Technoleg Iechyd Cymru
Health Technology Wales

Evidence Appraisal Report

Myopia-control spectacle lenses and contact lenses to slow the progression of myopia in children and adolescents

Appraisal summary

Why did Health Technology Wales (HTW) appraise this topic?

Myopia, also known as short-sightedness, is the most common eye condition worldwide (Williams et al. 2015). It is a refractive anomaly of the eye that occurs when the light rays entering the eye from distant objects are focused in front of the retina instead of on its surface, resulting in distant objects appearing blurred (Walline et al. 2020a). Myopia most often results from the eyeball being too long, but it can also occur when the image-forming structures of the eye are too strong (Flitcroft et al. 2019). If left untreated, myopia might progress to high myopia, which increases the risk of irreversible visual impairment and blindness (Garcia-Del Valle et al. 2021, Ruiz-Pomeda et al. 2018, Walline et al. 2020b). The prevalence of myopia is increasing and if current trends continue, it is estimated that approximately 50% of the world's population will have myopia by 2050 (Holden et al. 2016).

Most cases of myopia develop during childhood, after the age of six years, and stabilise in late adolescence (McCullough et al. 2016). Therefore, interventions to slow myopia progression should be delivered in childhood (Lawrenson et al. 2023). There are many different types of myopia-control interventions. This appraisal will look at the following optical interventions, and they are described in Table 1 of the Evidence Appraisal Report:

- Myopia-control spectacle lenses, including:
  - multifocal spectacle lenses
  - peripheral plus spectacle lenses
  - novel lens designs.
- Myopia-control contact lenses, including:
  - multifocal soft contact lenses
  - orthokeratology
  - rigid gas-permeable contact lenses.

Although these interventions may not prevent myopia, a reduction in the extent of myopia may provide a reduction in the risk of developing serious eye conditions later in life (College of Optometrists 2022). Whilst some of these myopia-control interventions are used in some private clinics in Wales, the standard of care is single-vision spectacle lenses or single-vision soft contact lenses, which may correct myopia but do not slow its progression.

In Wales, children under 16 years old are entitled to help towards the cost of spectacles and contact lenses in the form of a voucher from the NHS. At present, there is no provision for the

higher cost of myopia-control interventions under the current voucher system, creating inequity of access to myopia-control optical interventions.

This topic was submitted to HTW by a clinical advisor to the NHS.

What evidence did HTW find?

This appraisal aims to address the following question: what is the clinical and cost effectiveness of myopia-control spectacle lenses and contact lenses to slow the progression of myopia in children and adolescents (up to and including 18 years old), compared to standard care?

We identified a Cochrane network meta-analysis (NMA) of myopia-control interventions to slow the progression of myopia in children (Lawrenson et al. 2023). The Cochrane review included 40 randomised controlled trials (RCTs) investigating myopia-control spectacle lenses and myopia-control contact lenses compared to single-vision spectacle lenses or single-vision soft contact lenses. The authors of the NMA stated that the network was not well-connected and so they primarily based their comparisons on direct evidence from pairwise meta-analyses.

We searched for any RCTs published after the search-date limit in the NMA. We identified an additional meta-analysis of seven RCTs, which reported pooled outcomes that were not reported by Lawrenson et al. (2023). We also identified a systematic review of two RCTs reporting quality of life for certain myopia-control interventions, not reported by Lawrenson et al. (2023). In addition, we identified a further seven RCTs published since the NMA, most of which showed similar effects to those seen in the Cochrane review.

The critical outcome 'progression of myopia' in the meta-analysis by Lawrenson et al. (2023) was defined as both change in spherical equivalent refraction (SER) and change in axial length. These outcomes are summarised in Table 3 and Table 4 of the Evidence Appraisal Report, respectively.

At one year, all interventions except for rigid gas-permeable contact lenses were statistically superior to standard of care in reducing myopia progression. However, although statistically significant, the reduction in myopia progression with multifocal spectacle lenses was deemed not clinically significant (Lawrenson et al. 2023).

At two years, all interventions except for rigid gas-permeable contact lenses and peripheral plus spectacle lenses were statistically superior to standard of care in reducing myopia progression. Only orthokeratology was reported as being both statistically and clinically significant compared to standard of care. However, only change in axial length was reported for this intervention. The Cochrane review reported that orthokeratology appears to be the most effective optical treatment for slowing myopia progression (Lawrenson et al. 2023).

Multifocal spectacle lenses, multifocal soft contact lenses and rigid gas-permeable contact lenses were the only interventions assessed at three years of follow up, with only multifocal soft contact lenses being reported as statistically superior to standard of care in reducing both SER progression and axial length elongation. However, Lawrenson et al. (2023) reported that these results were not clinically significant.

RCTs identified since the NMA also reported that myopia-control interventions slow the progression of myopia compared to standard of care at up to two years, although none of them included peripheral plus spectacle lenses or rigid gas-permeable contact lenses. There was evidence of slowing in efficacy of myopia-control treatment over time for all myopia-control interventions in the Cochrane review, with most of the reduction in progression occurring in the first year (Lawrenson et al. 2023).

The review by Lawrenson et al. (2023) did not find a significant difference in the progression of myopia following cessation of myopia-control treatment for one year.

An RCT by Zhu et al. (2022) reported no significant difference in treatment effects by age, and a meta-analysis by Yu et al. (2022) found no significant difference in treatment effects by ethnicity or by multifocal soft contact lens design type. There was, however, a difference in the effect of multifocal spectacle lenses compared to standard of care in groups with different baseline myopia levels, with multifocal spectacle lenses significantly reducing SER progression in children with baseline myopia levels higher than -2.00 dioptres ('less myopia'), but not in those with baseline levels less than or equal to -2.00 dioptres ('more myopia') (Zhu et al. 2022).

Based on limited evidence that was often poorly reported, spectacle interventions were well-tolerated with minimal and mild adverse events (Lawrenson et al. 2023). In contact lens studies, the incidence of adverse events for multifocal soft contact lenses was similar to single-vision soft contact lenses, and they were generally not serious. The incidence and severity of corneal staining was higher in studies using orthokeratology, and the Cochrane review reported that there is uncertainty regarding the risk-benefit of these lenses (Lawrenson et al. 2023). UK guidance and experts contacted by HTW state that myopia-control spectacles and contact lenses are safe, as long as handling and hygiene advice is followed, and the orthokeratology lenses are fitted accurately.

Treatment adherence was generally reported as being high in the studies in the Cochrane review, with levels that were similar across study arms for all myopia-control interventions, except for those wearing orthokeratology and rigid-gas permeable contact lenses. However, adherence was inconsistently reported, and not formally reported by Lawrenson et al. (2023) for orthokeratology. Reasons for discontinuation included, but were not limited to, finding contact lenses uncomfortable, having issues with handling contact lenses, or no longer being interested in wearing the myopia-control intervention.

Relevant quality of life or visual acuity outcomes were not reported in the review by Lawrenson et al. (2023). Only two RCTs for each of these outcomes were identified since the NMA. These RCTs showed mixed results for quality of life (Kandel 2022), and no significant difference between treatment groups for visual acuity (Weng et al. 2022, Liu et al. 2023).

Lawrenson et al. (2023) noted that evidence on the efficacy of myopia-control treatments was limited by short study durations and heterogeneity in treatment response. The heterogeneity of the evidence may, in part, be explained by the different ages of participants and the fact that most studies were conducted in children from Asian countries, who typically have faster progression of myopia than children of other ethnicities. Most of the evidence in the review by Lawrenson et al. (2023) followed participants for up to two years, and uncertainty remains about the sustained effect of these interventions.

One health economic study compared the costs of myopia-control strategies to single-vision correction in China and Australia but was considered only partially applicable because of the settings and societal perspective taken. We conducted an original cost utility analysis to estimate the cost effectiveness of myopia-control strategies compared with single-vision correction for children and adolescents in Wales.

Based on the results of the meta-analysis by Lawrenson et al. (2023), we modelled no difference in SER between peripheral plus spectacle lenses and single-vision correction at two years from baseline. Consequently, peripheral plus spectacle lenses were estimated to provide minimal benefit at a greater cost and were not cost effective compared with single-vision correction. Multifocal soft contact lenses and orthokeratology were estimated to provide small quality-adjusted life year (QALY) gains at an increased cost compared with single-vision correction. Both strategies were estimated to be cost effective compared with single-vision correction, with incremental cost effectiveness ratios (ICER) of £8,367 and £3,995 per QALY gained, respectively. Orthokeratology was estimated to represent the best value for money of the strategies considered, providing the highest total health benefit at a willingness to pay threshold of £20,000 per QALY.

The cost utility analysis has several limitations; most notably the reliance on assumptions to link orthokeratology effects on axial length to SER and to model the impact of myopia severity on health-related quality of life. Sensitivity analysis showed that results were sensitive to uncertainty in these assumptions. However, orthokeratology was estimated to be the most cost-effective strategy throughout sensitivity and scenario analyses.

What was the outcome of HTW's appraisal?

HTW is a national body working to improve quality of care in Wales. We collaborate with partners across health, social care, and industry to issue independent guidance that informs commissioning within Wales health and social care. We are supported by an Assessment Group, who ensure our work adheres to high standards of methodological and scientific rigour, and an Appraisal Panel, who consider evidence within the Welsh context and produce HTW guidance. More details on our appraisal process, the assessment group, and the appraisal panel can be found on the HTW website.

In this case, the HTW Assessment Group considered the evidence presented in this Evidence Appraisal Report (EAR049) and concluded there was sufficient evidence for the development of guidance. Please refer to the HTW website for full guidance details.

Evidence Appraisal Report 049 follows below and provides full details for this topic. More comprehensive details of the HTW Guidance and HTW Appraisal Panel considerations can be found on the HTW website.

1. Purpose of the Evidence Appraisal Report

This report aims to identify and summarise evidence that addresses the following question: what is the clinical and cost effectiveness of myopia-control spectacle lenses and contact lenses to slow the progression of myopia in children and adolescents (up to and including 18 years old), compared to standard care?

Evidence Appraisal Reports are based on rapid systematic literature searches of published evidence, with the aim of identifying the best clinical and economic evidence on health technologies. Researchers critically evaluate this evidence. The draft Evidence Appraisal Report is reviewed by experts and by Health Technology Wales multidisciplinary advisory groups before publication.

2. Health problem

Myopia, also known as short- or near- sightedness, is the most common eye condition worldwide (Williams et al. 2015). It is a refractive anomaly of the eye that occurs when the light rays entering the eye from distant objects are focused in front of the retina instead of on its surface, resulting in distant objects appearing blurred and close objects appearing clear (Walline et al. 2020a). Myopia is defined as a spherical equivalent refractive error (SER) of less than or equal to -0.50 dioptres (D) when ocular accommodation is relaxed, and high myopia is defined as a SER of -6.00 D or worse when ocular accommodation is relaxed (Németh et al. 2021). If left untreated, myopia might progress to high myopia (Lu et al. 2020). Myopia reduces visual acuity levels, which may have an impact on educational achievement and has been linked to reduced literacy levels (Bruce et al. 2016). High levels of myopia are associated with ocular diseases such as glaucoma, macular degeneration, cataracts, and retinal detachment, and can lead to significant visual impairment (Garcia-Del Valle et al. 2021, Ruiz-Pomeda et al. 2018, Walline et al. 2020b). Evidence suggests that slowing myopia by one D may reduce the likelihood of developing adverse pathological events by 40% (Bullimore & Brennan 2019).

Myopia most often results from the eyeball being too long (i.e., there is excessive axial elongation), but it can also occur when the image-forming structures of the eye are too strong (Flitcroft et al. 2019). Although genetic inheritance is a well-established predisposing factor for myopia, genetic factors cannot explain the rapidly rising prevalence of the condition (Williams et al. 2019). Evidence suggests that children are developing myopia at a younger age than they did 50 years ago (McCullough et al. 2016). Most cases of myopia develop during childhood and the prevalence of myopia begins to increase noticeably after the age of six years (McCullough et al. 2016). This appraisal will focus on children with developmental myopia and not those with congenital myopia, where pathological changes have already occurred.

The prevalence of myopia shows significant age, ethnic and regional variation (Rudnicka et al. 2016). The prevalence of myopia in some parts of the UK has been reported as 1.9% amongst six to seven year olds (McCullough et al. 2016), 3.4% amongst 10 to 11 year olds (Rudnicka et al. 2010) and 16.4% amongst 12 to 13 year olds (McCullough et al. 2016). The prevalence of myopia in children and adolescents in Wales is uncertain, but based on these prevalence estimates, approximately 46,000 children aged between six and 18 years old had myopia in Wales in 2021 (Office for National Statistics 2022, Rudnicka et al. 2010, McCullough et al. 2016). Myopia progression rates in Asian children are reported to be approximately 0.20 D per year faster than in European children of the same age (Donovan et al. 2012). The prevalence of myopia is increasing and if current trends continue, it is estimated that approximately 50% of the world's population will have myopia by 2050 (Holden et al. 2016).

According to the topic proposer, standard of care in Wales is prescription single-vision spectacle lenses or single-vision soft contact lenses. Although single-vision spectacle lenses and single-vision soft contact lenses may correct myopia, they do not slow its progression (Lawrenson et al. 2023). In Wales, children under 16 years old are entitled to help towards the cost of spectacles and contact lenses in the form of a voucher from the NHS (Welsh Government 2022a). Although most providers in Wales offer a basic pair of spectacles at no additional cost to the value of the voucher, it is not currently mandatory. In addition, the value of the NHS voucher does not currently cover a full year's supply of contact lenses.

3. Health technology

Since myopia tends to stabilise in late adolescence, interventions to slow myopia progression should be delivered in childhood (Lawrenson et al. 2023). Although these interventions may not prevent myopia, a reduction in the extent of myopia may provide a reduction in the risk of developing serious eye conditions later in life (College of Optometrists 2022). Myopia-control interventions can be grouped into three broad categories (Wildsoet et al. 2019):

- Optical myopia-control interventions include a variety of spectacle and contact lens designs. It is reported that these interventions may result in optically-induced changes to the effective refractive status of the eye, which can regulate eye growth and influence refractive development (Lawrenson et al. 2023). Spectacles are the least invasive and most accessible method for potentially slowing myopia progression (Lawrenson et al. 2023). Contact lenses may be used but their use requires greater dexterity and responsibility than spectacles (Walline et al. 2020a). The different types of myopia-control spectacle lenses and contact lenses included in this appraisal are summarised in Table 1. Experts contacted by HTW advised that none of the myopia-control interventions described in Table 1 are currently available in NHS Wales. Of these experts, those who practice in Wales stated that orthokeratology, peripheral plus spectacles, and multifocal soft contact lenses are currently being used in private clinics in Wales.
- Pharmacological interventions include atropine eye drops, pirenzepine gel and cyclopentolate. These medicines are not currently licensed for slowing the progression of myopia in the UK, and, according to experts contacted by HTW, few optometrists in Wales currently have the independent prescribing qualification necessary to be able to prescribe them, although this number is anticipated to increase. Pharmaceutical interventions are outside of the scope of this appraisal.
- Environmental interventions include time spent outdoors or modifications to the performance of 'near work' (such as screen use). Spending increased time outside may delay the onset of myopia in some children, and may prevent it in others (College of Optometrists 2022). Guidance recommends that optometrists should encourage children to spend time outdoors and promote a healthy balance of near-vision activities regardless of whether myopia management is offered (College of Optometrists 2022).

This appraisal will focus on optical myopia-control interventions. Refractive under-correction spectacle lenses are one type of optical myopia-control intervention that will not be covered in this appraisal as they are not used in Wales, according to the topic proposer. Currently in Wales, myopia control is only administered in the form of spectacles or contact lenses by optometrists at some, but not all, private practices. At present, there is no provision for the higher cost of myopia-control interventions under the current voucher system, creating inequity of access to myopia-control optical interventions.

Table 1. Description of myopia-control spectacle and contact lenses

Myopia-control intervention	Type of lens	Description
Myopia-control spectacle lenses		
Multifocal spectacle lenses	Bifocal	Combine two different prescriptions into one lens. One area of the lens has one prescription (usually distance) and a segment in the lower half will have the other (usually near-vision) (Specsavers 2023a)
	Progressive-addition lenses (varifocal and multifocal)	Correct vision at different working distances. Unlike bifocals, they have a gradual change in prescription and don't have visible lines that separate the segments. The distance vision part of the lens is usually in front of the pupil, with the near vision part in the lower section of the lenses (Specsavers 2023c)
Peripheral plus spectacle lenses	Defocus incorporated multiple segments	Have a central optical zone for correcting refractive error and multiple segments of constant myopic defocus (+3.50 dioptres) surrounding the central zone (Németh et al. 2021)
	Highly aspherical lenslet	Have a spherical front surface with 11 concentric rings formed by contiguous aspherical lenslets. The area of the lens without lenslets provides distance correction. They are designed to create a volume of signal that slows down elongation of the eye (Bao et al. 2022)
	Slightly aspherical lenslet	
Novel lenses	Diffusion optics technology (DOT) spectacle lenses	Modulate retinal contrast by creating lower signal differences between adjacent cones (Rappon et al. 2022). Whilst they have a CE-mark, experts contacted by HTW noted that they are not yet available in Wales but may be in the near-future
	Cylindrical annular refractive element (CARE) spectacle lenses	Have a central optical area of full correction and a control area where many microcylinders are arranged in concentric circles (Liu et al. 2023). Evidence suggests that they are available in Europe, but it is unclear whether they are available in Wales (ZEISS 2023)
Myopia-control contact lenses		
Multifocal soft contact lenses	Progressive design	Have a central zone that contains the distance refractive correction, with peripheral regions of the lens having relatively increased positive power. This is achieved by a gradual increase in power towards the periphery (Lawrenson et al. 2023)
	Concentric ring design	Have a central zone that contains the distance refractive correction, with peripheral regions of the lens having relatively increased positive power. This is achieved by using concentric peripheral zones of alternating myopic defocus and distance correction (Lawrenson et al. 2023)
	Extended depth of focus	Optimise focus in front of and on the retina and degrade focus behind the retina (Lawrenson et al. 2023)
	Spherical aberration soft contact lenses	Lenses with an aspheric surface designed to shift retinal hyperopic blur to the myopic direction (Cheng et al. 2016)

Myopia-control intervention	Type of lens	Description
Orthokeratology	Not applicable	Corneal reshaping lenses worn overnight to flatten the central cornea and reduce its dioptric power. The geometry of these lenses also creates a corneal profile that produces relative myopic defocus (Lawrenson et al. 2023)
Rigid gas-permeable contact lenses	Not applicable	Hard lenses porous to oxygen (Specsavers 2023b)

4. Guidance, guidelines and health technology assessments

4.1 UK guidance

The College of Optometrists recommends that optometrists can offer myopia-control spectacles and contact lenses if they have the relevant knowledge and skills (College of Optometrists 2022). Optometrists should signpost to local practices offering the service if they do not offer myopia management, and they should encourage children to spend time outdoors and promote a healthy balance of near-vision activities regardless of whether myopia management is offered (College of Optometrists 2022).

