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Efficacy of spectacle lenses for myopia control: a meta-analysis of randomised controlled trials

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ABSTRACT

Purpose To determine the effects of advanced spectacle lens technologies on changes in spherical equivalent of refraction (SER) and axial length (AL) elongation in slowing down the progression of myopia in children and adolescents, by synthesising data from randomised controlled trials (RCTs).

Methods A systematic review and meta-analysis was conducted to identify all RCTs up to 27 February 2025 that compared intervention groups with myopia control lenses and control groups with standard single vision lenses (SVLs). Data from eligible studies were extracted into specially-designed data collection forms without changing the original values. Means and SD for continuous outcomes were determined and imported into RevMan.

Results This meta-analysis included 23 RCTs with a total of 13.315 subjects. Compared with SVLs, myopia control lenses significantly reduced AL (−0.15 mm; 95% CI −0.20 to −0.09; p<0.00001) and SER progression (−0.31 D; 95% CI −0.42 to −0.20; p<0.00001). Highly Aspherical Lenslet lenses significantly reduced AL (−0.28 mm; 95% CI −0.37 to −0.19) and SER progression (−0.52 D; 95% CI −0.84 to −0.20). Defocus Incorporated Multiple Segments lenses also significantly reduced SER (−0.45 D; 95% CI −0.65 to −0.26), although only one eligible RCT reported AL data. Other lens types had modest or variable effects.

Conclusions This meta-analysis provides an up-to-date and detailed comparative evaluation of spectacle lens designs for myopia control, based exclusively on RCTs. These findings support the use of specialty lenses as an effective, non-invasive strategy to reduce the risks associated with high-myopia and guide optimal lens selection in clinical practice.

PROSPERO registration number CRD420251009898

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Several spectacle lens technologies, including bifocals, progressive addition lenses and myopic defocus-based designs, have been developed to slow myopia progression in children. While previous reviews have explored their efficacy, comparative data based exclusively on randomised controlled trials (RCTs) remain limited, especially regarding long-term outcomes, comprehensive subgroup analyses and head-to-head comparisons across all major lens types.

WHAT THIS STUDY ADDS

⇒ This meta-analysis of 23 RCTs—six of which were published in 2024 and one in 2025—offers the most up-to-date and comprehensive comparison of spectacle lens technologies for myopia control. It includes detailed subgroup analyses by lens type and follow-up duration, providing clinically relevant insights to support evidence-based and individualised lens selection.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings support the use of advanced spectacle lenses as a safe and effective strategy to slow myopia progression in children. They also provide evidence-based guidance for selecting the most effective lens design and underscore the need for long-term, independent head-to-head trials to refine future recommendations.

INTRODUCTION

Myopia is emerging as a major global public health issue, with its prevalence increasing rapidly—particularly among children and adolescents. Defined by excessive axial elongation of the eye, myopia not only causes blurred distance vision but also heightens the risk of serious ocular complications, including myopic maculopathy, retinal detachment, glaucoma and cataracts.[1 2] In response to this growing burden, significant efforts have been made to develop effective strategies to slow myopia progression, leading to the introduction of various innovative optical interventions designed to influence retinal signalling and ocular growth. Among these, specialised spectacle lenses have drawn considerable attention due to their non-invasive nature and their capacity to modulate optical defocus or retinal contrast. Over time, multiple lens technologies have been developed, each employing different optical principles.[1–6]

While bifocal and progressive addition lenses (PALs) were among the first approaches tested and may still offer clinical benefits in specific subgroups, newer designs that incorporate mechanisms such as myopic defocus, aspherical lenslets, multipoint defocus distribution and contrast modulation have generally demonstrated superior efficacy

in controlling myopia progression. Notable examples include Defocus Incorporated Multiple Segments (DIMS) lenses, Highly Aspherical Lenslet (HAL) lenses, Lenslet-Array-Integrated (LARi) lenses, Defocus Distributed Multipoint (DDM) lenses, Individualized Ocular Refraction Customized (IORC) lenses and Slightly Aspherical Lenslet (SAL) lenses. Shamir Myopia Control (SMC) lenses combine progressive addition and defocus elements, while Diffusion Optics Technology (DOT) lenses offer a novel, contrast-based approach.[1–5 7–12]

As spectacle lens technologies for myopia control continue to evolve, the growing variety of available options necessitates a clear understanding of their relative effectiveness. Comparative data are essential to inform clinical decisions and support evidence-based recommendations. This meta-analysis aims to systematically evaluate the efficacy of these advanced spectacle lens designs by synthesising findings from randomised controlled trials (RCTs), focusing on their effects on changes in spherical equivalent refraction (SER) and axial length (AL) elongation. The findings seek to identify the most effective optical strategies for managing myopia progression.

