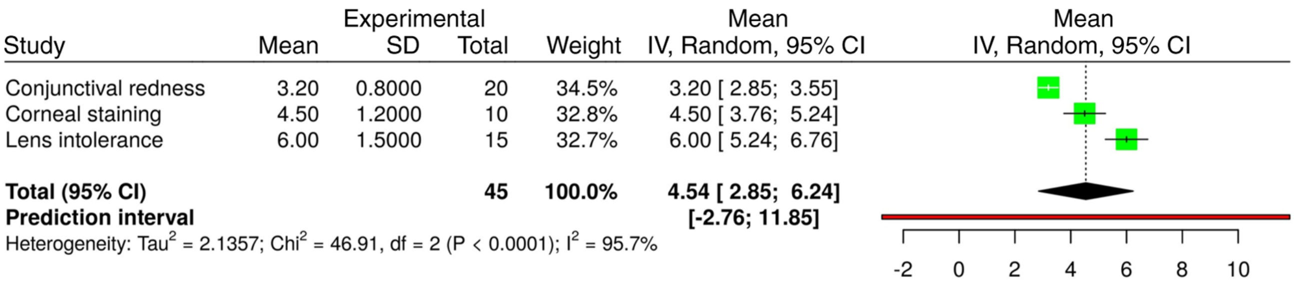

Figure 5. Forest plot of the mean resolution time of three adverse events in 45 patients.

design are key strengths. However, the reliance on a single cohort may restrict the generalizability of the findings. Although it was designed as a prospective study, no parallel, crossover or matched historical control group was included, which precludes the ability to make direct comparisons or infer treatment-specific effects. Also, no details of previous myopia progression were available, which could have allowed within-subject comparisons to assess the extent of the slowing achieved by treatment. Compliance and adherence levels were self-reported, introducing potential reporting bias. In addition, the analysis of adverse events may be underpowered for the detection of rare complications such as microbial keratitis. The study population comprised myopic children presenting for vision correction and may not represent progressive childhood myopes. Lastly, corneal biomechanical parameters, which may have contributed to observed outcomes, were not assessed.

Based on these findings, it is recommended that OK should be considered a valuable option for myopia management in pediatric patients, particularly those with moderate myopia. To maximize efficacy, healthcare providers should emphasize the importance of lens wear compliance through regular monitoring and patient education. In addition, future studies should aim to include larger, more diverse populations and explore combinations of OK with other myopia control strategies, such as atropine therapy, to optimize outcomes. Long-term safety considerations should also remain a priority in research and clinical practice.

In conclusion, the present study demonstrated that OK lenses are a highly effective intervention for the management of pediatric myopia, significantly improving refractive error and visual acuity over 3 years. The findings highlight the benefits of OK in addressing structural and functional aspects of myopia. Compliance emerged as a crucial factor influencing treatment outcomes, with higher adherence to lens wear protocols associated with significantly lower axial elongation rates. These results underscore the importance of regular follow-up and robust patient education to ensure the proper use of OK lenses.

Acknowledgements

Not applicable.

Funding

No funding was received.

Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

YL served as project administrator and contributed to supervision, resources, methodology, validation and literature review. RZ contributed to the investigation, resources, visualization, methodology and literature review. YS contributed to resources, conceptualization, methodology, visualization and literature review. RL contributed to resources, methodology, software, data curation, formal analyses, literature review and supervision. All authors contributed to the drafting and editing of the manuscript. YL and RL confirm the authenticity of all the raw data. All authors read and approved the final version of the manuscript.

Ethics approval and consent to participate

The study adhered to the ethical principles of the Declaration of Helsinki, and was approved by the Ethics Committee of The First Affiliated Hospital of Anhui Medical University and Anhui Women and Children's Medical Center (approval no. AMUfah1514; January 15, 2020). Written informed consent was obtained from all participants and their legal guardians after detailed explanation of the study protocol, including the risks and benefits of OK lens wear. Participants were regularly followed up to ensure the early detection and management of any adverse events, and participants retained the right to withdraw from the study at any time without affecting their standard of care.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Authors' information

The ORCIDs of the authors are as follows: YL, 0009-0008-0286-3762; RZ, 0000-0003-3472-3576; YS, 0009-0002-2720-9018; and RL, 0009-0005-6352-5642.