The College states that myopia-control spectacles and contact lenses are safe with a low incidence of serious adverse events (AEs) (College of Optometrists 2022). There could be a small increased risk of corneal infections associated with wearing contact lenses for longer periods and overnight wear, or for an individual moving from spectacle wear only to contact lenses wear, but the risk can be significantly reduced with proper advice on handling these lenses and hand hygiene (College of Optometrists 2022).

4.2 European guidance

Guidance from the European Society of Ophthalmology and International Myopia Institute states that multifocal spectacle lenses yielded a small effect in slowing myopia progression compared to single-vision spectacle lenses (Németh et al. 2021). Studies evaluating different peripheral plus spectacle lenses compared to single-vision spectacle lenses reported inconsistent results for SER and axial length (AL) outcomes, although results for defocus incorporated multiple segments were described as promising. They recommend that rigid gas-permeable contact lenses and spherical aberration multifocal soft contact lenses are ineffective in myopia progression. The guidance also recommends that multifocal soft contact lenses and orthokeratology lenses are effective myopia-control interventions (Németh et al. 2021).

4.3 International guidance

The World Council of Optometry (2021) recommends that the standard of care for myopia should include optometrists correcting myopia, whilst also providing evidence-based interventions to slow the progression of myopia.

A Canadian Health Technology Review included five systematic reviews and seven randomised controlled trials (RCTs) investigating SER progression and AL elongation in children wearing multifocal soft contact lenses, peripheral plus spectacle lenses (specifically defocus incorporated multiple segments lenses) or orthokeratology lenses compared to standard care

(Banerjee & Horton 2021). They reported that SER progression and AL elongation were less with all myopia-control interventions, but that the findings need to be interpreted in the light of limitations, such as the quantity and quality of the included studies, limited information regarding AEs and lack of long-term data and cost effectiveness data (Banerjee & Horton 2021).

An Ophthalmic Technology Assessment by the American Academy of Ophthalmology, of three RCTs, seven non-randomised comparative studies and three observational studies, recommends that orthokeratology may be effective in slowing myopic progression for children and adolescents, with a potentially greater effect when initiated at six to eight years old (VanderVeen et al. 2019). They report that safety remains a concern because of the risk of potentially blinding microbial keratitis from overnight contact lens wear (VanderVeen et al. 2019).

5. Clinical effectiveness

5.1 Overview of clinical evidence

For details on the methodology used to identify evidence for this report, refer to Section 11. Table 2 summarises the evidence identified for each clinical outcome and myopia-control intervention. Table 3 summarises the change in SER at one, two and three years for all myopia-control interventions. Table 4 summarises the change in AL at one, two and three years for all myopia-control interventions. Appendix 7 (Table A7.1) describes the study characteristics for systematic reviews and Table A7.2 describes individual RCTs.

We identified a network meta-analysis (NMA) by Lawrenson et al. (2023) of myopia-control interventions to slow the progression of myopia in children. The NMA included 40 RCTs investigating multifocal spectacle lenses, peripheral plus spectacle lenses, multifocal soft contact lenses, orthokeratology, or rigid gas-permeable contact lenses, compared to single-vision spectacle lenses or single-vision soft contact lenses. The primary outcome was 'progression of myopia,' defined as both change in SER and change in AL (Lawrenson et al. 2023). Only change in AL, and not SER, was reported for orthokeratology in the review by Lawrenson et al. (2023). Overnight wear of orthokeratology lenses flattens the central cornea and temporally reduces SER, and Lawrenson et al. (2023) concluded that it is therefore not possible to assess the true progression of refractive error without ceasing lens wear for a period of time to allow the cornea to return to its pre-treatment state.

As well as statistical significance, the review by Lawrenson et al. (2023) reported clinical significance, which was determined by an expert panel. They concluded that a mean difference in SER between intervention groups of 0.25 D per year (0.75 D over the course of a three-year study) would be regarded as clinically significant. This would correspond to a difference in AL of approximately 0.1 millimetres (mm) per year (0.3 mm over three years) (Lawrenson et al. 2023). Experts contacted by HTW generally agreed with the clinically significant thresholds set by the Cochrane review but stated that higher (0.5 D per year) and lower (0.125 D per year) SER thresholds may also be relevant. They noted that the amount of progression considered clinically meaningful may differ by age and highlighted the importance of considering the accumulation of effects over time.

Lawrenson et al. (2023) stated that since the networks in the NMA were poorly connected, most estimates versus control were as, or more, imprecise than the corresponding direct estimates. Consequently, the authors mostly reported estimates based on direct (pairwise) comparisons. We have therefore reported the meta-analysis results from Lawrenson et al. (2023) in the main body of text in this report. Data from the NMA are only reported in the main body of the text in this report when the conclusions differed from the meta-analysis; NMA data are reported in Appendix 1 in cases where conclusions are the same in both types of analysis.

Since the search dates in the Cochrane review, we identified a further seven RCTs (Fang et al. 2022, Rappon et al. 2022, Shen et al. 2022, Weng et al. 2022, Zhu et al. 2022, Liu et al. 2023, Zhu et al. 2023). Some of the RCTs identified since the Cochrane review showed similar effects to the NMA and meta-analysis, and so have not been described in the main body of text in this report. These outcomes can be found in Appendix 2. Some of the RCTs identified since the Cochrane review report different interventions and/or outcomes to those reported by Lawrenson et al. (2023), and we have reported these in the main body of this report.

We also identified an additional meta-analysis by Yu et al. (2022) and systematic review by Kandel (2022), published since the NMA search dates. These were included when they reported pooled outcome data not pooled in the systematic review by Lawrenson et al. (2023), or when they reported on outcomes not reported in Lawrenson et al. (2023).

Where the evidence allowed, we aimed to report outcomes separately according to the design of the myopia-control intervention, age of participants, ethnicity of participants, and baseline myopia level. An RCT by Zhu et al. (2022) reported change in SER by age and baseline SER level in children wearing multifocal spectacle lenses compared to single-vision spectacle lenses. Four RCTs in a meta-analysis by Yu et al. (2022) reported change in SER and AL at two years by ethnicity and multifocal soft contact lens design.

Appendix 6 gives full details of the studies selected for inclusion in the review.

Table 2. Summary of outcomes and sources of evidence used

Outcome	Multifocal spectacle lenses			Peripheral plus spectacle lenses			Novel spectacle lenses (DOT and CARE)			Multifocal soft contact lenses			Orthokeratology			Rigid gas-permeable contact lenses		
Follow-up (years)	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Change in SER	NMA and MA	NMA, MA and 1 RCT	MA	NMA and MA	NMA and MA	NI	2 RCTs	NI		NMA, MA and 3 RCTs	NMA and MA	MA	NA			NMA and MA	NMA and SR	SR
Change in AL	NMA and MA	NMA, MA and 1 RCT	MA	NMA and MA	NMA and MA	NI	2 RCTs	NI		NMA, MA and 3 RCTs	NMA and MA	MA	NMA, MA and 1 RCT	NMA and MA	NI	NMA and MA	NMA and MA	SR
Change in SER following cessation of treatment	SR	NI		NI			NI			SR	NI		NA			NI		
Change in AL following cessation of treatment	NI			NI			NI			SR	NI		NI			NI		
AEs	SR			SR		NI	2 RCTs	NI		SR			SR	NI		SR		
QoL	NI			NI			NI			SR		NI	NI			SR		
Adherence and discontinuation	SR			SR		NI	2 RCTs	NI		MA and SR			1 RCT	NI		SR		NI
Visual acuity	NI			NI			1 RCT	NI		1 RCT	NI		NI			NI		
SA: change in SER by age, baseline SER, ethnicity or lens design	NI	1 RCT	NI	NI			NI			MA		NI	NI			NI		
SA: Change in AL by ethnicity or lens design	NI			NI			NI			MA		NI	NA			NI		

No evidence identified

AEs: adverse events; AL: axial length; CARE: cylindrical annular refractive element; DOT: diffusion optics technology; MA: meta-analysis; NA: not applicable; NI: none identified; NMA: network meta-analysis; QoL: quality of life; RCT: randomised controlled trial; SA: subgroup analysis; SER: spherical equivalent refraction; SR: systematic review

Table 3. Summary of change in spherical equivalent refraction at one, two and three years from baseline

Intervention	Year 1 MD (95% CI)	Year 2 MD (95% CI)	Year 3 MD (95% CI)	Evidence source
Multifocal spectacles	MD: 0.14 D (0.08 to 0.21)	MD: 0.19 D (0.08 to 0.30)	MD: 0.26 D (−0.07 to 0.59)	Meta-analysis (Lawrenson et al. 2023)
Peripheral plus spectacles	MD: 0.51 D (0.19 to 0.82)	MD: 0.34 D (−0.08 to 0.76)	NA	Meta-analysis (Lawrenson et al. 2023)
Novel DOT spectacle lenses (0.365 mm spacing)	MD: 0.40 D (0.27 to 0.53)	NA	NA	RCT (Rappon et al. 2022)
Novel DOT spectacle lenses (0.240 mm spacing)	MD: 0.32 D (0.17 to 0.47)	NA	NA	RCT (Rappon et al. 2022)
Novel CARE spectacle lenses	MD: 0.15 D (−0.04 to 0.32)	NA	NA	RCT (Liu et al. 2023)
Multifocal soft contact lenses	MD: 0.26 D (0.17 to 0.35)	MD: 0.30 D (0.19 to 0.41)	MD: 0.47 D (0.13 to 0.82)	Meta-analysis (Lawrenson et al. 2023)
Rigid gas-permeable contact lenses	MD: 0.02 D (−0.05 to 0.10)	MD: 0.54 D (0.27 to 0.81) MD: −0.05 D (−0.25 to 0.15)	MD: 0.63 D (0.30 to 0.96)	Meta-analysis (year 1) and systematic review (year 2 and 3) by Lawrenson et al. (2023)
Orthokeratology	NA	NA	NA	NA

Key

Statistically and clinically significant (favours myopia-control intervention)

Statistically significant (favours myopia-control intervention) but clinically insignificant

No statistically significant difference between groups

Not available

CARE: cylindrical annular refractive element; CI: confidence interval; D: dioptres; DOT: diffusion optics technology; MD: mean difference; mm: millimetre; NA: not applicable; RCT: randomised controlled trial

Table 4. Summary of change in axial length at one, two and three years from baseline

Intervention	Year 1 MD (95% CI)	Year 2 MD (95% CI)	Year 3 MD (95% CI)	Evidence source
Multifocal spectacles	MD: -0.06 mm (-0.09 to -0.04)	MD: -0.07 mm (-0.12 to -0.03)	MD: -0.12 mm (-0.18 to -0.07)	Meta-analysis (Lawrenson et al. 2023)
Peripheral plus spectacles	MD: -0.13 mm (-0.24 to -0.03)	MD: -0.20 mm (-0.45 to 0.05)	NA	Meta-analysis (Lawrenson et al. 2023)
Novel DOT spectacle lenses (0.365 mm spacing)	MD: -0.15 mm (-0.20 to -0.10)	NA	NA	RCT (Rappon et al. 2022)
Novel DOT spectacle lenses (0.240 mm spacing)	MD: -0.10 mm (-0.17 to -0.04)	NA	NA	RCT (Rappon et al. 2022)
Novel CARE spectacle lenses	MD: -0.10 mm (-0.15 to -0.02)	NA	NA	RCT (Liu et al. 2023)
Multifocal soft contact lenses	MD: -0.11 mm (-0.13 to -0.09)	MD: -0.15 mm (-0.19 to -0.12)	MD: -0.22 mm (-0.34 to -0.10)	Meta-analysis (Lawrenson et al. 2023)
Rigid gas-permeable contact lenses	MD: 0.02 mm (-0.05 to 0.10)	MD: 0.03 mm (-0.05 to 0.12)	MD: 0.05 mm (-0.12 to 0.22)	Meta-analysis (year 1 and 2) and systematic review (year 3) by Lawrenson et al. (2023)
Orthokeratology	MD: -0.19 mm (-0.23 to -0.15)	MD: -0.28 mm (-0.38 to -0.19)	NA	NA

Key

Statistically and clinically significant (favours myopia-control intervention)

Statistically significant (favours myopia-control intervention) but clinically insignificant

No statistically significant difference between groups

Not available

CARE: cylindrical annular refractive element; CI: confidence interval; D: dioptres; DOT: diffusion optics technology; MD: mean difference; mm: millimetre; NA: not applicable; RCT: randomised controlled trial

5.2 Change in spherical equivalent refraction at one year (Table 5 for meta-analysis and Appendix 1 [Table A1.1] for NMA)

In the direct, pairwise meta-analysis of 24 RCTs by Lawrenson et al. (2023), there was evidence that multifocal spectacle lenses, peripheral plus spectacle lenses and multifocal soft contact lenses may reduce SER progression compared to standard of care, but this finding was not deemed to be clinically significant for multifocal spectacle lenses, according to thresholds of clinical significance in the Cochrane review. Rigid gas-permeable contact lenses did not significantly reduce SER progression compared to standard of care. There was evidence of slowing of efficacy of myopia-control treatment over time for all interventions in the Cochrane review, with most of the reduction in progression occurring in the first year (Lawrenson et al. 2023). This outcome was not reported for orthokeratology as per reasons discussed previously in this report.

An RCT reporting novel diffusion optics technology (DOT) spectacle lenses, and another RCT investigating novel cylindrical annular refractive element (CARE) spectacle lenses, interventions not included in the Cochrane review, also came to this conclusion, and are reported below (Rappon et al. 2022, Liu et al. 2023). RCTs published since the Cochrane review reported a significant reduction in SER progression at one year with multifocal soft contact lenses compared to standard of care (Table A2.1 in Appendix 2).

5.2.1 Multifocal spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of nine RCTs of 1,463 children, found that multifocal spectacle lenses significantly reduced SER progression at one year compared to single-vision spectacle lenses (mean difference [MD]: 0.14 D, 95% confidence interval [CI]: 0.08 to 0.21 D). Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant.

The NMA of four RCTs (445 children in the multifocal spectacle lenses group) did not find a significant difference between the two groups (MD: 0.14 D, 95% CI: −0.04 to 0.32 D) (Lawrenson et al. 2023).

5.2.2 Peripheral plus spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of five RCTs of 832 children, found that peripheral plus spectacle lenses significantly reduced SER progression at one year compared to single-vision spectacle lenses (MD: 0.51 D, 95% CI: 0.19 to 0.82 D). The NMA by Lawrenson et al. (2023) reported the same conclusion. Lawrenson et al. (2023) stated that the mean difference was also clinically significant in the meta-analysis and the NMA.

5.2.3 Novel spectacle lenses

5.2.3.1 Diffusion optics technology lenses

One RCT by Rappon et al. (2022) compared 256 children wearing a novel spectacle lens (DOT lenses), with either diffusers applied with 0.365 mm spacing or 0.240 mm spacing, to those wearing single-vision spectacle lenses. Both types of DOT lenses significantly reduced SER progression at one year compared to controls (MD: 0.40 D, 95% CI: 0.27 to 0.53 D for 0.365 mm spacing DOT lenses; and MD: 0.32 D, 95% CI: 0.17 to 0.47 D for 0.240 mm spacing DOT lenses)

(Rappon et al. 2022). According to the threshold for clinical significance in the review by Lawrenson et al. (2023), the mean differences for both DOT lenses are clinically significant.

5.2.3.2 Cylindrical annular refractive element lenses

An RCT of 118 children reported that novel CARE lenses did not significantly reduce SER progression at one year compared to single-vision spectacle lenses (MD: 0.15 D, 95% CI: −0.04 to 0.32 D) (Liu et al. 2023).

5.2.4 Multifocal soft contact lenses

The meta-analysis by Lawrenson et al. (2023), of eight RCTs of 1,135 children, found that multifocal soft contact lenses significantly reduced SER progression at one year compared to single-vision soft contact lenses (MD: 0.26 D, 95% CI: 0.17 to 0.35 D). The NMA by Lawrenson et al. (2023) reported the same conclusion. Lawrenson et al. (2023) reported that the mean difference was also clinically significant in the meta-analysis but not in the NMA.

5.2.5 Rigid gas-permeable contact lenses

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 420 children, found that rigid gas-permeable contact lenses did not significantly reduce SER progression at one year compared to single-vision spectacle lenses or single-vision soft contact lenses (MD: 0.02 D, 95% CI: −0.05 to 0.10 D). The NMA by Lawrenson et al. (2023) reported the same conclusion.

5.3 Change in spherical equivalent refraction at two years (Table 6 for meta-analysis and Appendix 1 [Table A1.2] for NMA)

In the meta-analysis of 17 RCTs by Lawrenson et al. (2023), there was evidence that multifocal spectacle lenses and multifocal soft contact lenses may reduce SER progression compared to standard of care, but neither of these findings were deemed clinically significant according to thresholds of clinical significance in the Cochrane review. Peripheral plus spectacle lenses did not significantly reduce myopia progression at two years compared to standard of care. For rigid gas-permeable contact lenses, one study found a benefit, and another found no difference compared to controls. There was evidence of slowing of efficacy of myopia-control treatment over time for all interventions in the Cochrane review, with most of the reduction in progression occurring in the first year (Lawrenson et al. 2023).

RCTs identified since the NMA also reported a significant reduction in SER progression at two years with multifocal spectacle lenses compared to standard of care (see Table A2.2 in Appendix 2). We did not identify evidence for change in SER at two years with DOT or CARE lenses. This outcome was not reported for orthokeratology as per reasons discussed previously in this report.