MATERIALS AND METHODS

Search strategy

This review was performed according to a protocol that was recommended for systematic review.[13] The search was performed using the electronic databases MEDLINE, EMBASE, Web of Science, Scopus, ClinicalTrial.gov, OVID and Cochrane Library from their inception until 27 February 2025. The search terms used included "myopia", "progression of myopia", "myopia control", "spectacle lenses", "multifocal lenses," "bifocal lenses," and "peripheral defocus lenses". No restrictions were applied regarding language or geographic location. Additionally, the reference lists of all identified articles were screened to find additional relevant studies.

Study selection

All RCTs that assessed the efficacy of specialised spectacle lenses in slowing myopia progression in children and adolescents were identified. The included studies compared intervention groups wearing myopia control spectacle lenses with control groups wearing standard single-vision lenses (SVLs).

The interventions evaluated in the selected studies included PALs, DIMS, HAL, SAL, LARi, IORC, DDM, SMC and DOT synthesised in table 1.

The primary outcomes analysed were changes in SER and AL over the study period, as these are the key metrics used to assess myopia progression. Some studies also reported secondary outcomes such as contrast sensitivity, peripheral refraction and subjective adaptation to the lenses.

Eligible participants included children and adolescents aged 6–16 years with a diagnosis of myopia, typically ranging from −0.50 D to −6.00 Dioptres (D), with varying criteria for astigmatism, anisometropia and best-corrected visual acuity. Studies with participants having prior myopia control treatment, ocular pathologies or systemic conditions affecting refractive development were excluded.

Two authors (LDA and FI) independently reviewed the studies for inclusion, assessed the risk of bias and extracted relevant data. Any disagreements were resolved through discussion with a third reviewer (RP).

Risk of bias assessment

The risk of bias in each included study was assessed using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions.[12] Seven domains related to the risk of bias were evaluated for each included trial, as these factors have been shown to influence the reliability of treatment effect estimates:

Random sequence generation (assessment of whether the allocation sequence was adequately generated).

Allocation concealment (evaluation of whether allocation was adequately hidden from investigators and participants).

Blinding of participants and personnel (assessment of whether masking was implemented to minimise performance bias).

Blinding of outcome assessment (evaluation of whether outcome assessors were blinded to prevent detection bias).

Incomplete outcome data (analysis of the extent and handling of missing data).

Table 1 Overview of spectacle lens technologies for myopia control

Lens type	Design principle	Mechanism of action	Key features	Clinical rationale
PALs (Progressive Addition Lenses)	Progressive addition of power in lower segment	Reduces accommodative demand	Smooth gradient of power; clear central vision	Beneficial for children with high accommodative lag or esophoria; limited efficacy
DIMS (Defocus Incorporated Multiple Segments)	Central clear zone+peripheral defocus segments	Induces myopic defocus in peripheral retina	Multiple defocus segments around central zone	Clinically proven to significantly reduce myopia progression
HAL (Highly Aspherical Lenslet)	Dense, highly aspherical lenslet array	Creates uniform myopic defocus across lens	Thousands of aspherical lenslets on surface	Enhances retinal signalling; optimised for axial elongation control
LARi (Lenslet-Array-Integrated)	Regular grid of lenslets	Enhances peripheral myopic defocus	Precisely arranged lenslet array; central clarity	Balances optical quality and myopia control efficacy
SAL (Slightly Aspherical Lenslet)	Mildly aspherical lenslets	Softer myopic defocus profile	Lower asphericity than HAL or LARi	Designed for better adaptation and comfort, with retained efficacy
DDM (Defocus Distributed Multipoint)	Uniform defocus distribution	Homogeneous myopic defocus across lens	No distinct zones; smooth optical transitions	Aims for natural adaptation and consistent defocus stimulation
IORC (Individualized Ocular Refraction Customized)	Fully personalised optical design	Tailored optical power to eye's unique refraction	Custom-mapped correction per patient	Maximises effectiveness via individual customisation
Shamir Myopia Control (SMC)	Hybrid of progressive and aspherical optics	Gradual, distributed myopic defocus	Combines progressive design with aspheric power shifts	Creates natural transition of defocus; comfort+control
DOT (Diffusion Optics Technology)	Contrast modulation via micro-diffusers	Reduces retinal contrast without blur	Microscopic light diffusers within lens material	Targets contrast sensitivity to regulate eye growth (novel approach)

Selective reporting (evaluation of whether all expected outcomes were reported as prespecified in study protocols).

Other sources of bias (consideration of any other potential risks of bias that might influence study validity).

Each domain was classified as 'low risk', 'high risk' or 'unclear risk' of bias. The overall risk of bias for each study was considered when interpreting the results. All analyses were conducted following an intention-to-treat approach, ensuring that participants were analysed in their originally assigned treatment groups.