References

1. Jonas JB, Ang M, Cho P, Guggenheim JA, He MG, Jong M, Logan NS, Liu M, Morgan I, Ohno-Matsui K, *et al*: IMI prevention of myopia and its progression. Invest Ophthalmol Vis Sci 62: 6, 2021.
2. Bullimore MA and Johnson LA: Overnight orthokeratology. Cont Lens Anterior Eye 43: 322-332, 2020.
3. Nti AN and Berntsen DA: Optical changes and visual performance with orthokeratology. Clin Exp Optom 103: 44-54, 2020.
4. Zhang J, Lu X, Cheng Z, Zou D, Shi W and Wang T: Alterations of conjunctival microbiota associated with orthokeratology lens wearing in myopic children. BMC Microbiol 23: 397, 2023.
5. Wan K, Yau HT, Cheung SW and Cho P: Corneal thickness changes in myopic children during and after short-term orthokeratology lens wear. Ophthalmic Physiol Opt 41: 757-767, 2021.
6. Lee SS, Lingham G, Sanfilippo PG, Hammond CJ, Saw SM, Guggenheim JA, Yazar S and Mackey DA: Incidence and progression of myopia in early adulthood. JAMA Ophthalmol 140: 162-169, 2022.
7. Sankaridurg P, Berntsen DA, Bullimore MA, Cho P, Flitcroft I, Gawne TJ, Gifford KL, Jong M, Kang P, Ostrin LA, *et al*: IMI 2023 digest. Invest Ophthalmol Vis Sci 64: 7, 2023.
8. Yang Y, Wu Q, Pan W, Wen L, Luo Z, Wu H, Ran G, Yang Z and Li X: Characteristics of the ocular surface in myopic child candidates of orthokeratology lens wear. Ophthalmol Ther 12: 3067-3079, 2023.
9. Hung LL, Liao LL, Chen HJ, Lin HL and Chang LC: Factors associated with follow-up visits in parents with myopic children wearing orthokeratology lens. J Nurs Res 30: e244, 2022.
10. Qin J, Qing H, Ji N, Lyu T, Ma H, Shi M, Yu S, Ma C and Fu A: Changes in axial length in anisometropic children wearing orthokeratology lenses. Front Med (Lausanne) 10: 1266354, 2023.
11. Chen Y, Liu M, Lu H, Zhang Y, Luo D, Pan H, Wan C, Szentmáry N and Shi L: Impact of overnight wear of orthokeratology lens on thickness of tear film lipid layer in children with myopia. Klin Monbl Augenheilkd 240: 1151-1157, 2023.
12. Zhu Q and Zhao Q: Short-term effect of orthokeratology lens wear on choroidal blood flow in children with low and moderate myopia. Sci Rep 12: 17653, 2022.
13. Li D, Ye Q and Li C: Trends in noninvasive ocular nanoparticle drug delivery: A bibliometric analysis (2004-2023). Biomol Biomed 25: 1949-1960, 2025.
14. Ashara KC and Shah KV: The study of chloramphenicol for ophthalmic formulation. IJSRR 7 (Suppl 1): S173-S178, 2018.
15. Fekete JT and Gyorffy B: MetaAnalysisOnline.com: An online tool for the rapid meta-analysis of clinical and epidemiological studies. J Med Internet Res 27: e64016, 2025.
16. Zhang Y, Sun X and Chen Y: Controlling anisomyopia in children by orthokeratology: A one-year randomised clinical trial. Cont Lens Anterior Eye 46: 101537, 2023.
17. Wu H, Peng T, Zhou W, Huang Z, Li H, Wang T, Zhang J, Zhang K, Li H, Zhao Y, *et al*: Choroidal vasculature act as predictive biomarkers of Long-term ocular elongation in myopic children treated with orthokeratology: A prospective cohort study. Eye Vis 10: 27, 2023.
18. Santodomingo-Rubido J, Cheung SW and Villa-Collar C; ROMIO/MCOS/TO-SEE Groups: The safety of orthokeratology contact lens wear in slowing the axial elongation of the eye in children. Cont Lens Anterior Eye 48: 102258, 2025.
19. Zhong Y, Ke L, Qiong W and Liu F: Orthokeratology lens for management of myopia in anisometropic children: A contralateral study. Cont Lens Anterior Eye 43: 40-43, 2020.
20. Zhang J, Li Z, Cheng Z, Wang T and Shi W: Comparison of the clinical efficacy of orthokeratology and 0.01% atropine for retardation of myopia progression in myopic children. Cont Lens Anterior Eye 47: 102094, 2024.
21. Li X, Huang Y, Zhang J, Ding C, Chen Y, Chen H and Bao J: Treatment zone decentration promotes retinal reshaping in Chinese myopic children wearing orthokeratology lenses. Ophthalmic Physiol 42: 1124-1132, 2022.
22. Zhu MJ, Ding L, Du LL, Chen J, He XG, Li SS and Zou HD: Photopic pupil size change in myopic orthokeratology and its influence on axial length elongation. Int J Ophthalmol 15: 1322-1330, 2022.
23. Zhu S, Song Y, Yang B, Wang X, Ma W, Dong G and Liu L: The relationship between accommodative and binocular function with myopia progression in myopic children undergoing orthokeratology. Cont Lens Anterior Eye 47: 102171, 2024.
24. Hu P, Zhao Y, Chen D and Ni H: The safety of orthokeratology in myopic children and analysis of related factors. Cont Lens Anterior Eye 44: 89-93, 2021.
25. Zhu Q, Yin J, Li X, Hu M, Xue L, Zhang J, Zhou Y, Zhang X, Zhu Y and Zhong H: Effects of long-term wear and discontinuation of orthokeratology lenses on the eyeball parameters in children with myopia. Int J Med Sci 20: 50-56, 2023.
26. Hahn IK, Lee D, Lee DH, Lee H, Tchah H and Kim JY: Serially checked spherical aberration can evaluate the anti-myopia effect of orthokeratology lens in children. J Pers Med 12: 1686, 2022.
27. Chang LC, Sun C and Liao LL: Compliance with orthokeratology care among parents of young children in Taiwan. Cont Lens Anterior Eye 44: 101427, 2021.
28. Chu M, Zhao Y, Hu P, Chen D, Yu Y and Ni H: Is orthokeratology treatment zone decentration effective and safe in controlling myopic progression? Eye Contact Lens 49: 147-151, 2023.