5.3.1 Multifocal spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of eight RCTs of 1,401 children, found that multifocal spectacle lenses significantly reduced SER progression at two years compared to single-vision spectacle lenses (MD: 0.19 D, 95% CI: 0.08 to 0.30 D). The NMA by Lawrenson et al. (2023) reported the same conclusion. Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant in the meta-analysis or the NMA.

5.3.2 Peripheral plus spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 329 children, did not find a significant difference in SER progression between peripheral plus spectacle lenses and single-vision spectacle lenses at two years (MD: 0.34 D, 95% CI: −0.08 to 0.76 D).

The NMA of two RCTs reported that peripheral plus spectacle lenses significantly reduced SER progression at two years compared to single-vision spectacle lenses (MD: 0.34 D, 95% CI: 0.05 to 0.63 D) (Lawrenson et al. 2023). Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant in the NMA.

5.3.3 Multifocal soft contact lenses

The meta-analysis by Lawrenson et al. (2023), of five RCTs of 843 children, found that multifocal soft contact lenses significantly reduced SER progression at two years compared to single-vision soft contact lenses (MD: 0.30 D, 95% CI: 0.19 to 0.41 D). The NMA by Lawrenson et al. (2023) reported the same conclusion. Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant in the meta-analysis or the NMA.

5.3.4 Rigid gas-permeable contact lenses

Authors of the Cochrane review reported that outcomes for rigid gas-permeable contact lenses could not be pooled due to heterogeneity (Lawrenson et al. 2023). Two RCTs of 398 children, identified by Lawrenson et al. (2023), reported mixed results. One of the RCTs found that rigid gas-permeable contact lenses significantly reduced SER progression at two years compared to single-vision soft contact lenses (MD: 0.54 D, 95% CI: 0.27 to 0.81 D). Lawrenson et al. (2023) reported that the mean difference was also clinically significant. The other RCT found no significant difference between the rigid gas-permeable contact lens and single-vision spectacle lens groups (MD: −0.05 D, 95% CI: −0.25 to 0.15 D).

The NMA of two RCTs by Lawrenson et al. (2023) found that rigid gas-permeable contact lenses did not significantly reduce SER progression at two years compared to single-vision soft contact lenses or single-vision spectacle lenses (MD: 0.22 D, 95% CI: −0.09 to 0.53 D).

5.4 Change in spherical equivalent refraction at three years (Table 7 for meta-analysis)

This outcome was not reported in the NMA. The meta-analysis of seven RCTs by Lawrenson et al. (2023) found that multifocal soft contact lenses and rigid gas-permeable contact lenses significantly reduced myopia progression at three years compared to standard of care, but multifocal spectacle lenses did not. However, none of these results were deemed to be clinically significant according to thresholds of clinical significance in the Cochrane review. There was evidence of slowing of efficacy of myopia-control treatment over time, with most of the reduction in progression occurring in the first year (Lawrenson et al. 2023).

We did not identify evidence for change in SER at three years for DOT lenses, CARE lenses or peripheral plus spectacle lenses. This outcome was not reported for orthokeratology as per reasons discussed previously in this report.

5.4.1 Multifocal spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of four RCTs of 835 children, did not find a significant difference in SER progression at three years in the multifocal spectacle lenses group compared to the single-vision spectacle lenses group (MD: 0.26 D, 95% CI: −0.07 to 0.59 D).

5.4.2 Multifocal soft contact lenses

The meta-analysis of two RCTs of 395 children found that multifocal soft contact lenses significantly reduced SER progression at three years compared to single-vision soft contact lenses (MD: 0.47 D, 95% CI: 0.13 to 0.82 D) (Lawrenson et al. 2023). Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant.

5.4.3 Rigid gas-permeable contact lenses

One RCT of 116 children, included in the review by Lawrenson et al. (2023), reported that rigid gas-permeable contact lenses significantly reduced SER progression at three years compared to single-vision soft contact lenses (MD: 0.63 D, 95% CI: 0.30 to 0.96 D). Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant.

5.5 Change in axial length at one year (Table 8 for meta-analysis and Appendix 1 [Table A1.3] for NMA)

In the meta-analysis of 24 RCTs by Lawrenson et al. (2023), there was evidence that multifocal spectacle lenses, peripheral plus spectacle lenses, multifocal soft contact lenses and orthokeratology may reduce AL elongation compared to standard of care. However, this finding was not deemed to be clinically significant for multifocal spectacle lenses according to thresholds of clinical significance in the Cochrane review. Rigid gas-permeable contact lenses did not significantly reduce axial elongation compared to standard of care. There was evidence of slowing of efficacy of myopia-control treatment over time for all interventions in the Cochrane review, with most of the reduction in progression occurring in the first year (Lawrenson et al. 2023).

An RCT reporting DOT lenses and another investigating CARE lenses, interventions not included in the NMA, found that they reduced AL elongation compared to standard of care, and are reported below (Rappon et al. 2022, Liu et al. 2023). RCTs published since the NMA also reported a significant reduction in AL elongation for multifocal soft contact lenses and orthokeratology compared to standard of care (see Table A2.3 in Appendix 2).

5.5.1 Multifocal spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of four RCTs of 896 children, found that multifocal spectacle lenses significantly reduced AL elongation at one year compared to single-vision spectacle lenses (MD: −0.06 mm, 95% CI: −0.09 to −0.04 mm). Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant.

The NMA of four RCTs by Lawrenson et al. (2023) did not find a significant difference in AL elongation between the two groups (MD: −0.04 mm, 95% CI: −0.16 to 0.08 mm).

5.5.2 Peripheral plus spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of three RCTs of 522 children, found that peripheral plus spectacle lenses significantly reduced AL elongation at one year compared to single-vision spectacle lenses (MD: −0.13 mm, 95% CI: −0.24 to −0.03 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion. Lawrenson et al. (2023) also reported that the mean difference was clinically significant in the meta-analysis and the NMA.

5.5.3 Novel spectacle lenses

5.5.3.1 Diffusion optics technology

Since the NMA by Lawrenson et al. (2023), one RCT by Rappon et al. (2022) of 256 children compared those wearing the novel DOT spectacle lens, either with diffusers applied with 0.365 mm or 0.240 mm spacing, to those wearing single-vision spectacle lenses. Both types of DOT lenses significantly reduced AL elongation compared to controls (MD: −0.15 mm, 95% CI: −0.20 to −0.10 mm for 0.365 mm spacing DOT lenses; and MD: −0.10 mm, 95% CI: −0.17 to −0.04 mm for 0.240 mm spacing DOT lenses) (Rappon et al. 2022). According to the threshold for clinical significance in the review by Lawrenson et al. (2023), the mean difference for the 0.365 mm spacing DOT lenses is clinically significant, and the mean difference for the 0.240 mm spacing DOT lenses is on the threshold of clinical significance.

5.5.3.2 Cylindrical annular refractive element lenses

An RCT by Liu et al. (2023), of 118 children, reported that CARE lenses significantly reduced AL elongation at one year compared to single-vision spectacle lenses (MD: -0.10 mm, 95% CI: −0.15 to −0.02 mm). This mean difference is on the threshold of clinical significance, according to the threshold in the review by Lawrenson et al. (2023).

5.5.4 Multifocal soft contact lenses

The meta-analysis by Lawrenson et al. (2023), of eight RCTs of 1,143 children, found that multifocal soft contact lenses significantly reduced AL elongation at one year compared to single-vision soft contact lenses (MD: −0.11 mm, 95% CI: −0.13 to −0.09 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion. Lawrenson et al. (2023) also reported that the mean difference was clinically significant in the meta-analysis and the NMA.

5.5.5 Orthokeratology

The meta-analysis by Lawrenson et al. (2023), of seven RCTs of 759 children, found that orthokeratology significantly reduced AL elongation at one year compared to single-vision spectacle lenses or single-vision soft contact lenses (MD: −0.19 mm, 95% CI: −0.23 to −0.15 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion. Lawrenson et al. (2023) also reported that the mean difference was clinically significant in the meta-analysis and the NMA.

5.5.6 Rigid gas-permeable contact lenses

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 415 children, found that rigid gas-permeable contact lenses did not significantly reduce AL elongation at one year compared to

single-vision spectacle lenses or single-vision soft contact lenses (MD: 0.02 mm, 95% CI: −0.05 to 0.10 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion.

5.6 Change in axial length at two years (Table 9 for meta-analysis and Appendix 1 [Table A1.4] for NMA)

In the meta-analysis of 14 RCTs by Lawrenson et al. (2023), there was evidence that multifocal spectacle lenses, multifocal soft contact lenses and orthokeratology may reduce AL elongation compared to standard of care. However, only orthokeratology was reported as having clinically significant results, according to thresholds of clinical significance in the Cochrane review. Authors of the meta-analysis reported that peripheral plus spectacle lenses and rigid gas-permeable contact lenses did not significantly reduce axial elongation at two years compared to standard of care. There was evidence of slowing of efficacy of myopia-control treatment over time, with most of the reduction in progression occurring in the first year (Lawrenson et al. 2023).

RCTs published since the NMA reported a significant reduction in AL elongation for multifocal spectacle lenses compared to standard of care (Table A2.4 in Appendix 2). We did not identify evidence for change in axial elongation at two years with DOT or CARE lenses.

5.6.1 Multifocal spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of three RCTs of 699 children, found that multifocal spectacle lenses significantly reduced AL elongation at two years compared to single-vision spectacle lenses (MD: −0.07 mm, 95% CI: −0.12 to −0.03 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion. Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant in the meta-analysis or the NMA.

5.6.2 Peripheral plus spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 329 children, found that peripheral plus spectacle lenses did not significantly reduce AL elongation at two years compared to single-vision spectacle lenses (MD: −0.20 mm, 95% CI: −0.45 to 0.05 mm).

The NMA of two RCTs found that peripheral plus spectacle lenses did significantly reduce AL elongation at two years compared to single-vision spectacle lenses (MD: −0.23 mm, 95% CI: −0.33 to −0.12 mm) (Lawrenson et al. 2023). This result was also reported as being clinically significant (Lawrenson et al. 2023).

5.6.3 Multifocal soft contact lenses

The meta-analysis by Lawrenson et al. (2023), of five RCTs of 843 children, found that multifocal soft contact lenses significantly reduced AL elongation at two years compared to single-vision soft contact lenses (MD: −0.15 mm, 95% CI: −0.19 to −0.12 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion. Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant in the meta-analysis or the NMA.

5.6.4 Orthokeratology

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 106 children, found that orthokeratology significantly reduced AL elongation at two years compared to single-vision spectacle lenses (MD: −0.28 mm, 95% CI: −0.38 to −0.19 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion. Lawrenson et al. (2023) also reported that the mean difference was clinically significant in the meta-analysis and the NMA.

5.6.5 Rigid gas-permeable contact lenses

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 394 children, found that rigid gas-permeable contact lenses did not significantly reduce AL elongation at two years compared to single-vision spectacle lenses or single-vision soft contact lenses (MD: 0.03 mm, 95% CI: −0.05 to 0.12 mm). The NMA by Lawrenson et al. (2023) reported the same conclusion.

5.7 Change in axial length at three years (Table 10)

The Cochrane NMA did not report this outcome, but the Cochrane meta-analysis included five RCTs for this outcome (Lawrenson et al. 2023). Multifocal spectacle lenses and multifocal soft contact lenses significantly reduced AL elongation at three years, but rigid gas-permeable contact lenses did not, and none of the findings were reported as being clinically significant. No evidence was found for peripheral plus spectacle lenses, DOT spectacle lenses, CARE spectacle lenses or for orthokeratology.

5.7.1 Multifocal spectacle lenses

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 558 children, found that multifocal spectacle lenses significantly reduced AL elongation at three years compared to single-vision spectacle lenses (MD: −0.12 mm, 95% CI: −0.18 to −0.07 mm). Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant.

5.7.2 Multifocal soft contact lenses

The meta-analysis by Lawrenson et al. (2023), of two RCTs of 394 children, found that multifocal soft contact lenses significantly reduced AL elongation at three years compared to single-vision soft contact lenses (MD: −0.22 mm, 95% CI: −0.34 to −0.10 mm). Although statistically significant, Lawrenson et al. (2023) reported that the mean difference wasn't clinically significant.

5.7.3 Rigid gas-permeable contact lenses

One RCT in the review by Lawrenson et al. (2023) (116 children) found that rigid gas-permeable contact lenses did not significantly reduce AL elongation at three years compared to single-vision soft contact lenses (MD: 0.05 mm, 95% CI: −0.12 to 0.22 mm).

5.8 Change in spherical equivalent refraction following cessation of treatment (rebound) (Table 11)

The review by Lawrenson et al. (2023) included two RCTs investigating SER progression after treatment with multifocal spectacle lenses or multifocal soft contact lenses was ended, compared with standard of care. The NMA did not report this outcome. No evidence was found for peripheral plus spectacle lenses, DOT spectacle lenses, CARE spectacle lenses, or rigid gas-permeable contact lenses. We did not search for evidence for orthokeratology lenses, as per the explanation previously given in this report.

5.8.1 Multifocal spectacle lenses

One RCT of 83 children, in the review by Lawrenson et al. (2023), reported SER progression over one year for children who had previously used multifocal spectacle lenses for one year. There was no significant difference in SER progression following the cessation of multifocal spectacle lenses compared to single-vision spectacle lenses (MD: 0.00 D, 95% CI: −0.17 to 0.17 D).

5.8.2 Multifocal soft contact lenses

One RCT of 42 children, in the review by Lawrenson et al. (2023), reported SER progression over one year for children who had previously used multifocal soft contact lenses for two years. There was no significant difference in SER progression following the cessation of multifocal soft contact lenses compared to single-vision spectacle lenses (MD: 0.09 D, 95% CI: −0.16 to 0.34 D).

5.9 Change in axial length following cessation of treatment (rebound) (Table 12)

The review by Lawrenson et al. (2023) included one RCT investigating change in AL after treatment with multifocal soft contact lenses was ended, compared with standard of care. The NMA did not report this outcome. No evidence was found for multifocal spectacle lenses, peripheral plus spectacle lenses, DOT spectacle lenses, CARE spectacle lenses, orthokeratology or rigid gas-permeable contact lenses.

5.9.1 Multifocal soft contact lenses

One RCT of 42 children, in the review by Lawrenson et al. (2023), reported AL elongation over one year for children who had previously used multifocal soft contact lenses for two years. There was no significant difference in AL elongation following the cessation of multifocal soft contact lenses compared to single-vision spectacle lenses (MD: 0.01 mm, 95% CI: −0.05 to 0.07 mm).

5.10 Adverse events (Table 13)

Lawrenson et al. (2023) stated that quantitative synthesis was not possible for this outcome due to insufficient available data. In the systematic review by Lawrenson et al. (2023), 12 RCTs reported AEs. Multiple AEs occurring in the same study participant, including events affecting both eyes, were counted as independent events. Studies used a variety of methods to record AEs (they were usually reported using telephone interviews or self-reported at follow-up appointments by parents and/or children). Objective clinical signs were usually based on clinical examination at each follow-up visit (Lawrenson et al. 2023).

Since publication of the NMA by Lawrenson et al. (2023), we identified an RCT by Rappon et al. (2022) and an RCT by Liu et al. (2023) reporting AEs in people using novel DOT and CARE spectacle lenses, respectively.

5.10.1 Multifocal spectacle lenses

The systematic review by Lawrenson et al. (2023) included three RCTs of 530 children wearing multifocal spectacle lenses or single-vision spectacle lenses for one to three years. Multifocal spectacle lenses were usually well-tolerated following a short adaptation period, and the reported AEs were generally mild. There were 53 events in the multifocal spectacle lens group and 41 in the single-vision spectacle lens group. Blurred vision and dizziness were the most frequently reported AEs, with similar rates in both groups (blurred vision: 29/306 [9.5%] in the multifocal spectacle lenses group, and 18/224 [8.0%] in the single-vision spectacle lenses group; dizziness: 13/306 [4.2%] in the multifocal spectacle lenses group, and 15/224 [6.7%] in the single-vision spectacle lenses group) (Lawrenson et al. 2023).

5.10.2 Peripheral plus spectacle lenses

The systematic review by Lawrenson et al. (2023) included one RCT, which reported AEs for 170 children wearing peripheral plus spectacle lenses compared to those wearing single-vision spectacle lenses for two years. There were no AEs reported in either group in this study.

5.10.3 Novel spectacle lenses

5.10.3.1 Diffusion optics technology

One RCT by Rappon et al. (2022) compared 256 children wearing single-vision spectacle lenses to those wearing DOT lenses, with either diffusers applied with 0.365 mm spacing or 0.240 mm spacing.

After one year of wearing the lenses, there were nine reported ocular AEs in the 0.365 mm spacing group, four reported ocular AEs in the 0.240 mm spacing group, and seven in the control group. Although one ocular AE due to ocular trauma was classified as significant in the 0.240 mm spacing group, none of the ocular AEs were classified as device related (Rappon et al. 2022).

Forty-four AEs were classified as non-ocular, four of which were classified as device related. These included three cases of headache in one control subject, and one case of skin irritation from the spectacle frame nose pad in the 0.365 mm spacing group (Rappon et al. 2022).

A total of 12/55 (22%) device deficiencies were reported in both DOT groups. The most common device deficiencies in both DOT groups were issues with the lenses (15/163 [9%]) or issues with the frame (28/163 [17%]), compared to 1.1% having issues with the lens and 11.8% having issues with the frame in the single-vision spectacle lenses group (Rappon et al. 2022).

5.10.3.2 Cylindrical annular refractive element lenses

In the RCT by Liu et al. (2023), of 118 children, no treatment-related AEs were reported in either the CARE spectacle lens group or the single-vision spectacle lens group at one year.

5.10.4 Multifocal soft contact lenses

Four RCTs in the systematic review by Lawrenson et al. (2023) reported AEs separately for multifocal soft contact lenses and single-vision soft contact lenses or single-vision spectacle lenses groups. The largest RCT, of 294 children, reported safety data for multifocal soft contact lenses and single-vision soft contact lenses groups combined. The most frequently reported AEs were corneal infiltrative events (17/697 [2.4%]), conjunctival papillary reaction (22/697 [3.2%]) and corneal staining (13/697 [1.9%]). The number of events were similar for multifocal soft contact lenses and single-vision correction groups. These events were generally not serious, with only one Grade 3 slit-lamp finding (most severe and usually requiring clinical action), and one participant reported as having probable microbial keratitis. There were four reported AE-related withdrawals in these studies (approximately 0.6% incidence) Lawrenson et al. (2023).