Statistical analysis

The data analysis was conducted using Review Manager (RevMan, V.5.3; The Nordic Cochrane Centre, Cochrane Collaboration, Copenhagen, Denmark). The primary summary measures were reported as weighted mean differences with 95% CIs for continuous outcomes, using the random-effects model of DerSimonian and Laird to account for potential heterogeneity among studies.

Heterogeneity was assessed using Higgins' I^2 statistic, where values of 25%, 50% and 75% were interpreted as low, moderate and high heterogeneity, respectively.

Data from each eligible study were extracted without modification of the original values onto custom-designed data collection forms. For continuous outcomes, means and SD were extracted and imported into RevMan. When studies included multiple intervention groups, data were combined using the formula provided in the Cochrane Handbook for Systematic Reviews of Interventions to avoid unit-of-analysis errors.

A p value <0.05 was considered statistically significant.

This meta-analysis was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.[14] Before data extraction, the review was registered with the PROSPERO International Prospective Register of Systematic Reviews (registration No. CRD420251009898).

RESULTS

Study characteristics

This meta-analysis included 23 RCTs with a total of 13 315 children and adolescents diagnosed with myopia (figure 1). The studies varied in duration, ranging from 1 to 4 years and were conducted across different geographical regions, including China, the USA, Canada, Australia, Singapore, Vietnam, Israel and Japan. The sample sizes ranged from 82 to 10.477 participants per study.

The quality of the included RCTs was assessed using the Cochrane Handbook for Systematic Reviews of Interventions criteria. As shown in figure 2, the majority of studies had a low risk of bias in key domains such as random sequence generation and allocation concealment.

However, some studies presented unclear risk in the blinding of participants and personnel, given the nature of spectacle lens interventions. Additionally, a few trials had high risk of bias in selective reporting and other bias categories (figure 2). The 'unclear risk' classification in 'other bias' was often assigned due to industry funding of the studies. Although financial sponsorship from lens manufacturers was present, there was no direct evidence indicating that this influenced the study results. Therefore, while a potential source of bias exists, it was not possible to determine its actual impact on the findings.

The included studies evaluated the efficacy of specialised spectacle lenses in slowing myopia progression compared with SVLs.

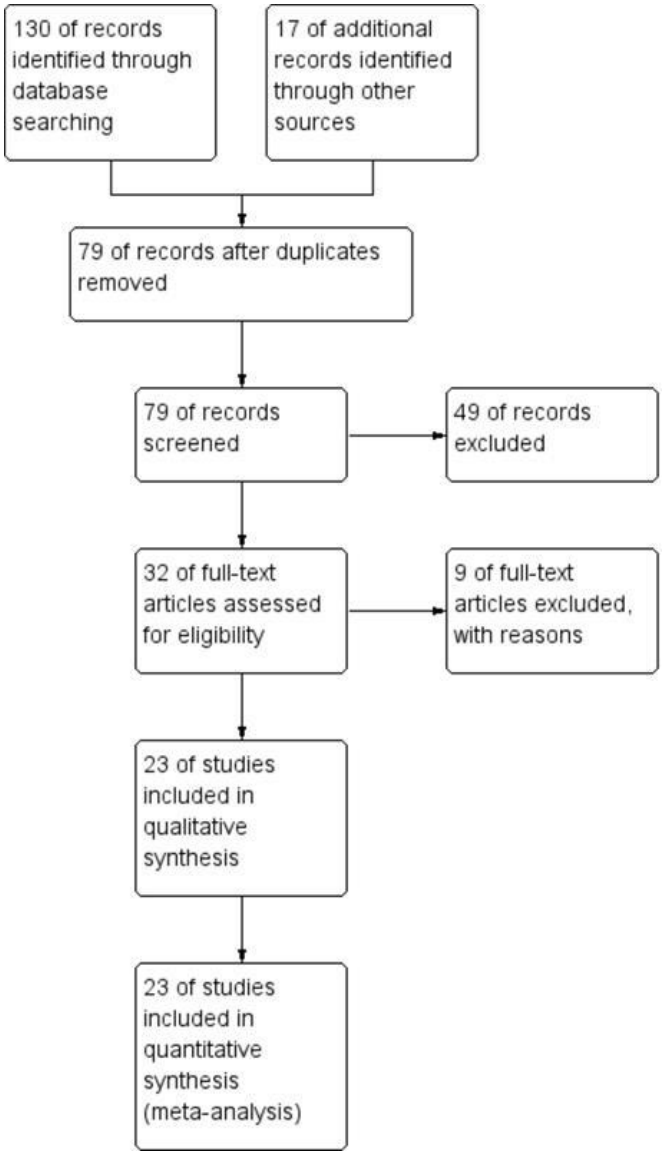

Figure 1 Flow diagram of studies identified in the systematic review.