5.10.5 Orthokeratology lenses

Two RCTs in the systematic review by Lawrenson et al. (2023) reported AEs for 149 children wearing orthokeratology lenses or single-vision spectacle lenses. There was corneal staining in 16/87 (18.4%) wearers in the orthokeratology groups, and 3/62 (4.8%) wearers in the single-vision spectacle lenses groups, with four cases of corneal erosion or staining graded greater than or equal to three in the orthokeratology group (Grade 3 and 4 are regarded as clinically significant and usually require clinical action) (Lawrenson et al. 2023).

5.10.6 Rigid gas-permeable contact lenses

The systematic review by Lawrenson et al. (2023) included one RCT which reported AEs for 116 children wearing rigid gas-permeable contact lenses compared to those wearing single-vision soft contact lenses for three years. There were no AEs reported in the rigid gas-permeable contact lenses lens group but four AEs were reported in the single-vision soft contact lenses group (one allergy or hypersensitivity reaction and three listed as ‘other’, but it is unclear what these are) (Lawrenson et al. 2023).

5.11 Quality of life (Table 14)

No data for quality of life (QoL), for the interventions described in this EAR, were found in the review by Lawrenson et al. (2023). We identified one systematic review by Kandel (2022) of two RCTs reporting QoL in children wearing multifocal soft contact lenses or rigid gas-permeable contact lenses, compared to those wearing standard of care, for two to three years. QoL was assessed using the Paediatric Refractive Error Profile (PREP) or National Eye Institute Visual Function Questionnaire (NEI-VFQ). We did not identify QoL data for multifocal spectacles, peripheral plus spectacles, novel DOT lenses, novel CARE lenses, or orthokeratology.

5.11.1 Multifocal soft contact lenses

A systematic review by Kandel (2022) included one RCT measuring QoL at two years, using PREP, in 74 children wearing multifocal soft contact lenses compared to those wearing single-vision spectacle lenses. The systematic review did not report data quantitively, but stated that the Appearance, Satisfaction, Activities, Handling, Peer perceptions, and Total score PREP categories were significantly improved in those wearing multifocal soft contact lenses. The Near vision PREP category was significantly improved in those wearing single-vision spectacle lenses. There were

no significant differences between groups for the Overall vision, Far vision and Academic PREP categories (Kandel 2022).

5.11.2 Rigid gas-permeable contact lenses

A systematic review by Kandel (2022) included one RCT comparing QoL at three years, measured using the NEI-VFQ, in 116 children wearing rigid gas-permeable contact lenses or single-vision soft contact lenses. The systematic review did not report data quantitively, but stated that the Pain and Comfort subscales of the NEI-VFQ were significantly improved for those wearing single-vision soft contact lenses (Kandel 2022).

5.12 Treatment adherence and discontinuation (Table 15)

Lawrenson et al. (2023) stated that quantitative synthesis was not possible for this outcome due to insufficient available data. In the systematic review by Lawrenson et al. (2023), 10 RCTs reported treatment adherence and/or discontinuation. We included a meta-analysis by Yu et al. (2022) of seven RCTs for multifocal soft contact lenses compared to standard of care, as it provided pooled data. We also included data on adherence and/or discontinuation for an additional five RCTs published since Lawrenson et al. (2023), which are described below, and an RCT by Fang et al. (2022), which is reported in Appendix 2 (Table A2.5) as it does not add much detail about reasons for study discontinuation.

Lawrenson et al. (2023) reported that adherence was usually assessed through an estimate by parents and/or children of wearing time of spectacles or contact lenses, and the number of days per week the optical appliances were worn (six to seven days per week was usually judged as being fully compliant). A variety of methods were used for data collection, including questionnaires or discussion of adherence at follow-up appointments. Where adherence data were available at multiple time points, study authors of the systematic review reported the results at the longest time point (Lawrenson et al. 2023).

5.12.1 Multifocal spectacle lenses

The systemic review of seven RCTs by Lawrenson et al. (2023) reported treatment adherence in 1,264 children wearing multifocal spectacle lenses or single-vision spectacle lenses for two to three years. The percentage of participants who were judged to be adherent was similar between groups (72% to 96% in the multifocal spectacle lenses group, and 82% to 96% in the single-vision spectacle lenses group) (Lawrenson et al. 2023).

An RCT by Zhu et al. (2022), published since the NMA by Lawrenson et al. (2023), reported on treatment adherence in 93 children wearing multifocal spectacle lenses or single-vision spectacle lenses over two years. In the multifocal spectacle lens group, 15.4% of children discontinued, and 8% of children discontinued in the single-vision spectacle lenses group. Whilst not all reasons for discontinuation were reported, they included children moving to a different area, children preferring to wear contact lenses and some being incompatible with cycloplegic eye drops (Zhu et al. 2022).

5.12.2 Peripheral plus spectacle lenses

The systematic review of two RCTs by Lawrenson et al. (2023) reported treatment adherence in 317 children who wore peripheral plus spectacle lenses or single-vision spectacle lenses. There was no significant difference between the percentage of participants who were judged to be adherent in each group. The range of mean daily wearing times was between 13.5 and 15.5 hours per day for children wearing peripheral plus spectacle lenses, and 13.1 to 15.3 hours per day for children wearing single-vision spectacle lenses (Lawrenson et al. 2023).

5.12.3 Novel spectacle lenses

5.12.3.1 Diffusion optics technology (DOT)

One RCT by Rappon et al. (2022) compared 256 children wearing either single-vision spectacle lenses or novel DOT spectacle lenses, with either diffusers applied with 0.365 mm or 0.240 mm spacing. Parent questionnaires indicated high levels of adherence for all groups (100% at one year) and mean daily wear times equal-to or greater-than 12 hours for all groups (Rappon et al. 2022).

Of the 88 children wearing 0.365 mm spacing DOT lenses, 6% discontinued, compared to 2% of children in the single-vision spectacle lenses group (who discontinued due to being ineligible after being dispensed the single-vision spectacle lenses). Reasons for discontinuation in the 0.365 mm spacing DOT group included one child discontinuing at the discretion of the investigator or subject, one child discontinuing due to parents stating that the DOT spectacles were impeding schoolwork and the ability to see normally, and one discontinuing due to wanting transition lenses (Rappon et al. 2022).

Of the 75 children wearing 0.240 mm spacing DOT lenses, 23% discontinued compared to 2% of children in the single-vision spectacle lenses group (who discontinued due to being ineligible after being dispensed the single-vision spectacle lenses). The main reasons for discontinuation in the 0.240 mm spacing DOT group were because of issues with the appearance of the lenses or adaptation to the lenses (41%) and discontinuing at the discretion of the investigator or subject (24%) (Rappon et al. 2022).

5.12.3.2 Cylindrical annular refractive element lenses (CARE)

Of 118 children randomised in the RCT by Liu et al. (2023), 96 completed the one-year follow-up. Eight children discontinued in the CARE group and 13 discontinued in the single-vision spectacle lens group. Reasons included switching to other myopia-control interventions and subjective willingness (Liu et al. 2023).

Of the 96 children who completed the study, 42.3% wearing CARE lenses and 54.5% wearing single-vision spectacle lenses wore them for more than 12 hours per day (Liu et al. 2023). One child wearing CARE lenses and two wearing single-vision spectacle lenses wore them for less than four hours per day. There was no significant difference in the distribution of daily wearing hours between the two groups ($p = 0.43$) (Liu et al. 2023).

5.12.4 Multifocal soft contact lenses

The systematic review of five RCTs by Lawrenson et al. (2023) reported that daily wearing times were between 6.5 hours to 13.7 hours per day for multifocal soft contact lenses, and 6.3 hours to

13.3 hours per day in the single-vision soft contact lenses group, with no significant difference between groups reported.

The meta-analysis by Yu et al. (2022) pooled data from seven RCTs of 1,272 children, comparing multifocal soft contact lenses to single-vision soft contact lenses or single-vision spectacle lenses, with a follow-up time of 10 months to three years. They reported a study dropout rate of 0 to 55% in the multifocal soft contact lenses group, and 0% to 49% in the standard of care group. Pooled data reported that 26% of participants in the multifocal soft contact lenses group, and 25% of participants in the standard of care group dropped out, but the difference between the groups was not significant (odds ratio: 1.08, 95% CI: 0.81 to 1.45, p = 0.59). Reasons for drop out included wearing-comfort and seeking keratoplasty treatment, although data were not reported for each reason (Yu et al. 2022).

Since publication of the NMA by Lawrenson et al. (2023), two RCTs were identified reporting on the treatment adherence of children wearing multifocal soft contact lenses compared to single-vision soft contact lenses (Shen et al. 2022, Weng et al. 2022). Shen et al. (2022) reported an average wear-time across both groups of 11.2 hours per day, and 5 children (6.9%) discontinued across both groups. Reasons for discontinuation included not wanting to wear contact lenses, being lost to follow up, idiopathic uveitis, and using tropicamide (Shen et al. 2022). Of the 95 children in the RCT by Weng et al. (2022), 44% discontinued. The main reasons for study discontinuation included children finding the contact lenses uncomfortable or not using them regularly (26%), no longer being interested in contact lens wear (21%) and having issues with lens handling (21%) (Weng et al. 2022).

5.12.5 Orthokeratology

Authors of the systematic review by Lawrenson et al. (2023) stated that adherence was not formally assessed in the included orthokeratology studies, but that these studies were often associated with high drop-out rates (over 50% in some studies).

An RCT of 55 children by Fang et al. (2022), published since the review by Lawrenson et al. (2023), compared study discontinuation rates in children wearing orthokeratology lenses or single-vision spectacle lenses for one year. In the orthokeratology group, 31% of children discontinued, and 8% discontinued in the single-vision spectacle lenses group. The reasons for discontinuation included children choosing other treatments (56%) or being lost to follow up (44%) (Fang et al. 2022).

5.12.6 Rigid gas-permeable contact lenses

One RCT in the systematic review by Lawrenson et al. (2023) compared adherence in 150 children wearing rigid gas-permeable contact lenses or single-vision spectacle lenses for two years. The percentage of participants who were judged to be adherent was 31.5% in the rigid gas-permeable contact lenses group and 98.4% in the single-vision spectacle lenses group.

5.13 Visual acuity (Table 16)

The review by Lawrenson et al. (2023) did not report visual acuity. Since this review, we identified two RCTs investigating visual acuity. We did not identify any evidence for this outcome for multifocal spectacle lenses, peripheral plus spectacle lenses, novel DOT lenses, orthokeratology, or rigid gas-permeable contact lenses.

5.13.1 Novel spectacle lenses

An RCT by Liu et al. (2023), of 118 children, reported that there was no significant difference in the mean high-contrast, distance Logarithm of the Minimum Angle of Resolution (logMAR) visual acuity between those wearing CARE spectacle lenses (–0.09, standard error: ± 0.02) and those wearing single-vision spectacle lenses (–0.09, standard error: ± 0.03) at one year (p = 0.84).

5.13.2 Multifocal soft contact lenses

In another RCT by Weng et al. (2022), 95 children either wore single-vision soft contact lenses for one year, or extended depth of focus or dual focus multifocal soft contact lenses in one eye and single-vision soft contact lenses in the other (with contact lenses being crossed over at six months and worn for a further six months in the intervention group). High-contrast visual acuity in the extended depth of focus contact lens group and single-vision soft contact lenses group did not differ significantly (extended depth of focus mean logMar: 0.21 [SD: 0.24]; single-vision soft contact lenses mean logMAR: 0.14 [SD: 0.27], p = 0.11). High-contrast visual acuity with the dual focus multifocal soft contact lenses also did not differ significantly from the visual acuity achieved with the single-vision soft contact lenses (dual focus multifocal soft contact lenses mean logMAR: 0.26 [SD: 0.33]; single-vision soft contact lenses mean logMAR: 0.26 [SD: 0.35], p > 0.99) (Weng et al. 2022).

There was no significant difference between the groups for subjective vision clarity, with groups rating their vision to be near excellent; on a one to 10 scale (where 10 is best vision), mean extended depth of focus subjective vision clarity was scored as 9.3 (SD: 0.8) and single-vision soft contact lenses was scored at 9.5 (SD: 0.6), p > 0.99. The mean subjective clarity for dual focus multifocal soft contact lenses was 9.5 (SD: 0.8), and 9.8 (SD: 0.4) for single-vision soft contact lenses (p = 0.68) (Weng et al. 2022).

5.14 Subgroup analyses

Where the evidence allowed, we aimed to report outcomes separately according to the design of the myopia-control lens, age of participants, ethnicity of participants, and the degree of baseline myopia. We identified an RCT by Zhu et al. (2022) reporting change in SER by age and baseline SER level in children wearing multifocal spectacle lenses, and a meta-analysis by Yu et al. (2022) reporting change in SER and AL by ethnicity and multifocal soft contact lens design.

5.14.1 Subgroup analysis: change in spherical equivalent refraction by age, baseline myopia level, ethnicity, and lens design

5.14.1.1 Age (Appendix 3, Table A3.1)

Multifocal spectacle lenses

An RCT by Zhu et al. (2022), of 93 children wearing multifocal spectacle lenses or single-vision spectacle lenses, reported no significant difference in SER progression at two years in children aged 7 to 11 years old and in children aged 11 to 14 years old, (MD in 7 to 11 year olds: 0.22 D, standard error of mean [SE]: ± 0.13 D, 95% CI: -0.07 to 0.52 D; MD in 11 to 14 year olds: 0.26 D, SE: ± 0.10 D, 95% CI -0.08 to 0.61 D). Zhu et al. (2022) did not find a statistically significant treatment effect between the age subgroups.

5.14.1.2 Baseline myopia level (Appendix 3, Table A3.2)

Multifocal spectacle lenses

The RCT by Zhu et al. (2022) found that multifocal spectacle lenses significantly reduced SER progression at two years, compared to single-vision spectacle lenses, in children with baseline myopia levels higher than −2.00 D (less myopia) (MD: 0.33, SE: ± 0.09 D, 95% CI: 0.14 to 0.52 D). However, there was no significant difference in SER progression in children with baseline myopia levels less than or equal to −2.00 D (more myopia) (MD: 0.09, SE: ± 0.12 D, 95% CI: −0.15 to 0.33 D). Zhu et al. (2022) reported that there was a statistically significant difference in treatment effect between these subgroups .

5.14.1.3 Ethnicity (Appendix 3, Table A3.3)

Multifocal soft contact lenses

A meta-analysis by Yu et al. (2022) included seven RCTs of 415 Asian children and 591 White children. Multifocal soft contact lenses significantly reduced SER progression at one year in both Asian children (MD: 0.12 D, 95% CI: 0.05 to 0.20 D) and White children (MD: 0.18 D, 95% CI: 0.11 to 0.25 D) compared to standard of care. No significant difference was found for treatment effectiveness between Asian and White children (p = 0.31) (Yu et al. 2022).

At two years, the meta-analysis by Yu et al. (2022), of four RCTs of 320 Asian children and 463 White children, found that multifocal soft contact lenses significantly reduced SER progression in both Asian (MD: 0.22 D, 95% CI: 0.10 to 0.34 D) and White children (MD: 0.19 D, 95% CI: 0.08 to 0.31 D) compared to standard of care. No significant difference was found for treatment effectiveness between Asian and White children (p = 0.77) (Yu et al. 2022).

5.14.1.4 Lens design (Appendix 3, Table A3.4)

Multifocal soft contact lenses

In the meta-analysis by Yu et al. (2022), of seven RCTs of 198 children wearing bifocal contact lenses, 463 children wearing multifocal contact lenses (including dual focus lenses) and 345 children wearing progressive power or varifocal power contact lenses, all multifocal soft contact lens subgroups significantly reduced SER progression at one year compared to standard of care (MD in bifocal group: 0.18 D, 95% CI: 0.07 to 0.30 D; MD in multifocal contact lens group: 0.14 D, 95% CI: 0.06 to 0.23 D; and MD in progressive power/varifocal power contact lens group: 0.14 D, 95% CI: 0.06 to 0.22 D). No significant differences were found between the effectiveness of multifocal soft contact lenses design types (p = 0.84) (Yu et al. 2022).

At two years, the meta-analysis by Yu et al. (2022), of four RCTs of 128 children wearing bifocal contact lenses, 266 children wearing multifocal contact lenses (including dual focus lenses) and 389 children wearing progressive power or varifocal power contact lenses, reported that multifocal contact lenses (including dual focus lenses) significantly reduced SER progression at two years compared to standard of care (MD: 0.24 D, 95% CI: 0.10 to 0.37 D), as did progressive power/varifocal power lenses (MD: 0.18 D, 95% CI: 0.05 to 0.31 D). There was no significant difference in SER progression at two years between the bifocal contact lens group and standard of care group (MD in bifocal lens group: 0.21 D, 95% CI: −0.01 to 0.43 D). No significant differences were found between the effectiveness of multifocal soft contact lenses design types (p = 0.81) (Yu et al. 2022).

5.14.2 Subgroup analysis: change in axial length by ethnicity and lens design

5.14.2.1 Ethnicity (Appendix 3, Table A3.5)

Multifocal soft contact lenses

A meta-analysis by Yu et al. (2022) included seven RCTs of 215 Asian children and 202 White children. Multifocal soft contact lenses significantly reduced AL elongation at one year in both Asian children (MD: −0.09 mm, 95% CI: −0.12 to −0.06 mm) and White children (MD: −0.11, 95% CI: −0.14 to −0.07 mm) compared to standard of care. No significant difference was found for treatment effectiveness between Asian and White children (p = 0.46) (Yu et al. 2022).

At two years, the meta-analysis by Yu et al. (2022), of four RCTs of 320 Asian children and 463 White children, reported that multifocal soft contact lenses significantly reduced AL elongation compared to standard of care in both Asian children (MD: −0.12 mm, 95% CI: −0.18 to −0.06 mm) and White children (MD: −0.21, 95% CI: −0.28 to −0.15 mm). No significant differences were found in treatment effectiveness between Asian and White children (p = 0.05) (Yu et al. 2022).