The primary outcomes assessed in all trials were SER progression, measured in Dioptres and AL elongation, measured in millimetres.

In cases where the SD was not reported in the original study, and it was not possible to obtain it on request from the primary authors, the missing values were estimated using established statistical methods:

- In one case (Zhang *et al*),[15] where only the IQR was available, SD was estimated using the formula SD≈IQR/1.35, a commonly accepted method for converting non-parametric data into a format suitable for meta-analysis.
- In another case (Yuval *et al*),[10] where SD was derived from the 95% CI, it was estimated using the formula:

$$SD = \frac{Upper\ bound - Lower\ bound}{2*Z}$$

where upper bound and lower bound represent the CI limits, and Z = 1.96 for a 95% CI, assuming a normal distribution of the data.

For the overall meta-analysis, all included studies compared specialised spectacle lenses with SVLs (online supplemental table 1).[1–5 7–12 15–26] Subgroup analyses were conducted to specifically evaluate the effects of HAL, DIMS, PALs and bifocal lenses.

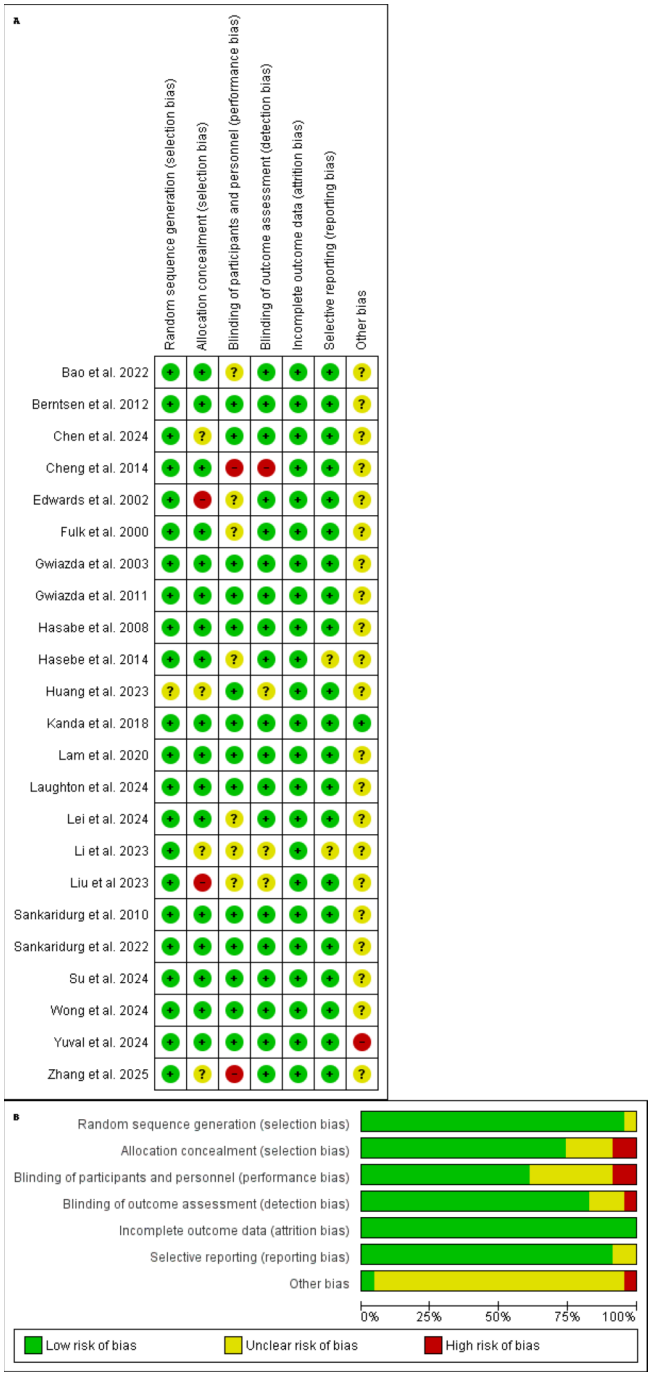

Figure 2 **(A)** Summary of risk of bias for each trial. The plus sign indicates low risk of bias; the minus sign indicates high risk of bias; the question mark indicates unclear risk of bias. **(B)** Risk of bias graph about each risk of bias item presented as percentages across all included studies.

Synthesis of results

The meta-analysis demonstrated that children wearing myopia control spectacle lenses experienced significantly slower myopia progression compared with those using SVLs. Specifically, the pooled analysis showed a mean reduction in AL elongation of −0.15 mm (95% CI −0.20 to −0.09; p<0.00001) (figure 3) and a reduction in SER progression of −0.31 dioptres (D) (95% CI −0.42 to −0.20; p<0.00001) (figure 4).