5.14.2.2 Lens design (Appendix 3, Table A3.6)

Multifocal soft contact lenses

Seven RCTs in the meta-analysis by Yu et al. (2022), of 198 children wearing bifocal contact lenses, 337 children wearing multifocal contact lenses (including dual focus lenses), and 82 children wearing progressive power or varifocal power contact lenses, found that multifocal soft contact lenses significantly reduced AL elongation at one year compared to standard of care (MD in bifocal group: −0.10 mm, 95% CI: −0.14 to −0.07 mm; MD in multifocal contact lens group: −0.11 mm, 95% CI: −0.14 to −0.07 mm; MD in progressive power/varifocal power group: −0.07 mm, 95% CI: −0.12 to −0.02 mm). No significant differences were found between the effectiveness of multifocal soft contact lens design types (p = 0.41) (Yu et al. 2022).

At two years, the meta-analysis of four RCTs by Yu et al. (2022), of 128 children wearing bifocal contact lenses, 266 children wearing multifocal contact lenses (including dual focus lenses), and 194 children wearing progressive power/varifocal power contact lenses, found that multifocal soft contact lenses significantly reduced AL elongation compared to standard of care (MD in bifocal group: 0.11 mm, 95% CI: −0.20 to −0.02 mm; MD in the multifocal contact lens group: −0.14 mm, 95% CI: −0.21 to −0.08 mm; and MD in progressive power/varifocal power group: −0.23 mm, 95% CI: −0.31 to −0.15 mm). No significant differences were found between the effectiveness of multifocal soft contact lens design types (p = 0.10) (Yu et al. 2022).

Table 5. Myopia-control spectacle lenses and contact lenses compared to standard of care: Difference in change in spherical equivalent refraction at one year

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	9 RCTs in MA by Lawrenson et al. (2023) (n = 1,463)	• Children 8 to 15 years old • Multifocal spectacle lenses included BFs or PALs with near additions between +1.00 D and +2.00 D	MD: 0.14 D (0.08 to 0.21) **Favours multifocal spectacle lenses**	• Using the RoB2 too, authors of the MA gave an overall RoB of 'some concerns', usually due to insufficient information concerning allocation concealment and lack of an a priori statistical analysis plan (Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 40% (see Appendix 8 for description) • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Peripheral plus spectacle lenses	Single-vision spectacle lenses	5 RCTs in MA by Lawrenson et al. (2023) (n = 832)	• Children 6 to 16 years old • peripheral plus spectacle lenses included DIMS lenses and HALs	MD: 0.51 D (0.19 to 0.82) **Favours peripheral plus spectacle lenses**	• Authors of the MA assessed RoB using the RoB2 tool. Three out of 5 studies were reported by the authors as having some concerns, and two studies were judged to be at high RoB (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results), imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) and inconsistency (due to substantial heterogeneity) • I2 in MA = 97% (see Appendix 8 for description) • Experts stated that although peripheral plus spectacle lenses can be loosely grouped together, some designs have better efficacy than others. Additionally, they stated that the lenses used in some of the RCTs (e.g.,

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
					Sankaridurg et al. 2010 in Lawrenson et al. (2023)) are not commercially available in the UK
Novel DOT spectacle lenses (0.365 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 181)	• Age: 8.0 years (SD: ± 1.2) • Baseline SER: −2.00 D (SD: ± 0.93) • Baseline AL: 24.09 mm (SD: ± 0.82)	MD: -0.40 D (−0.53 to −0.27 D) p < 0.0001 **Favours DOT**	• 258 subjects were dispensed study products and comprise the ITT population. Two subjects were dispensed control spectacles but were subsequently found to be ineligible; all efficacy analyses are therefore based on the modified ITT population of 256 subjects
Novel DOT spectacle lenses (0.240 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 168)	• Age: 8.2 years (SD: ± 1.2) • Baseline SER: −1.85 D (SD: ± 0.91) • Baseline AL: 23.94 mm (SD: ± 0.70)	MD: -0.32 D (-0.47 to -0.17 D) p < 0.0001 **Favours DOT**	
Novel CARE spectacle lenses	Single-vision spectacle lenses	1 RCT by Liu et al. (2023) (n = 118)	• Mean age: 10.4 years (SE: 0.6) • Baseline right eye SER: −2.67 (SE: 0.66) D • Mean right eye AL: 24.75 (SE: 0.77) mm	MD: 0.15 D (95% CI: −0.04 to 0.32) **No significant difference between groups**	• Only data from those who completed the study were included in the analysis (n = 96)
Multifocal soft contact lenses	Single-vision soft contact lenses	8 RCTs in MA by Lawrenson et al. (2023) (n = 1,135)	• Children 6 to 18 years old • Multifocal soft contact lenses included a progressive design, concentric ring design or EDOF	MD: 0.26 D (0.17 to 0.35) **Favours multifocal soft contact lenses**	• Using the RoB2 too, authors of the MA gave an overall RoB of 'some concerns', primarily due failure to describe the method of allocation concealment and no information on the predetermined analysis plan (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results), imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) and inconsistency (due to substantial heterogeneity) • I2 in MA = 67% (see Appendix 8 for description) • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
					have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 420)	• Children 6 to 12 years old	MD: 0.02 D (−0.05 to 0.10) **No significant difference between groups**	• Using the RoB2 tool, authors of the MA gave the included studies an overall high RoB (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results), imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) and inconsistency (due to substantial heterogeneity) • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

BF: bifocal; CARE: cylindrical annular refractive element; CI: confidence interval; D: dioptres; DIMS: defocus incorporated multiple segments; DOT: diffusion optics technology; EDOF: extended depth of focus; HAL: highly aspherical lenslet; ITT: intention-to-treat; MA: meta-analysis; MD: mean difference;; mm: millimetres; n = number of study participants; NR: not reported; OIS: optimal information size; PALS: progressive-addition lenses; RCT: randomised controlled trial; RoB: risk of bias; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SE: standard error; SER: spherical equivalent refraction; SL: spectacle lenses

Table 6. Myopia-control spectacle lenses and contact lenses compared to standard of care: Difference in change in spherical equivalent refraction at two years

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	8 RCTs in MA by Lawrenson et al. (2023) (n = 1,401)	• Children 8 to 15 years old • Multifocal spectacle lenses included BF or PALs with near additions between +1.00 and +2.00 D	MD: 0.19 D (0.08 to 0.30) **Favours multifocal spectacle lenses**	• Using the RoB2 tool, authors of the MA gave the included studies an overall RoB of 'some concerns', usually due to insufficient information concerning allocation concealment and lack of an a priori statistical analysis plan (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results), imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 56% (see Appendix 8 for description) • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Peripheral plus spectacle lenses	Single-vision spectacle lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 329)	• Children 6 to 16 years old • Peripheral plus spectacle lenses included DIMS lenses and HALs	MD: 0.34 D (−0.08 to 0.76) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. One study was reported by the authors as having some concerns, and one study was judged to be at high risk of bias (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 91% (see Appendix 8 for description) • Experts stated that although peripheral plus spectacle lenses can be loosely grouped together, some designs have better efficacy than others. Additionally, they stated that the lenses used in some of the RCTs (e.g., Sankaridurg et al. 2010 in Lawrenson et al. (2023)) are not commercially available in the UK
Multifocal soft contact lenses	Single-vision soft contact lenses	5 RCTs in MA by Lawrenson et al. (2023) (n = 843)	• Children 6 to 18 years old • Multifocal soft contact lenses included a progressive design,	MD: 0.30 D (0.19 to 0.41) **Favours multifocal soft contact lenses**	• Using the RoB2 tool, authors of the MA gave the included studies an overall RoB of 'some concerns', primarily due failure to describe the method of allocation concealment and no information on the predetermined analysis plan (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants])

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
			• concentric ring design or EDOF		• I2 in MA = 50% (see Appendix 8 for description) • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision soft contact lenses	2 RCTs in SR by Lawrenson et al. (2023) (n = 398)	• Children 6 to 12 years old	MD: 0.54 D (0.27 to 0.81) **Favours rigid gas-permeable contact lenses**	• Data could not be pooled due to heterogeneity • Authors assessed risk of bias using the RoB2 tool. They gave an overall high RoB (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
	Single-vision spectacle lenses			MD: −0.05 (−0.25 to 0.15) **No significant difference between groups**	

BF: bifocal; CI: confidence interval; D: dioptres; DIMS: defocus incorporated multiple segments; EDOF: extended depth of focus; HAL: highly aspherical lenslet; MA: meta-analysis; MD: mean difference; n = number of study participants; NR: not reported; OIS: optimal information size; PALS: progressive-addition lenses;; RCT: randomised controlled trial; RoB: risk of bias; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SER: spherical equivalent refraction; SR: systematic review

Table 7. Myopia-control spectacle lenses and contact lenses compared to standard of care: Difference in change in spherical equivalent refraction at three years

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	4 RCTs in MA by Lawrenson et al. (2023) (n = 835)	• Children 8 to 15 years old • Multifocal spectacle lenses included BF or PALs with near additions between +1.00 and +2.00 D	MD: 0.26 D (−0.07 to 0.59) **No significant difference between groups**	• Using the RoB2 tool, authors of the MA gave an overall RoB of 'some concerns' for 3 RCTs and high risk for 1 RCT (see Appendix 8 for description) • I2 in MA = 86% (see Appendix 8 for description) • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Multifocal soft contact lenses	Single-vision soft contact lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 395)	• Children 7 to 13 years old • Multifocal soft contact lenses included BF soft contact lenses and a concentric ring design	MD: 0.47 D (0.13 to 0.82) **Favours multifocal soft contact lenses**	• Using the RoB2 tool, authors of the MA gave an overall RoB of 'some concerns' • I2 in MA = 86% (see Appendix 8 for description) • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision soft contact lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 116)	• Children 8 to 12 years old	MD: 0.63 D (0.30 to 0.96) **Favours rigid gas-permeable contact lenses**	• Authors assessed risk of bias using the RoB2 tool. They gave an overall risk of bias of some concerns (see Appendix 8 for description) • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

BF: bifocal; CI: confidence interval; D: dioptres; MA: meta-analysis; MD: mean difference; n = number of study participants; PALS: progressive-addition lenses; RCT: randomised controlled trial; RoB: risk of bias; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials

Table 8. Myopia-control spectacle lenses and contact lenses compared to standard of care: Difference in change in axial length at one year

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	4 RCTs in MA by Lawrenson et al. (2023) (n = 896)	• Children 8 to 15 years old • Multifocal spectacle lenses included BFs or PALs with near additions between +1.00 and +2.00 D	MD: -0.06 mm (-0.09 to -0.04) **Favours multifocal spectacle lenses**	• Using the RoB2 tool, authors of the MA gave an overall risk of bias of 'some concerns', usually due to insufficient information concerning allocation concealment and lack of an a priori statistical analysis plan. 1 RCT was assessed as having a high RoB (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 0% (see Appendix 8 for description) • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Peripheral plus spectacle lenses	Single-vision spectacle lenses	3 RCTs in MA by Lawrenson et al. (2023) (n = 522)	• Children 6 to 16 years old • Peripheral plus spectacle lenses included DIMS lenses and HALs	MD: -0.13 mm (-0.24 to -0.03) **Favours peripheral plus spectacle lenses**	• Authors assessed RoB using the RoB2 tool. They gave an overall risk of bias of 'some concerns' (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results), imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) and inconsistency (due to substantial heterogeneity) • I2 in MA = 90% (see Appendix 8 for description) • Experts stated that although peripheral plus spectacle lenses can be loosely grouped together, some designs have better efficacy than others. Additionally, experts state that the lenses used in some of the RCTs (e.g., Sankaridurg et al. 2010 in Lawrenson et al. (2023)) are not commercially available in the UK

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Novel DOT spectacle lenses (0.365 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 181)	• Age: 8.0 years (SD: ± 1.2) • Baseline SER: −2.00 D (SD: ± 0.93) • Baseline AL: 24.09 mm (SD: ± 0.82)	MD: 0.15 mm (0.10 to 0.20 mm) p < 0.0001 **Favours DOT**	• 258 subjects were dispensed study products and comprise the ITT population. Two subjects were dispensed control spectacles but were subsequently found to be ineligible (both were hyperopic via cycloplegic autorefraction); all efficacy analyses are therefore based on the modified ITT population of 256 subjects
Novel DOT spectacle lenses (0.240 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 168)	• Age: 8.2 years (SD: ± 1.2) • Baseline SER: −1.85 D (SD: ± 0.91) • Baseline AL: 23.94 mm (SD: ± 0.70)	MD: 0.10 mm (0.04 to 0.17 mm) p = 0.0018 **Favours DOT**	
Novel CARE spectacle lenses	Single-vision spectacle lenses	1 RCT by Liu et al. (2023) (n = 118)	• Mean age: 10.4 years (SE: 0.6) • Baseline right eye SER: −2.67 (SE: 0.66) D • Mean right eye AL: 24.75 (SE: 0.77) mm	MD: −0.10 mm (95% CI: −0.15 to −0.02) **Favours CARE**	• Only data from those who completed the study were included in the analysis (n = 96)
Multifocal soft contact lenses	Single-vision soft contact lenses	8 RCTs in MA by Lawrenson et al. (2023) (n = 1,143)	• Children 6 to 18 years • Multifocal soft contact lenses included a progressive design, concentric ring design or EDOF	MD: −0.11 mm (−0.13 to −0.09) **Favours multifocal soft contact lenses**	• Authors assessed RoB using the RoB2 tool. They gave an overall risk of bias of 'some concerns', primarily due failure to describe the method of allocation concealment and no information on the predetermined analysis plan (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 3% (see Appendix 8 for description) • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Orthokeratology	Single-vision spectacle lenses (6 RCTs) or single-vision soft contact lenses (1 RCT)	7 RCTs in MA by Lawrenson et al. (2023) (n = 759)	• Children 6 to 15 years • Children in 6 RCTs had low to moderate degrees of myopia (up to −6.00 D). Children in 1 RCT had myopia ≥ 5.00 D • 1 RCT included children with anisomyopia with a difference between the eyes of ≥ 1.00 D	MD: −0.19 mm (−0.23 to −0.15) **Favours orthokeratology**	• Authors assessed RoB using the RoB2 tool and gave an overall risk of bias of 'some concerns' (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) • I2 in MA = 0% (see Appendix 8 for description) • Experts stated that although orthokeratology lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 415)	• Children 6 to 12 years old	MD: 0.02 mm (−0.05 to 0.10) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. They gave an overall risk of bias of high risk (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 0% (see Appendix 8 for description) • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

BF: bifocal; CARE: cylindrical annular refractive element; CI: confidence interval; D: dioptres; DIMS: defocus incorporated multiple segments; DOT: diffusion optics technology; EDOF: extended depth of focus; HAL: highly aspherical lenslet; MA: meta-analysis; MD: mean difference; mm: millimetres; n = number of study participants; NR: not reported; OIS: optimal information size; PALS: progressive-addition lenses; RCT: randomised controlled trial; RoB: risk of bias; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SE: standard error; SER: spherical equivalent refraction; SL: spectacle lens

Table 9. Myopia-control spectacle lenses and contact lenses compared to standard of care: Difference in change in axial length at two years

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	3 RCTs in MA by Lawrenson et al. (2023) (n = 699)	• Children 8 to 15 years old • Multifocal spectacle lenses included BFs or PALs with near additions between +1.00 and +2.00 D	MD: −0.07 mm (−0.12 to −0.03) **Favours multifocal spectacle lenses**	• Authors assessed RoB using the RoB2 tool. Two RCTs were given an overall RoB of 'some concerns.' One RCT was assessed as having a high RoB (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 77% (see Appendix 8 for description) • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Peripheral plus spectacle lenses	Single-vision spectacle lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 329)	• Children 6 to 16 years old • peripheral plus spectacle lenses included DIMS lenses and HALs	MD: −0.20 mm (−0.45 to 0.05) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. One RCT was given an overall risk of bias of 'some concerns' and the other was given an overall high risk of (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results), imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) and inconsistency (due to substantial heterogeneity) • I2 in MA = 91% (see Appendix 8 for description) • Experts stated that although peripheral plus spectacle lenses can be loosely grouped together, some designs have better efficacy than others. Additionally, experts state that the lenses used in some of the RCTs (e.g., Sankaridurg et al. 2010 in Lawrenson et al. (2023)) are not commercially available in the UK
Multifocal soft contact lenses	Single-vision soft contact lenses	5 RCTs in MA by Lawrenson et al. (2023) (n = 843)	• Children 6 to 18 years old • multifocal soft contact lenses included a progressive	MD: −0.15 mm (−0.19 to −0.12) **Favours multifocal soft contact lenses**	• Authors assessed RoB using the RoB2 tool. They gave an overall RoB of 'some concerns', primarily due failure to describe the method of allocation concealment and no information on the predetermined analysis plan (see Appendix 8 for description)

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
			design, concentric ring design or EDOF		• The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) • I2 in MA = 0% (see Appendix 8 for description) • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Orthokeratology	Single-vision spectacle lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 106)	• Children 6 to 12 years • Children in 1 RCT had low to moderate degrees of myopia (up to –6.00 D. Children in 1 RCT had myopia ≥ 5.00 D	MD: –0.28 mm (–0.38 to –0.19) **Favours orthokeratology**	• Authors assessed RoB using the RoB2 tool. Both RCTs had an overall high risk of bias (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) • Experts stated that although orthokeratology lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 394)	• Children 6 to 12 years	MD: 0.03 mm (–0.05 to 0.12) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. They gave an overall risk of bias of high risk (see Appendix 8 for description) • The authors reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results) and imprecision (due to the CI including small and clinically unimportant effects, or the OIS not being met [usually less than 400 participants]) • I2 in MA = 0% (see Appendix 8 for description) • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

BF: bifocal; CI: confidence interval; D: dioptres; DIMS: defocus incorporated multiple segments; EDOF: extended depth of focus; HAL: highly aspherical lenslet; mm: millimetres; MA: meta-analysis; MD: mean difference; mm: millimetres; n = number of study participants; NR: not reported; OIS: optimal information size; PALS: progressive-addition lenses; RCT: randomised controlled trial; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SER: spherical equivalent refraction; SR: systematic review

Table 10. Myopia-control spectacle lenses and contact lenses compared to standard of care: Difference in change in axial length at three years