Among the various lens types, HAL lenses significantly reduced axial elongation by −0.28 mm (95% CI −0.37 to −0.19; p<0.00001) and SER progression by −0.52 D (95% CI −0.84 to −0.20; p<0.02) (online supplemental figure 1)

DIMS lenses also showed a significant effect on SER, with a pooled mean difference of −0.45 D (95% CI −0.65 to −0.26; p<0.0001). Only one included RCT provided complete data for AL in the DIMS group, precluding pooled analysis for this outcome (−0.32 mm (−0.33 to –0.31) p<0.00001) (online supplemental figure 2). PALs and bifocal lenses produced more modest results. PALs showed a small but statistically significant reduction in SER progression (−0.21 D; 95% CI −0.26 to −0.16; p<0.00001), although their effect on AL elongation was not significant (−0.05 mm; 95% CI −0.12 to 0.02; p=0.2) (online supplemental figure 3). Bifocal lenses demonstrated a significant reduction in AL elongation (−0.19 mm; 95% CI −0.35 to −0.03; p=0.02), with a non-significant reduction in SER (−0.60 D; 95% CI −1.26 to 0.07; p=0.08) (online supplemental figure 4).

Subgroup analyses based on follow-up duration (short-term <12 months, intermediate-term 12–36 months and long-term >36 months) provided additional context on time-dependent treatment effects. In short-term studies, spectacle lenses reduced axial elongation by −0.10 mm (95% CI −0.13 to −0.07; p<0.00001) and SER progression by −0.18 D (95% CI −0.25 to −0.10; p<0.00001) (online supplemental figure 5). In intermediate-term studies, the reductions were −0.15 mm (95% CI −0.30 to −0.01; p<0.04) for AL and −0.30 D (95% CI −0.51 to −0.10; p<0.004) for SER (online supplemental figure 6). Long-term studies showed the largest treatment effects, with AL reduction of −0.19 mm (95% CI −0.31 to −0.08; p<0.001) and SER reduction of −0.56 D (95% CI −0.93 to −0.19; p<0.003) (online supplemental figure 7).

COMMENTS

Main findings

This meta-analysis of 23 RCTs evaluated the effectiveness of specialised spectacle lenses in slowing myopia progression in children and adolescents compared with SVLs.

The pooled results demonstrated that myopia control spectacle lenses significantly reduced both AL elongation and spherical SER progression compared with SVLs.

Although the observed mean reduction in AL elongation was −0.15 mm and in SER progression −0.31 D, these values are considered clinically meaningful. Clinical data indicate that risk of vision-threatening complications such as myopic maculopathy increases sharply with AL beyond 26 mm. Therefore, even modest reductions in axial elongation may delay reaching these thresholds and reduce lifetime risk.[27 28]

Among the different lens designs, both HAL and DIMS lenses demonstrated statistically significant efficacy in slowing myopia progression. HAL lenses reduced axial elongation by −0.28 mm and SER progression by −0.52 D. DIMS lenses showed a statistically significant reduction in SER, with a mean difference of −0.45 D (95% CI −0.65 to −0.26; p<0.0001), supporting their efficacy in slowing myopia progression in children. Regarding AL, only one eligible RCT reported sufficient data for inclusion, precluding pooled analysis. However, the available evidence from that study also suggested a beneficial effect.

While the meta-analysis shows a statistically significant reduction in SER with DIMS lenses, the current evidence base remains limited to a small number of eligible RCTs. Further well-designed, high-powered studies with consistent methodologies are needed to strengthen conclusions and inform clinical guidelines regarding DIMS efficacy. These findings are consistent with