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 558)	• Children 6 to 13 years old • Multifocal spectacle lenses included BFs or PALs with near additions between +1.00 and +2.00 D	MD: −0.12 mm (−0.18 to −0.07) **Favours multifocal spectacle lenses**	• Authors assessed RoB using the RoB2 tool. One RCT was given an overall risk of bias of 'some concerns' and 1 RCT was assessed as having a high risk of bias (see Appendix 8for description) • I2 in MA = 58% (see Appendix 8 for description) • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Multifocal soft contact lenses	Single-vision soft contact lenses	2 RCTs in MA by Lawrenson et al. (2023) (n = 394)	• Children 7 to 13 years old • Multifocal soft contact lenses included BF soft contact lenses and a concentric ring design	MD: −0.22 mm (−0.34 to −0.10) **Favours multifocal soft contact lenses**	• Authors assessed RoB using the RoB2 tool. One RCT was given an overall risk of bias of 'some concerns' and 1 RCT was given an overall low risk of bias (see Appendix 8 for description) • I2 in MA = 74% (see Appendix 8 for description) • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision soft contact lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 116)	• Children 8 to 12 years old	MD: 0.05 mm (−0.12 to 0.22) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. They gave an overall risk of bias of 'some concerns' (see Appendix 8 for description) • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

BF: bifocal; CI: confidence interval; D: dioptres; MA: meta-analysis; MD: mean difference; mm: millimetres; n = number of study participants; PALS: progressive-addition lenses; RCT: randomised controlled trial; RoB: risk of bias; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SR: systematic review

Table 11. Myopia-control spectacle lenses and contact lenses compared to standard of care: Change in spherical equivalent refraction following cessation of treatment (rebound)

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 83)	• Children 6 to 11 years old • Multifocal spectacle lenses were worn for 1 year and single-vision spectacle lenses were worn for another year in the intervention group. single-vision spectacle lenses were worn for 2 years in the control group • Multifocal spectacle lenses included PALs with near additions +2.00 D	MD: 0.00 D (−0.17 to 0.17) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. They gave an overall risk of bias of 'some concerns' (see Appendix 8 for description) • Small population size in RCT • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Multifocal soft contact lenses	Single-vision soft contact lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 42)	• Children 8 to 12 years old • Multifocal soft contact lenses included those with a concentric ring design • Multifocal spectacle lenses were worn for 2 years, and single-vision spectacle lenses were worn for another year in the intervention group. single-vision spectacle lenses were worn for 3 years in the control group	MD: 0.09 D (−0.16 to 0.34) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. They gave an overall RoB of 'some concerns' (see Appendix 8 for description) • Small population size in RCT • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

CI: confidence interval; D: dioptres; MD: mean difference; n = number of study participants; PALS: progressive-addition lenses; RCT: randomised controlled trial; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SER: spherical equivalent refraction; SR: systematic review

Table 12. Myopia-control contact lenses compared to standard of care: Change in axial length following cessation of treatment (rebound)

Intervention	Comparator	Evidence source	Population	Absolute effect	Comments on reliability
Multifocal soft contact lenses	Single-vision soft contact lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 42)	• Children 8 to 12 years old • Multifocal soft contact lenses included those with a concentric ring design	MD: 0.01 mm (95% CI: −0.05 to 0.07) **No significant difference between groups**	• Authors assessed RoB using the RoB2 tool. They gave an overall RoB of 'some concerns' (see Appendix 8 for description) • Small population size in RCT • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

CI: confidence interval; MD: mean difference; mm: millimetres; n = number of study participants; RCT: randomised controlled trial; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SR: systematic review

Table 13. Myopia-control spectacle lenses and contact lenses compared to standard of care: Adverse events

Intervention	Comparator	Evidence source	Population	Absolute values	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	3 RCTs in SR by Lawrenson et al. (2023) (n = 530)	• Follow-up: 1 to 3 years • Children 6 to 12 years old • Multifocal spectacle lenses included BFs or PALs with near additions between +1.00 and +2.00 D	• Total AEs in multifocal spectacle lenses group: 53 (n = 53): - Dizziness: 13 - Blurred vision: 29 - Distortion: 1 - Headache: 1 - Difficulty with stairs: 8 - Other: 1 • Total AEs in control group: 41 (n = 41): - Dizziness: 15 - Blurred vision: 18 - Distortion: 2 - Difficulty with stairs: 4 - Other: 2	• Authors of the SR commented that AEs in the included studies were generally poorly described with a lack of standardisation of reporting. Symptoms were usually self-reported by parents and/or children • Authors of the SR noted that the duration of follow-up and the size of the population in the RCTs may have been insufficient to capture long-term or rare events • 'Other' AEs were not described or defined • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Peripheral plus spectacle lenses	Single-vision spectacle lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 170)	• Follow-up: 2-years • Children 8 to 13 years old • Peripheral plus spectacle lenses included HALs and SALs	Total AEs in peripheral plus spectacle lenses group: 0	• Authors of the SR commented that AEs in the included studies were generally poorly described with a lack of standardisation of reporting. Symptoms were usually self-reported by parents and/or children • Authors of the SR noted that the duration of follow-up and the size of the population in the RCTs may have been insufficient to capture long-term or rare events • Experts stated that although peripheral plus spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

Intervention	Comparator	Evidence source	Population	Absolute values		Comments on reliability
Novel DOT spectacle lenses (0.365 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 181)	• Age: 8.0 years (SD: ± 1.2) • Baseline SER: −2.00 D (SD: ± 0.93) • Baseline AL: 24.09 mm (SD: ± 0.82)	<u>0.365 mm spacing DOT lens:</u> • Ocular AEs: - Blepharitis; 6/88 (6.8%) - Hordeolum: 1/88 (1.1%) - Lattice: 1/88 (1.1%) - Skin irritation: 1/88 (1.1%) • Non-ocular, non-device-related AEs: 13/88 (14.8%) • Device deficiencies: - Total 12/88 (13.6%) - Issue with lens: 4/88 (4.5%) - Misaligned optical centre: 2/88 (2.3%) - Scratched lenses: 2/88 (2.3%) - Issue with frame: 8/88 (9.1%)	<u>Single-vision spectacle lenses:</u> • Ocular AEs: - Blepharitis: 2/93 (2.1%) - Headache: 3/93 (3.2%) - Hordeolum: 1/93 (1.1%) - Reduction in visual acuity: 1/93 (1.1%) • Non-ocular, non-device-related AEs: 14/93 (15.1%) • Device deficiencies: - Total: 12/93 (12.9%) - Issue with lens: 1/93 (1.1%) - Wrong prescription: 1/93 (1.1%) - Issue with frame: 11/93 (11.8%)	• 258 subjects were dispensed study products and comprise the ITT population. Two subjects were dispensed control spectacles but were subsequently found to be ineligible; all efficacy analyses are therefore based on the modified ITT population of 256 subjects
Novel DOT spectacle lenses (0.240 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 168)	• Age: 8.2 years (SD: ± 1.2) • Baseline SER: −1.85 D (SD: ± 0.91) • Baseline AL: 23.94 mm (SD: ± 0.70)	<u>0.240 mm spacing DOT lens:</u> • Ocular AEs: - Conjunctivitis: 2/75 (2.7%) - Operculated retinal hole: 1/75 (1.3%) - Trauma to eye: 1/75 (1.3%)		

Intervention	Comparator	Evidence source	Population	Absolute values		Comments on reliability
				• Non-ocular, non-device-related AEs: 13/75 (17.3%) • Device deficiencies: - Total: 31/75 (41.3%) - Issue with lens: 11/75 (14.7%) - Misaligned optical centre: 6/75 (8%) - Scratched lenses 2/75 (2.7%) - Issue with lens edge: 2/75 (2.7%) - Issue with frame: 19/75 (25.3%) - Broken frame and scratched lens: 1/75 (1.3%)		
Novel CARE spectacle lenses	Single-vision spectacle lenses	1 RCT by Liu et al. (2023) (n = 118)	• Mean age: 10.4 years (SE: 0.6) • Baseline right eye SER: −2.67 (SE: 0.66) D • Mean right eye AL: 24.75 (SE: 0.77) mm	No AEs reported in either group		• AEs were reported based on phone interviews 1 week after dispensing and every 6 months through self-administered questionnaires. • Only data from those who completed the study were included in the analysis (n = 96)

Intervention	Comparator	Evidence source	Population	Absolute values	Comments on reliability
Multifocal soft contact lenses	Single-vision soft contact lenses (4 RCTs) and single-vision spectacle lenses (1 RCT)	5 RCTs in SR Lawrenson et al. (2023) (n = 697) in	• Follow-up time: 1- to 3-years • Children 7 to 15 years • Multifocal soft contact lenses included a progressive design, concentric ring design, EDOF and PSASCL	• Total AEs in BLINK 2020 study (data combined for all groups): 35 (n = 35): - Corneal infiltrates: 10 - Allergy/hypersensitivity reactions: 7 - Corneal erosions/staining: 4 - Papillary reaction: 9 - Other: 5 • Total AEs in multifocal soft contact lenses group: 31: - Grade ≥ 3 slit-lamp findings (most severe and usually requires clinical action): 1 - Corneal infiltrates: 4 - Allergy/hypersensitivity reactions: 2 - Corneal erosions/staining: 7 - Corneal neovascularisation: 5 - Papillary reaction: 9 - Other: 3 • Total AEs in single-vision soft contact lenses group: 14 (n = 11): - Corneal infiltrates: 3 - Allergy/hypersensitivity reactions: 2 - Corneal erosions/staining: 1 - Corneal revascularisation: 2 - Papillary reaction: 2 - Other: 4 • Total AEs in single-vision spectacle lenses group: 3: - Corneal erosions/staining: 1 - Papillary reaction: 2	• Data from the largest study (BLINK 2020) (n = 294) were combined for the intervention and control lenses • 'Other' AEs were not described • Authors of the SR commented that AEs in the included studies were generally poorly described with a lack of standardisation of reporting. Symptoms were usually self-reported by parents and/or children • Authors of the SR noted that the duration of follow-up and the size of the population in the RCTs may have been insufficient to capture long-term or rare events • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Orthokeratology	Single-vision spectacle lenses	2 RCTs in SR by Lawrenson et al. (2023) (n = 149)	• Follow-up time: 13 to 18 months • Children 6 to 12 years old	• Total AEs in orthokeratology group: 18 (n =18) (2 of the corneal staining AEs are Grade ≥ 3 and so are reported twice below): - Grade ≥ 3 slit-lamp findings (Grades 3 and 4 are most severe and usually require clinical action): 4	• Authors of the SR commented that AEs in the included studies were generally poorly described with a lack of standardisation of reporting. Symptoms were usually self-reported by parents and/or children

Intervention	Comparator	Evidence source	Population	Absolute values	Comments on reliability
				- Corneal erosions/staining: 16 • Total AEs in single-vision spectacle lenses group: 3 (n = 3): - Corneal erosions/staining: 3	• Authors of the SR noted that the duration of follow-up and the size of the population in the RCTs may have been insufficient to capture long-term or rare events • Experts stated that although orthokeratology lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision soft contact lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 116)	• Follow-up time: 3-years • Children 8 to 12 years old	• Total AEs in rigid gas-permeable contact lenses group: 0 • Total AEs in single-vision soft contact lenses group: 4 (n = 4): - Allergy/hypersensitivity reactions: 1 - Other: 3	• 'Other' AEs were not described • Authors of the SR commented that AEs in the included studies were generally poorly described with a lack of standardisation of reporting. Symptoms were usually self-reported by parents and/or children • Authors of the SR noted that the duration of follow-up and the size of the population in the RCTs may have been insufficient to capture long-term or rare events • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

AE: adverse event; BF: bifocal; CI: confidence interval; D: dioptres; DIMS: defocus incorporated multiple segments; EDOF: extended depth of focus; HAL: highly aspherical lenslet; ITT: intention-to-treat; MA: meta-analysis; MD: mean difference; n = number of study participants; NR: not reported; OIS: optimal information size; PALS: progressive-addition lenses; PSASCL: positive spherical aberration soft contact lenses; RCT: randomised controlled trial; RoB2: version 2 of the Cochrane risk-of-bias tool for randomised trials; SER: spherical equivalent refraction; SR: systematic review; VA: visual acuity

Table 14. Myopia-control contact lenses compared to standard of care: Quality of life

Intervention	Comparator	Evidence source	Population	Absolute values	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses	1 RCT in SR by Kandel (2022) (n = 74)	• Children 8 to 12 years old • Defocus soft contact lenses • PREP, refractive error specific, used to measure PRO • Follow-up time: 2 years	• PREP categories: - Appearance, Satisfaction, Activities, Handling, Peer perceptions, and Total score **Favours multifocal soft contact lenses** - Near vision **Favours single-vision spectacle lenses** - Overall vision, Far vision, and Academics scores **No significant difference between groups**	• Data not reported quantitatively in the SR • Only the successful contact lens wearers were included in the SR • Authors of the SR commented that a MA was not possible due to heterogeneity, particularly differences in the PRO measures as these tools capture different issues of contact lens wear • Not all patient baseline characteristics reported in SR • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Rigid gas-permeable contact lenses	Single-vision soft contact lenses	1 RCT in SR by Kandel (2022) (n = 116)	• Children 8 to 11 years old • NEI-VFQ used to measure PRO • Follow-up time: 3 years	NEI-VFQ pain or comfort subscale score **Favours single-vision soft contact lenses**	• Data not reported quantitatively in the SR • Only the successful contact lens wearers were included in the SR • Authors of the SR commented that a MA was not possible due to heterogeneity, particularly differences in the PRO measures as these tools capture different issues of contact lens wear • Not all patient baseline characteristics reported in SR • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

AE: adverse event; MA: meta-analysis; NEI-VFQ: National Eye Institute Visual Function Questionnaire; PREP: Paediatric Refractive Error Profile; PRO: patient-reported outcome; QoL: quality of life; SR: systematic review

Table 15. Myopia-control spectacle lenses and contact lenses compared to standard of care: Treatment adherence and discontinuation

Intervention	Comparator	Evidence source	Population	Absolute values	Relative effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	7 RCTs in SR by Lawrenson et al. (2023) (n = 1,264)	• Follow-up: 2- to 3-years • Children 6 to 13 years old • Multifocal spectacle lenses included BFs or PALs with near additions between +1.00 and +2.00 D	• Multifocal spectacle lenses % compliant range (always or most of the time): 72% to 96% • Single-vision spectacle lenses % compliant range (always or most of the time): 82% to 96%		• 1 of the RCTs assessed compliance during school hours (COMET2 2011 in Lawrenson et al. (2023)) • Only 1 of the RCTs reported a p-value (and found the difference in compliance between the 2 groups was not significant) (Hasebe et al. 2008 in Lawrenson et al. (2023)) • The COMET 2003 and Pärssinen 1989 studies, in Lawrenson et al. (2023), reported a lower proportion of participants wearing multifocal spectacle lenses than the single-vision spectacle lenses controls • Experts stated that although multifocal spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
		1 RCT by Zhu et al. (2022) (n = 93)	• Follow-up time: 2 years • Multifocal spectacle lenses were customised PALs • Myopia children with near esophoria • Age: 11.02 years (SD ± 0.24) • Baseline SER: -1.91 D (SD: ± 0.13)	• Multifocal soft contact lenses group: 2/46 (15.4%) children discontinued: - 1/46 moved to a different area - 1/46 preferred to wear CLs • Single-vision spectacle lenses group: 7/47 (8%) discontinued: - 1/47 incompatible with cycloplegic eye drops - 3/47 moved to a different area - 3/47 preferred to wear CLs		• Not all reasons for study discontinuation reported

Intervention	Comparator	Evidence source	Population	Absolute values	Relative effect (95% CI)	Comments on reliability
Peripheral plus spectacle lenses	Single-vision spectacle lenses	2 RCTs in SR by Lawrenson et al. (2023) (n = 317	• Follow-up: 2-years • Children 8 to 13 years old • Peripheral plus spectacle lenses included HALs (n = 54), SALs (n = 53) and DIMS (n = 79)	• Peripheral plus spectacle lenses (DIMS) mean (SD) wearing time: 15.5 (2.6) hours per day • Peripheral plus spectacle lenses (HAL) mean (SD) wearing time: 13.4 (2.1) hours per day • Peripheral plus spectacle lenses (SAL) mean (SD) wearing time: 13.4 (1.8) hours per day • Single-vision spectacle lenses range of mean (SD) wearing time: 13.1 (1.7) to 15.3 (2.1) hours per day **No significant difference between groups**		• The p-value was only reported for 1 of the RCTs (p = 0.35) in Lawrenson et al. (2023) (Bao et al. 2022). The results in the other RCT in Lawrenson et al. (2023) were described as 'not significantly different.' • Experts stated that although peripheral plus spectacle lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Novel DOT spectacle lenses (0.365 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 181)	• Age: 8.0 years (SD: ± 1.2) • Baseline SER: −2.00 D (SD: ± 0.93)	• DOT group: 5/88 (6%) children discontinued - 1/5 discontinued at the discretion of the Investigator or Subject - 1/5 removed as parents stated study glasses were impeding schoolwork and ability to see normally - 1/5 withdrew consent due to wanting transition lenses - 2/5 were lost to follow-up before 1-year visit • Single-vision spectacle lenses group: 2/95 (2%) children discontinued - 2/2 were found to be ineligible after being dispensed control spectacles • Parent questionnaires indicated high compliance for both groups (100% habitual users at 1 year) and mean wear times ≥12 hours for both groups		• 258 subjects were dispensed study products and comprise the ITT population. Two subjects were dispensed control spectacles but were subsequently found to be ineligible; all efficacy analyses are therefore based on the modified ITT population of 256 subjects

Intervention	Comparator	Evidence source	Population	Absolute values	Relative effect (95% CI)	Comments on reliability
Novel DOT spectacle lenses (0.240 mm spacing)	Single-vision spectacle lenses	1 RCT by Rappon et al. (2022) (n = 168)	• Age: 8.2 years (SD: ± 1.2) • Baseline SER: −1.85 D (SD: ± 0.91)	• DOT group: 17/75 (23%) children discontinued - 4/17 discontinued at the discretion of the Investigator or Subject - 7/17 withdrew due to issues with the appearance of the lenses or adaptation to the lenses - 2/17 were removed due to non-compliance to protocol - 2/17 were lost to follow-up before 1-year visit - 1/17 withdrew due to bullying at school - 1/17 subject withdrew assent • Single-vision spectacle lenses group: 2/95 (2%) children discontinued - 2/2 were found to be ineligible after being dispensed control spectacles • Parent questionnaires indicated high compliance for both groups (100% habitual users at 1 year) and mean wear times ≥12 hours for both groups		
Novel CARE spectacle lenses	Single-vision spectacle lenses	1 RCT by Liu et al. (2023) (n = 118)	• Mean age: 10.4 years (SE: 0.6) • Follow-up time: 1 year • Baseline right eye SER: −2.67 (SE: 0.66) D • Mean right eye AL: 24.75 (SE: 0.77) mm	• Daily wear-time in CARE group (n = 52): - More than 12 hours: n = 22 (42.3%) - 8 to 12 hours: n = 22 (42.3) - 4 to 8 hours: n = 7 (13.5%) - Less than 4 hours: n = 1 (1.9%) • Daily wear-time in single-vision spectacle lenses group (n = 44): - More than 12 hours: 24 (54.5%) - 8 to 12 hours: 12 (27.3%) - 4 to 8 hours: 6 (13.6%) - Less than 4 hours: 2 (4.5%) p = 0.43		• Only data from those who completed the study were included in the analysis (n = 96) • Questionnaires used to assess adherence • Reasons for discontinuation in control group not clearly reported

Intervention	Comparator	Evidence source	Population	Absolute values	Relative effect (95% CI)	Comments on reliability
				No significant difference between groups • Reasons for not completing 1-year follow-up in CARE group (n = 9): - 4 withdrew - 1 refusal to dilate - 1 changed to orthokeratology - 2 subjective willingness - 1 NR • Reasons for not completing 1-year follow-up in single-vision spectacle lens group (n = 13): - 8 withdrew - 4 switched to other myopia-control methods - 4 subjective willingness		
Multifocal soft contact lenses	Single-vision soft contact lenses	5 RCTs in SR by Lawrenson et al. (2023) (n = 723)	• Follow-up time: 1- to 3-years • Children 7 to 15 years • Multifocal soft contact lenses included a progressive design, concentric ring design, EDOF and PSASCL	• All arms combined for 2 RCTs (Anstice 2011 and BLINK 2020): mean wearing time ranged from 13.2 (SD: 2.8) hours per day and 11.0 (SD: 4.4) hours per day • In 3 RCTs reporting data for each group separately, mean wearing time for: - multifocal soft contact lenses group: 6.5 (SD: 2.2) to 13.7 (SD: 1.5) hours per day - single-vision soft contact lenses group: 6.3 (1.7) to 13.3 (1.5) hours per day **No significant differences between groups**		• Data from the largest study (BLINK 2020 in Lawrenson et al. (2023)) (n = 294) were combined for the intervention and control lenses • The SR authors commented that adherence in the included studies were generally poorly described with a lack of standardisation of reporting • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

Intervention	Comparator	Evidence source	Population	Absolute values	Relative effect (95% CI)	Comments on reliability
		1 RCT by Shen et al. (2022) (n = 72)	• EDOF CL in 1 eye and single-vision soft contact lenses in other eye • Follow up: 1 year • Age: 12.36 years (SD: ± 1.46) • Baseline SER: –3.60 D (SD: ± 1.39)	• 5/72 (6.9%) children discontinued (affecting both intervention and control groups): - 2/5 did not want to wear CLs - 1/5 lost to follow-up - 1/5 had idiopathic uveitis - 1/5 used tropicamide • Average lens wear time: 11.2 hours per day		• The contralateral eye comparison design does not reflect the real-world situation, and the possibility of inter-ocular interactions could not be eliminated • Data from both groups were combined
		1 RCT by Weng et al. (2022) (n = 95)	• Multifocal soft contact lenses included EDOF and dual focus (MiSight) • Group I wore single-vision soft contact lenses for 1-year. In Group II and III, EDOF and dual focus CLs, respectively, were worn in one and a SVCL in the other eye. CLs were crossed over at 6 months and worn for a further 6 months • Follow-up: 1 year • Average age was 10 years • Baseline SER ranged from: -1.91 D (SD: ± 0.72) to -2.08 D (SD: ± 0.64	• Total discontinuations: 42/95 (44%) - 11/42 uncomfortable with CL wear or not using CLs regularly - 9/42 no longer interested in CL wear - 9/42 issues with lens handling - 6/42 lost to follow-up - 3/42 safety concerns - 2/42 time issues - 1/42 other symptoms - 1/42 dissatisfied with quality of vision with CL • Group I: 10/30 (33.3%) children discontinued • Group II: 15/31 (48.4%) children discontinued • Group III: 17/34 (50.0%) children discontinued		• There were a significant number of discontinuations in the study (44%) • A breakdown of reasons for discontinuation by Group is not given • The contralateral study design induces an imbalance in binocular vision in the initial phase and anisometropia towards the end of the wearing stage

Intervention	Comparator	Evidence source	Population	Absolute values	Relative effect (95% CI)	Comments on reliability
	Single-vision soft contact lenses and single-vision spectacle lenses	7 RCTs in MA by Yu et al. (2022) (n = 1,272)	• Follow-up time: 10-months to 3-years • Children aged 7 to 16 years • Multifocal spectacle lenses included BFs or PALs with near additions between +0.50 and +2.50 D • Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group	• Multifocal soft contact lenses dropout rate range: 0 to 55% • Multifocal soft contact lenses group: 167/642 (26%) people dropped out • Single-vision soft contact lenses and single-vision spectacle lenses dropout rate: 0 to 49% • Single-vision soft contact lenses and single-vision spectacle lenses group: 159/630 (25%) people dropped out	OR: 1.08 (0.81 to 1.45) p = 0.59 **No significant difference between groups**	• Authors of the MA stated that the RoB of the included studies was low overall • I2 = 0% • Data for reasons for study drop out were NR • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing
Orthokeratology	Single-vision spectacle lenses	1 RCT by Fang et al. (2022) (n = 55)	• Follow-up: 1 year • Age: 7 to 15 years • % female: 41 • Range of baseline SER: −1.00 D to −8.00 D • Mean baseline SER: −2.659 D (SD: ± 0.208)	• Orthokeratology group: 9/29 (31%) children discontinued: - 2/9 chose other treatments before 6-month visit - 3/9 chose other treatments before 12-month visit - 2/9 were lost to follow-up before 6-month visit - 2/9 were lost to follow-up before 12-month visit • Single-vision spectacle lenses group: 2/26 (8%) discontinued: - 1/26 lost to follow-up before 6-month visit - 1/26 lost to follow-up before 12-month visit		• The reasons for study discontinuation were not clearly reported • This was a single-masked RCT, where only the investigators analysing the outcomes were masked • Experts stated that although orthokeratology lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

Intervention	Comparator	Evidence source	Population	Absolute values	Relative effect (95% CI)	Comments on reliability
Rigid gas-permeable contact lenses	Single-vision spectacle lenses	1 RCT in SR by Lawrenson et al. (2023) (n = 150)	• Follow-up time: 2-years • Children 6 to 12 years old	• Rigid gas-permeable contact lenses % compliant (always or most of the time): 31.5% • Single-vision spectacle lenses % compliant (always or most of the time): 98.4%		• Reasons for lack of compliance NR • Experts stated that although rigid gas-permeable contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK

BF: bifocal; CARE: cylindrical annular refractive element; CL: contact lens; D: dioptres; DIMS: defocus incorporated multiple segments; DOT: diffusion optics technology; EDOF CL: extended depth of focus contact lens; HAL: highly aspherical lenslet; ITT: intention-to-treat; MA: meta-analysis; NMA: network meta-analysis; NR: not reported: OR: odds ratio; PALS: progressive-addition lenses; peripheral plus spectacle lenses; RCT: randomised controlled trial; RoB: risk of bias: SAL: slightly aspherical lenslet; SD: standard deviation; SE: standard error; SER: spherical equivalent refraction; SL: spectacle lenses; SR: systematic review

Table 16. Myopia-control spectacle lenses and contact lenses compared to standard of care: Visual acuity

Intervention	Comparator	Evidence source	Population	Absolute values	Comments on reliability
Multifocal soft contact lenses	Single-vision soft contact lenses	1 RCT by Weng et al. (2022) (n = 95)	• High-contrast VA assessed • Follow up: 1 year • Multifocal soft contact lenses included EDOF and dual focus (MiSight) • Group I wore single-vision soft contact lenses for 1-year. In Group II and III, EDOF and dual focus CLs, respectively, were worn in one and a SVCL in the other eye. CLs were crossed over at 6 months and worn for a further 6 months • Average age; 10 years • Baseline SER ranged from: -1.91 D (SD: ± 0.72) to -2.08 D (SD: ± 0.64	High-contrast VA: • EDOF mean logMar: 0.21 (SD: 0.24) • single-vision soft contact lenses mean logMAR: 0.14 (0.27) P = 0.11 **No significant difference between groups** • Dual focus multifocal soft contact lenses mean logMAR: 0.26 (SD: 0.33) • Single-vision soft contact lenses mean logMAR: 0.26 (SD: 0.35) p > 0.99 **No significant difference between groups** Vision clarity (1 to 10 [10 is most clarity]): • EDOF mean: 9.3 (SD:0.8) • single-vision soft contact lenses mean: 9.5 (SD:0.6) p > 0.99 **No significant difference between groups** • Dual focus multifocal soft contact lenses mean: 9.5 (SD: 0.8) • single-vision soft contact lenses mean: 9.8 (SD: 0.4) p = 0.68 **No significant difference between groups**	• There are limitations to subjective performance assessments and high-contrast VA measurements • There were a significant number of discontinuations in the study (44%) • The contralateral study design induces an imbalance in binocular vision in the initial phase and anisometropia towards the end of the wearing stage • Experts stated that although multifocal soft contact lenses can be loosely grouped together, some designs have better efficacy than others and some of the lens designs may not be commercially available in the UK
Novel CARE spectacle lenses	Single-vision spectacle lenses	1 RCT by Liu et al. (2023) (n = 118)	• Follow-up time: 1 year • High-contrast, distance visual acuity measured • Mean age: 10.4 years (SE: 0.6) • Baseline right eye SER: -2.67 (SE: 0.66) D • Mean right eye AL: 24.75 (SE: 0.77) mm	• Mean logMAR in CARE group: -0.09 (SE: ± 0.02) • Mean logMAR in single-vision spectacle lens group: -0.09 (SE: ± 0.03) p = 0.84 **No significant difference between groups**	• Only data from those who completed the study were included in the analysis (n = 96)

Intervention	Comparator	Evidence source	Population	Absolute values	Comments on reliability
AL: axial length; BF: bifocal; CL: contact lens; D: dioptres; DIMS: defocus incorporated multiple segments; DOT: diffusion optics technology; EDOF CL: extended depth of focus contact lens; HAL: highly aspherical lenslet; ITT: intention to treat; logMAR: log of Minimum Angle of Resolution; MA: meta-analysis; MFVA: multifunctional visual acuity test; NMA: network meta-analysis; OR: odds ratio; PALS: progressive-addition lenses; RCT: randomised controlled trial; RoB: risk of bias: SAL: slightly aspherical lenslet; SD: standard deviation; SE: standard error; SER: spherical equivalent refraction; SL: spectacle lenses; SR: systematic review; VA: visual acuity					

5.15 Ongoing studies

The review by Lawrenson et al. (2023) is a living systematic review, which involves authors searching the literature every six months and incorporating new evidence as it becomes available.

We identified 12 ongoing RCTs during the search. One of these was for multifocal spectacle lenses, three investigated peripheral plus spectacle lenses, two reported multifocal soft contact lenses, and one investigated orthokeratology. Five studies looked at novel lenses, including two which reported DOT lenses. One-year published data for one of these DOT RCTs are presented in this report (Rappon et al. 2022) and the three-year data are ongoing. Details of the ongoing RCTs and their primary and secondary outcomes are summarised in Appendix 9.

5.16 Certainty of the evidence

- The network in the NMA by Lawrenson et al. (2023) was not well-connected, and so the authors primarily based their comparisons on direct evidence from pairwise meta-analyses. For some outcomes, the NMA consisted of fewer studies than in the corresponding meta-analysis; the reasons for this are unclear.
- Lawrenson et al. (2023) stated that, although SER and AL at one and two years were statistically significant, some of the efficacy estimates were small and clinically insignificant. Experts contacted by HTW generally agreed with the clinically significant thresholds set by the Cochrane review but stated that higher and lower SER thresholds may also be relevant. They noted that the amount of progression considered clinically meaningful may differ by age and highlighted the importance of considering the accumulation of effects over time.
- Lawrenson et al. (2023) reported concerns with the certainty of the evidence arising from RoB (the randomisation process and selection of reporting of the results), imprecision (due to the CI including small and clinically unimportant effects, or the optimal information size not being met) and inconsistency (due to substantial heterogeneity).
- Most of the RCTs in the meta-analysis by Lawrenson et al. (2023) were reported as having a RoB of 'some concerns', often due to inadequate reporting of information by the study authors (for example, no information on allocation concealment and lack of a pre-specified analysis plan), and unexplained heterogeneity or inconsistency in the results. As a result, Lawrenson et al. (2023) state that they may have overestimated the impact of bias on their findings by downgrading the certainty of evidence of the critical and important outcomes due to RoB.
- Most of the studies followed participants up to two years or less. A consensus report produced by the International Myopia Institute, guiding principles of myopia control clinical trial design, recommends three years as the minimum length to assess the efficacy of a treatment for myopia control, since treatment needs to be applied over multiple years during the period of most rapid myopia progression (Wolffsohn et al. 2019). Extrapolation of efficacy data for outcomes measured at one year is therefore likely to overestimate the effectiveness of treatment (Lawrenson et al. 2023).
- Many of the included trials in the review by Lawrenson et al. (2023) did not meet the guiding principles developed by the International Myopia Institute progression (Wolffsohn et al. 2019), particularly regarding standardised reporting of AEs. There was also a tendency for studies in the review by Lawrenson et al. (2023) to report a relative percentage reduction in myopia progression to express treatment effect, which can be misleading.

- A number of factors complicated the comparison of studies in the review by Lawrenson et al. (2023), including differences in the demographic characteristics of the participants, and variability in the parameters used within similar treatments (e.g., different add powers and lens designs for multifocal spectacle lenses and multifocal soft contact lenses). Although most studies adopted similar eligibility criteria, recruiting children aged six to 13 years, other studies used a wider age range of up to 18 years. This may bias results as faster progression occurs in younger children and progression slows in older teenagers. In addition, studies were conducted in different ethnic groups, particularly in children from Southeast Asian countries, who typically have faster progression of myopia than White children, and applicability to NHS Wales is uncertain.

- Experts contacted by HTW stated that whilst the treatment modalities grouped together in the review by Lawrenson et al. (2023) have similar underpinning designs (for example, all multifocal soft contact lenses and all peripheral plus spectacle lenses), developments in these technologies mean that some designs may have better efficacy than others. Additionally, experts noted that some of the studies in the review by Lawrenson et al. (2023) did not include lenses commercially available in the UK.

- The Cochrane review reported that there is uncertainty regarding the risk-benefit of orthokeratology and other contact lens interventions in children. AEs across the included studies was generally poorly described with a lack of standardisation of reporting. Although most of the included studies reported non-serious AEs, authors of the review by Lawrenson et al. (2023) stated that the duration of follow up in trials may have been insufficient to capture long-term or rare AEs. UK guidance states that myopia-control spectacles and contact lenses are safe with a low incidence of serious AEs, as long as the child follows handling and hygiene advice, and the orthokeratology lenses are fitted accurately (College of Optometrists 2022). Experts contacted by HTW acknowledged the AEs identified in the Cochrane review and suggested that corneal exhaustion may also be an AE associated with orthokeratology. The experts generally supported the safety recommendations in UK guidance.

- Treatment adherence was not consistently reported in the systematic review by Lawrenson et al. (2023), with a number of different methods used to measure it (e.g., retrospective self-report by parents or children, questionnaires or diaries). Reasons for lack of adherence were not always clearly reported. Authors of the systematic review state that the short time frame of many studies may have overestimated adherence, since it is possible that it may reduce over time (Lawrenson et al. 2023).

- The review by Lawrenson et al. (2023) did not report relevant QoL outcomes. Only two RCTs of 190 children were identified for this outcome, and quantitative data were not reported. The review by Lawrenson et al. (2023) recommends a need for further studies using validated instruments to measure vision-related and health-related QoL.

- Only two RCTs included progression of myopia on cessation of treatment (rebound) and visual acuity outcomes.

- We identified limited evidence on novel spectacle lens designs. This intervention was not reported in the NMA by Lawrenson et al. (2023), but we found one RCT investigating DOT lenses and one investigating CARE lenses, published since the NMA.

6. Cost effectiveness

6.1 Health economic literature review

Appendix 6 (the PRISMA diagram) summarises the selection of articles for inclusion in the evidence review. The titles and abstracts of 1,784 records identified in the search for this research question were screened and 12 records were deemed potentially relevant. The full texts of these studies were reviewed against the inclusion/exclusion criteria (Appendix 4) and 11 studies were excluded. Four studies were excluded because they did not describe economic evaluations (Lawrenson et al. 2023, Walline et al. 2020a, Kearney et al. 2022, Banerjee & Horton 2021); two were not comparative evaluations (Lim et al. 2009, Naidoo et al. 2019); and five did not consider the interventions of interest (Rebenitsch et al. 2011, Foo et al. 2021, Sankaridurg et al. 2021, Berdeaux et al. 2002, Malvankar-Mehta et al. 2018). Fricke et al. (2022) was the only study included in the health economic review and is summarised in Table 17.

Fricke et al. (2022) compared the lifetime costs associated with single-vision correction and four active myopia controls: low-dose atropine, myopia-control spectacles, myopia-control contact lenses, and orthokeratology. Analyses were conducted from an Australian or Chinese societal perspective, for an 8-year old child with SER -0.75 D at baseline, of European or Han Chinese ethnicity, respectively. Intervention effects were captured in terms of SER progression, up to the age of 18 years. The effectiveness of myopia-control spectacles was informed by studies of bifocal and defocus incorporated multiple segments (DIMS) spectacles (i.e. types of multifocal spectacle lenses or peripheral plus spectacle lenses, described in Section 5). As no SER effect data were available for orthokeratology, this strategy was assumed to have the same proportional effect on SER as had been shown for AL. Myopia progression influenced the modelled requirement for more expensive corrective lenses, the frequency of ophthalmic examinations and spectacle replacements, and the risk of complications after the age of 55 years (myopic macular degeneration, glaucoma, retinal detachment, visual impairment, and blindness).