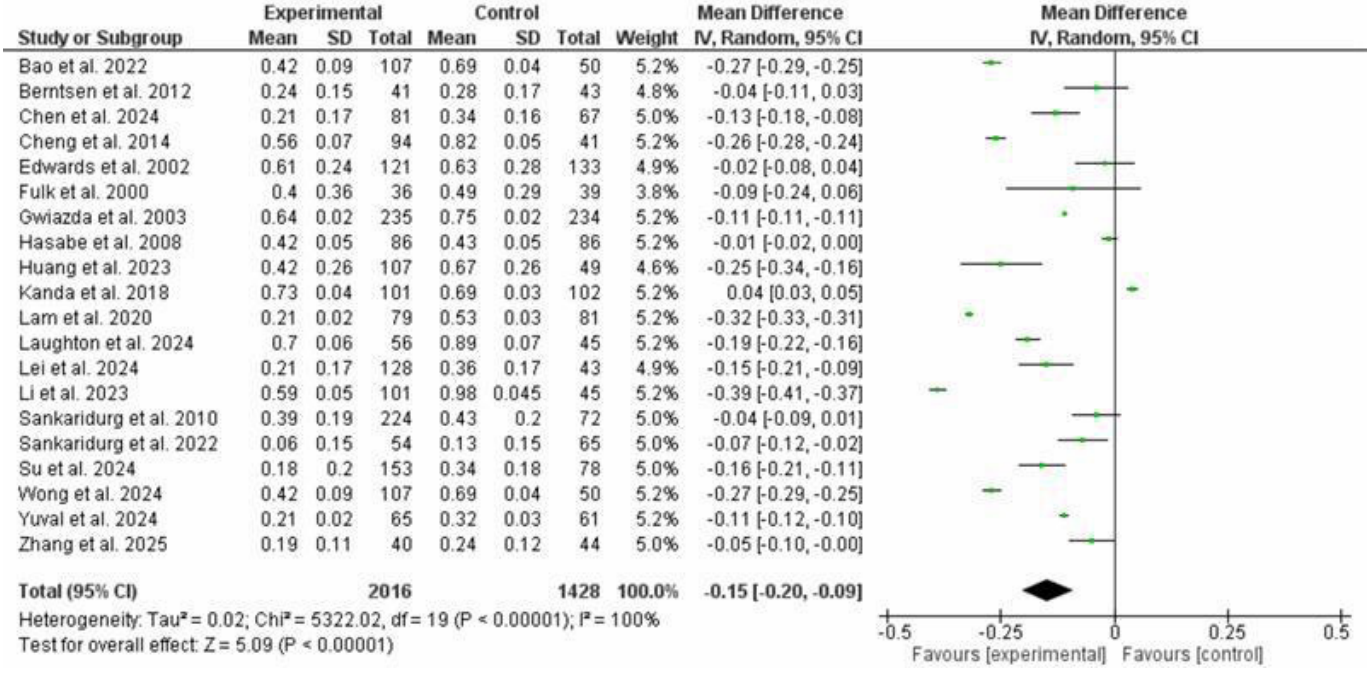

Figure 3 Changes in axial length extension in children wearing myopia control lenses in a pooled analysis showing significantly slower myopia progression compared with single-vision lenses (SVLs).

previous meta-analyses that have demonstrated the effectiveness of DIMS lenses.[29 30] Differences in inclusion criteria, such as the exclusive selection of RCTs and stricter lens classification, may explain variations in effect size and significance across reviews. The high heterogeneity observed (I^2=97%) highlights the need for further well-powered and methodologically consistent studies to strengthen the evidence base for DIMS technology.

Bifocal lenses also demonstrated a statistically significant reduction in axial elongation (−0.19 mm), though the effect on SER progression was not statistically significant. In contrast, PALs showed more limited or inconsistent effects in axial elongation, though the reduction in SER progression was statistically significant (−0.21). This finding supports the hypothesis that PALs may primarily act by reducing accommodative lag rather than slowing axial growth, an effect consistent with previous studies in children with esophoria or high lag of accommodation.[18 19] Among the PAL studies included, the addition powers varied from +1.50 D (Edwards *et al* and Hasebe *et al*)[17 19] to

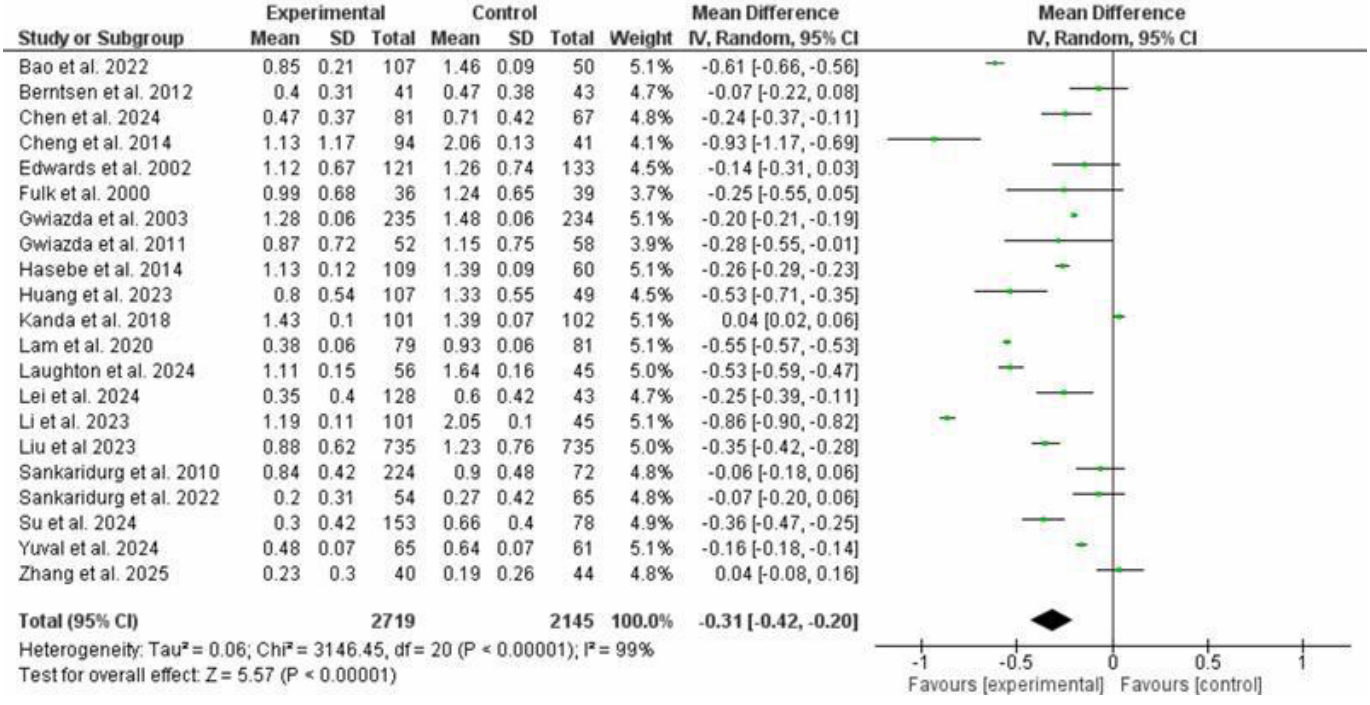

Figure 4 Changes in spherical equivalent refraction (SER) progression in children wearing myopia control lenses in a pooled analysis showing significantly slower myopia progression compared with single-vision lenses (SVLs).

+2.00 D (Gwiazda *et al* and Berntsen *et al*).[12 18] These differences may affect the degree of accommodative relief and peripheral defocus provided, potentially influencing treatment efficacy. Such variability likely contributes to the heterogeneity observed in the PAL subgroup and highlights the need for standardised lens specifications in future research.

Although HAL and DIMS lenses demonstrated the largest treatment effect in our pooled analysis, clinical preference should be individualised. Factors such as binocular vision status, rate of progression, lens availability and cost must be considered when selecting the most appropriate intervention.

This meta-analysis has several strengths. The included trials were generally of good methodological quality, with low risk of bias in key domains, and analyses were conducted using an intention-to-treat approach. Moreover, this is, to the best of our knowledge, the first meta-analysis to systematically compare the efficacy of the various types of spectacle lens technologies developed for myopia control, including not only traditional bifocal and progressive lenses but also advanced designs like HAL, DIMS, SAL, DOT, SMC, PAL, BF and IORC lenses.

Despite the encouraging results, considerable heterogeneity was observed in the overall meta-analyses, with I^2 values reaching 100% and 99%, respectively, for AL and spherical SER. To better understand this variability, we conducted subgroup analyses based on lens type and follow-up duration (short-term <12 months, intermediate-term 12–36 months and long-term >36 months). These analyses revealed that heterogeneity was partially reduced in certain subgroups, for instance, to 71% in studies with short-term follow-up on AL, and that some lens categories (such as HAL and DIMS) showed more consistent results across trials. In addition to subgroup analyses by follow-up duration and lens type, we also explored whether baseline myopia severity could account for some of the observed heterogeneity. When stratifying studies based on baseline SE, we found that the resulting subgroups were relatively homogeneous, and heterogeneity within them remained low. This suggests that SE did not meaningfully contribute to the variability in treatment effects across studies. We further performed a subgroup analysis based on baseline AL, dividing studies into two groups: those with mean AL between 24.0 mm and 24.7 mm and those with AXL above 24.7 mm. While the direction of treatment effect remained consistent in both subgroups, heterogeneity remained high (I^2=98% for the high AL group and 100% for the intermediate group). These findings suggest that, within the ranges analysed, baseline AL does not substantially explain the heterogeneity observed in the pooled outcomes. We also identified that some studies included small sample sizes (n<65), which may contribute to unstable estimates and wider confidence intervals. To explore this, we conducted a sensitivity analysis excluding small-sample studies (<100 participants), those with short-term follow-up (<12 months), and those with low-hyperopic baseline populations (Zhang *et al*[15]). The overall direction and magnitude of treatment effects remained consistent, suggesting the robustness of our findings. However, heterogeneity persisted even in these restricted analyses, highlighting the intrinsic variability in current evidence and underscoring the need for more standardised future RCTs.

Importantly, the direction of the treatment effect remained consistently favourable towards the intervention group across almost all included studies. This suggests that the observed heterogeneity is more likely driven by methodological and clinical diversity, such as differences in lens categories, study design, variation in lens addition power (in PAL studies), follow-up duration and outcome definitions, rather than by opposing or conflicting findings. While this limits the ability to produce a single precise estimate of effect size, it does not undermine the overall conclusion that myopia control spectacle lenses are effective. These findings highlight the need for individualised interpretation of outcomes in clinical decision-making and underscore the importance of standardised protocols in future trials. Several of the included trials were funded by lens manufacturers. While this raises concerns about potential bias, a recent systematic review and meta-analysis found no significant association between industry sponsorship and favourable research outcomes in myopia control studies (RR: 0.98, 95%CI 0.85 to 1.13).[31] Nonetheless, the study observed instances where conclusions in industry-sponsored trials did not fully align with the reported results, underscoring the importance of transparency and critical appraisal in clinical research.[31] These findings suggest that while industry sponsorship does not necessarily bias outcomes, careful interpretation of study conclusions remains essential.

Implications

The rising global prevalence of myopia, especially among children and adolescents, has elevated its management to a significant public health priority.[6] A range of optical interventions has been developed to slow the progression of myopia, with spectacle lenses standing out as a particularly appealing option due to their non-invasive nature, ease of use and broad accessibility.[1 3–5]

Various lens designs aim to manage myopia progression by altering retinal defocus or contrast signals, although their effectiveness can vary.[2 4 5 7 8 10 11 18 20 24] In particular, this meta-analysis highlights that HAL and DIMS lenses currently offer the most substantial benefit among spectacle lens technologies, significantly reducing both axial elongation and refractive error progression.

DIMS lenses demonstrated a statistically significant reduction in SER in our meta-analysis, supporting their effectiveness in slowing myopia progression. These findings are in line with previous studies reporting the efficacy of DIMS lenses.[4 22 26] However, the number of eligible RCTs remains limited, and the current evidence base does not yet allow for definitive conclusions. Differences in inclusion criteria, lens classification and analysis methods across meta-analyses may explain variations in the reported effect sizes. Although pooled analysis for AL was not possible due to limited available data, the direction of the observed effects remains consistent with a clinical benefit. These results support the continued relevance of DIMS lenses in practice, while also underscoring the need for further high-quality RCTs with standardised outcomes to validate and extend these findings.

While other lens types, such as bifocal lenses and PALs, showed more modest or inconsistent effects, they may still provide clinical benefits in specific patient populations, particularly where accommodative lag or binocular vision anomalies are present.[3 12 17–19 21] Previous meta-analyses and systematic reviews have primarily focused on pharmacological treatments (such as low-dose atropine) and contact lens-based interventions (such as orthokeratology and multifocal soft lenses).[29 32] In contrast, few reviews have specifically addressed the relative effectiveness of spectacle lens technologies for myopia control. This meta-analysis contributes to filling this gap by providing a comprehensive comparison of the available designs, including emerging options like DOT lenses, IORC lenses and Lenslet-Array-Integrated lenses.

Despite encouraging findings, several challenges persist. Differences in study design, population characteristics, outcome

measures and the frequent involvement of industry sponsors introduce a level of heterogeneity that limits direct comparisons. High-quality, independent and long-term RCTs directly comparing the most promising spectacle lens designs are essential to define the optimal strategies for clinical practice. Furthermore, this review focused exclusively on objective outcomes, AL and refractive error, to ensure comparability across studies. Subjective measures such as visual comfort, user adaptation or spectacle wear compliance were excluded due to inconsistent reporting. However, these factors are clinically relevant and should be explored in future studies.

Ultimately, while spectacle lenses represent a valuable and low-risk option within the broader toolkit for myopia management, they should be considered as part of a tailored, multifaceted approach. This might include pharmacological treatment, behavioural strategies and regular monitoring to offer children the best protection against high myopia and its long-term ocular complications.

CONCLUSION

In summary, the use of myopia control spectacle lenses in children and adolescents significantly slows myopia progression compared with SVL, reducing both AL elongation and spherical SER progression. Among the available options, HAL and DIMS lenses demonstrated the strongest efficacy in reducing AL progression. However, while the effect of HAL lenses is supported by multiple well-powered trials, the number of high-quality RCTs evaluating DIMS lenses remains limited. Therefore, although the available evidence for DIMS is promising, further large-scale studies are needed to confirm and consolidate these findings. Other designs, such as bifocal lenses and PALs, showed more modest or variable effects.

These findings support the use of specialised spectacle lenses as an effective, non-invasive strategy for myopia control within comprehensive management plans aimed at reducing the long-term risks associated with high myopia.

Contributors LD'A conceived and designed the study, conducted the literature search, and wrote the manuscript. FI participated in data extraction and quality assessment. RP resolved any discrepancies and supervised the process. LD'A, RP, FI, SLP, SM, ME, AM, FC, OO and CAU contributed to manuscript review, critical revisions and final approval. CC and MR read and approved the final manuscript. Guarantor: LD'A is the guarantor. They accept full responsibility for the work, had access to the data and controlled the decision to publish.

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Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

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