The additional costs of myopia controls were estimated to be partially or fully offset by reduced myopia progression and subsequent avoidance of long-term complications. In the Australian analysis, myopia-control spectacles were estimated to be cost saving compared with single-vision correction. The other myopia controls were estimated to increase lifetime costs by $927 (low-dose atropine), $2,000 (orthokeratology), and $4,844 (myopia-control contact lenses) compared with single-vision correction (equivalent to around £700 to £3,500 converted from US dollars to UK 2021/22 prices). Drivers of the analysis could not be determined from the limited sensitivity analyses reported. In scenario analysis, the incremental costs of myopia control were lower when compared with single-vision correction with contact lenses only, rather than a mix of single-vision correction (22%) modelled in the base case. Orthokeratology was estimated to be cost saving in this comparison.

The study only considered cost outcomes and was assessed as having minor limitations. It is only partially applicable to the UK NHS because of the settings and perspective taken.

Table 17. Summary of included health economic studies: Fricke et al. (2022)

Study details	Study population and design	Data sources	Results	Quality assessment
Author and year: Fricke et al. (2022) **Country:** Australia and China **Type of economic analysis:** Cost analysis **Perspective:** Societal perspective **Currency:** US dollars **Price year:** 2020 **Time horizon:** Lifetime **Discounting:** Costs discounted at 3% per year **Potential conflict of interest:** The authors were employees or consultants of Brien Holden Vision Institute, who hold patents in myopia control.	**Population** Two hypothetical patient profiles were modelled for an 8-year old child with SER -0.75 D at baseline, of either European Australian or Han Chinese descent **Intervention** • Low-dose atropine • Myopia-control spectacles • Myopia-control contact lenses • Orthokeratology **Comparator** Single-vision correction (assumed 22% contact lenses; 78% spectacles) **Study design** A decision-analytic model was used to estimate the lifetime costs associated with treatment, eye exams and the incidence of long-term complications associated with myopia progression. Treatment-specific SER progression was modelled from age 8 to 17 years; progression rates were tapered to zero from age 18 to 25 years and assumed to be stable thereafter. SER	**Source of baseline and effectiveness data:** Myopia progression in the control arm was informed by Chinese data, and adjusted using meta-analysed estimates from Donovan et al. (2012) for the Australian analysis. Weighted average reductions in SER progression (42% to 49%) were derived from published studies for each intervention. Most of these were considered in the review by Lawrenson et al. (2023). Adverse events were modelled for contact lenses only, at a rate of 4.5% annually. Risks of long-term complications were sourced from the literature. **Source of resource use and cost data:** The frequency of eye exams and spectacle replacement were modelled according to treatment strategy, age and SER. These clinical protocols were informed by the literature and ophthalmic centres. Indirect costs related to transport and lost productivity	Results are reported for Australia only. **Base case results** Total cost: • Single-vision correction: $7,437 • Low-dose atropine: $8,364 • Myopia-control spectacles: $7,280 • Myopia-control contact lenses: $12,281 • Orthokeratology: $9,437 Incremental cost versus single-vision correction: • Low-dose atropine: $927 • Myopia-control spectacles: saves $157 • Myopia-control contact lenses: $4,844 • Orthokeratology: $2,000 **Threshold analysis** Highest intervention cost to be cost neutral versus single-vision correction: • Low-dose atropine: $8.33 per 1-month supply • Myopia-control contact lenses: $27.22 per 3-month supply • Orthokeratology: $85.54 per 2-year period **Sensitivity analysis** All interventions were estimated to be cost incurring compared to single-vision correction when a higher discount rate of 5% was applied (incremental costs $894 to $5,471) or	**Applicability** Partially applicable to the UK NHS because it considered a broader societal perspective, in Australian and Chinese settings. **Limitations** This study has minor limitations: • All children were assumed to receive interventions until the age of 18 years, regardless of response. This may bias against intervention as treatments may be stopped if perceived to be ineffective. • Orthokeratology was assumed to have the same proportional effect on SER as the effect shown for axial length. • Short-term (1-5 year) efficacy data were applied over a 10-year period. Without longer-term studies the likely impact of this assumption is unknown. • No long-term complications were modelled before age 55 due to a lack of data in younger age groups. This may bias against intervention for a small proportion of people who experience complications at a younger age not captured in the model. • Though references were provided, the exact values applied in the analysis were

Study details	Study population and design	Data sources	Results	Quality assessment
	controlled the modelled risk of MMD, glaucoma, retinal detachment, visual impairment, and blindness from age 55 years.	associated with attendance for care. WHO disability weights were applied as a proxy for productivity losses due to vision impairment. Australian costs were sourced from Medicare scheduled fees, Optical Distributors and Manufacturers Association reference prices, the Victorian Eyecare Service and compounding pharmacies. Chinese costs were obtained from key ophthalmic centres in China.	when all inputs were set to their lower bounds ($293 to $3,274). When all inputs were set to their upper bounds, the conclusions of the base case were unchanged. Comparisons against single-vision correction with 100% contact lenses produced more favourable results and suggest that orthokeratology may be cost saving in this scenario.	unclear for some inputs. • Uncertainty may not have been fully explored. A limited number of deterministic sensitivity analyses were presented and probabilistic sensitivity analysis was not reported.
D: dioptres; MMD: myopic macular degeneration; SER: spherical equivalent refractive error; WHO: World Health Organization				

6.2 HTW cost utility analysis

HTW researchers developed an original cost utility analysis to evaluate the cost effectiveness of myopia-control spectacles and contact lenses for children and adolescents in Wales.

A state-transition model was used to evaluate the total costs and quality-adjusted life years (QALYs) of the following strategies:

- Single-vision lens spectacles or contact lenses
- Multifocal soft contact lenses
- Peripheral plus spectacle lenses
- Orthokeratology

Rigid gas-permeable contact lenses were not modelled because they were found to have little-to-no benefit in the review by Lawrenson et al. (2023). Experts contacted by HTW advised that multifocal spectacle lenses should not be modelled because the effects reported by Lawrenson et al. (2023) were below reported thresholds for clinical significance, but that multifocal soft contact lenses should be considered. DOT and CARE lenses were not modelled because these lenses are not currently available in the UK and their price is unknown.

We compared all the modelled strategies against each other within a fully incremental analytical framework. The strategies were first ranked in order of outcomes, from lowest to highest QALYs. Any strategy with both lower QALYs and higher costs than an alternative (i.e., dominated) or offering worse value for money than the next, more effective option (i.e., extendedly dominated) was removed from consideration. Incremental costs, QALYs, health benefit and cost effectiveness ratios (ICERs) were then estimated for each strategy compared to the previously ranked option. The strategy associated with the highest total health benefit at a willingness to pay threshold of £20,000 per QALY was considered the optimal strategy.

Effectiveness of each strategy was modelled in terms of SER and informed by the meta-analysis by Lawrenson et al. (2023). The modelled effects of orthokeratology on SER were assumed to be proportionally equal to its effects on AL. We did not model any difference in SER between peripheral plus spectacle lenses and single-vision lenses at year 2 because the meta-analysed effect was not statistically significant. With no modelled benefit over standard of care, peripheral plus spectacle lenses were stopped after two years. For all other strategies, changes in SER over the second year were assumed to be maintained in following years. Myopia control strategies were assumed to stop at age 16, when modelled myopia progression began to stabilise before reaching its final level at age 20 years.

We only considered the costs of single-vision lenses incurred by the NHS via the provision of free sight tests and optical vouchers up to the age of 18. Out-of-pocket expenses of myopia correction paid by individuals and families were not considered. We estimated the costs of myopia controls from the websites of private opticians because no list prices exist.

We used World Health Organization (WHO) disability weights for impaired distance vision to model the impact of myopia progression on quality of life. Myopic macular degeneration, retinal detachment, cataract, glaucoma and progression to a low-vision health state were modelled using published rates, adjusted for SER level. We only modelled these long-term complications from age 55 years because the available evidence came from older populations.

The analysis took the perspective of the UK NHS and personal social services (PSS). A lifetime time horizon was considered. Future costs and benefits were discounted at a rate of 3.5% annually. Full details of the methods and results are available in Appendix 10.

6.3 Cost utility results

The results of the base case analysis are presented in Table 18 and Table 19. All myopia-control strategies were estimated to increase costs compared with single-vision lenses. Peripheral plus spectacle lenses were modelled to have minimal benefit compared with single-vision lenses because they were stopped at two years with no difference in SER. Multifocal soft contact lenses and orthokeratology were estimated to provide small QALY gains, driven by the avoidance of progression to high myopia for some children.

Peripheral plus spectacle lenses were not estimated to be cost effective in the base case. In pairwise analysis, multifocal soft contact lenses and orthokeratology were both cost effective at a threshold of £20,000 per QALY gained compared with single-vision lenses. Orthokeratology was estimated to provide the highest total health benefit and represent the best value for money of the strategies considered. Orthokeratology was cost effective compared with single-vision lenses (the cheapest and least effective strategy) with an ICER of £3,995 per QALY gained, and was both cheaper and more effective than multifocal soft contact lenses.

The conclusions of the base case analysis were robust to probabilistic sensitivity analysis (PSA) using a cost effectiveness threshold of £20,000 per QALY. Compared with single-vision lenses, multifocal soft contact lenses were estimated to be cost effective in 71% of PSA iterations, while orthokeratology was cost effective in 90%. Orthokeratology was estimated to represent the best value for money among the strategies considered in 76% of PSA iterations. Multifocal soft contact lenses (18%) or single-vision lenses (5%) were estimated to represent better value in the remainder.

Deterministic sensitivity analysis showed results were most sensitive to variation in the parameters controlling SER progression, strategy costs and duration of intervention, the impact of high myopia on quality of life, and the incidence of long-term complications.

Scenario analysis highlighted the importance of key modelling assumptions. However, the conclusions of the base case remained largely unchanged. The main exception to this was the use of effectiveness estimates from the NMA by Lawrenson et al. (2023). In this scenario, SER effects at year 2 were modelled for peripheral plus spectacle lenses and their use continued up to age 16, as for the other myopia controls. Peripheral plus spectacle lenses were estimated to be cost effective compared with single-vision lenses in pairwise analysis. However, in fully incremental analysis, orthokeratology was estimated to provide better value for money than peripheral plus spectacle lenses.

Multifocal soft contact lenses were not estimated to be cost effective compared with single-vision lenses when alternative utility values were applied; however, orthokeratology remained cost effective in these scenarios.

Table 18. Summary of base case pairwise analysis

Strategy	Total costs	Total QALYs	Total health benefit	Incremental costs	Incremental QALYs	Net health benefit	ICER (£/QALY)
SVL	£1,718	22.91	22.82	N/A	N/A	N/A	N/A
MFSCL	£4,040	23.18	22.98	£2,322	0.28	0.16	£8,367
PPSL	£2,628	22.91	22.78	£910	0.00	-0.04	> £1M
Ortho-K	£3,732	23.41	23.22	£2,014	0.50	0.40	£3,995

ICER: incremental cost effectiveness ratio; M: million; MFSCL: multifocal soft contact lenses; N/A: not applicable; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; QALY: quality-adjusted life-year; SVL: single-vision lens spectacles or contact lenses
Results estimated over 1.000 iterations. Total and net health benefit estimated at a willingness to pay threshold of £20,000 per QALY.

Table 19. Summary of base case fully incremental analysis

Strategy	Comparator on efficiency frontier	Total costs	Total QALYs	Total health benefit	Incremental costs	Incremental QALYs	Net health benefit	ICER (£/QALY)
SVL	Reference strategy	£1,718	22.91	22.82	N/A	N/A	N/A	N/A
PPSL	N/A	£2,628	22.91	22.78	N/A	N/A	N/A	N/A
MFSCL	N/A	£4,040	23.18	22.98	N/A	N/A	N/A	N/A
Ortho-K	SVL	£3,732	23.41	23.22	£2,014	0.50	0.40	£3,995

ICER: incremental cost effectiveness ratio; M: million; MFSCL: multifocal soft contact lenses; N/A: not applicable; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; QALY: quality-adjusted life-year; SVL: single-vision lens spectacles or contact lenses
Results estimated over 1.000 iterations. Total and net health benefit estimated at a willingness to pay threshold of £20,000 per QALY.

7. Organisational considerations

Experts contacted by HTW made the following comments:

- Some myopia-control interventions are currently offered at some private clinics in Wales. The present service for myopia management is expensive and there is no provision for the higher cost of myopia-control interventions under the current voucher system. This creates inequity of access to these interventions.
- The way in which services are provided by optometrists in primary care is being reorganised in Wales, with an emphasis on including optometrists with additional post-graduate qualifications so that they can become independent prescribers. There is a financial model in place to include at least two optometrists per cluster area. Welsh Government commented that pathways could be set up that align with other services across Wales if myopia control was considered to be effective and cost efficient.
- Orthokeratology is more specialised than other myopia-control interventions and is used by fewer optometrists. Orthokeratology would require significant investment by practices to support the more specialist equipment and training required. Some experts noted that alternative myopia-control interventions should be available in addition to orthokeratology, for those who are unable or unwilling to use orthokeratology.
- Other than orthokeratology, most myopia-control interventions can be delivered in most practices and would not result in significant organisational changes, although many practices would need to invest in ocular biometers to accurately measure treatment efficacy. Some experts commented that companies offering myopia-control interventions may offer training prior to their use.
- Children with myopia-control interventions will usually need to be reviewed more frequently than children with single-vision interventions for myopia.
- Myopia-control interventions would need post-payment verification audits and audits of the service.

8. Patient, carer and family considerations

HTW did not identify any relevant patient and public involvement (PPI) evidence in the clinical literature search, or receive feedback from any of the PPI organisations contacted.

Expert reviewers reported that children with myopia can experience educational difficulties and exclusion from social activities, resulting in educational and social potential not being met. Expert reviewers also highlighted that earlier intervention to reduce myopia progression could potentially allow children to access careers where vision standards and maximum permitted corrections are stipulated.

Expert reviewers reported that without correction, children with myopia experience impaired vision and can be at risk when carrying out daily activities, such as crossing the road. Even when myopia is corrected with spectacles or contact lenses, children can still experience barriers to participation in daily activities. For example, participation in certain sports may be difficult due to the need to remove spectacles or contact lenses. Children may avoid some activities due to the fear of damaging spectacles or undertake risky behaviours, such as foregoing correction to take part in an activity with blurred vision or swimming in contact lenses.

Reliance on spectacles or contact lenses to correct vision can be inconvenient and uncomfortable. Expert reviewers commented that some children may not be able to tolerate

contact lenses. Additionally, discontinuation may arise if the benefits of spectacles or contact lenses are not observed as quickly as expected. Potential quality of life and wellbeing issues for children with myopia were highlighted by expert reviewers. These include low self-esteem and anxiety resulting from perceived negative stereotypes associated with spectacles. Wearing spectacles was reported as a source of stigma and bullying and experts highlighted that children with higher prescriptions face greater issues with appearance. Individuals and their families may also be concerned about the increased risks of future pathology and vision loss associated with myopia.

The financial impact of the cost of spectacles and contact lenses for myopia was also reported by expert reviewers. This includes frequent visits for eyecare, the cost for higher prescriptions, and replacement spectacles and contact lenses. Expert reviewers also highlighted socio-economic inequality with the cost of eyecare, where families with lower incomes may not be able to afford different interventions and travel to appointments.

9. Contributors

This topic was proposed by an NHS Clinical Adviser

The HTW staff and contract researchers involved in writing this report were:

- A Evans and G Davies – patient and public involvement authors
- E Hasler – literature searches and information management
- H Bennett – health economics author
- J Williams – clinical author
- L Elston – quality assurance of clinical section
- R Shepherd – project management
- T Winfield – quality assurance of health economics section

The HTW Assessment Group advised on methodology throughout the scoping and development of the report.

A range of clinical experts from the UK provided material and commented on a draft of this report. Their views were documented and have been actioned accordingly. All contributions from reviewers were considered by HTW's Assessment Group. However, reviewers had no role in authorship or editorial control, and the views expressed are those of Health Technology Wales.

Experts who contributed to this appraisal:

- Andy Britton, Specialist Optometrist, Optometry Wales
- Daniel Hardiman-McCartney, Lead Clinical Adviser, The College of Optometrists/ responding on behalf of the College of Optometrists
- David O'Sullivan, Chief Optometric Adviser, Welsh Government
- Dr Emma McConnell, Research Optometrist, Ulster University/Queen's University Belfast/Belfast Health and Social Care Trust
- Francesca Lado, National Clinical Advisor for Optometry, NHS
- Dr Janet Pooley, Chief Optometric Adviser, Scottish Government
- Dr Lesley Doyle, Study Coordinator/Research Optometrist, Northern Ireland Clinical Research Network Vision Team, Belfast Health and Social Care Trust
- Lyndsay Hewitt, Optometric Advisor, Swansea Bay Health Board
- Raymond Curran, Head of Ophthalmic Services, Strategic Planning & Performance Group, Department of Health, Northern Ireland
- Dr Sara McCullough, Lecturer in Optometry & Vision Science, Ulster University.

HTW would like to thank the Cochrane group for their help with this report.

10. References

Arunga S, Wiafe G, Habtamu E, et al. (2019). The impact of microbial keratitis on quality of life in Uganda. BMJ Open Ophthalmology. 4(1): e000351. doi: http://dx.doi.org/10.1136/bmjophth-2019-000351

Banerjee S, Horton J. (2021). Lenses and spectacles to prevent myopia worsening in children. CADTH Health Technology Review. 1(4). Available at: https://www.cadth.ca/lenses-and-spectacles-prevent-myopia-worsening-children

Bao J, Yang A, Huang Y, et al. (2022). One-year myopia control efficacy of spectacle lenses with aspherical lenslets. British Journal of Ophthalmology. 106(8): 1171-6. doi: https://doi.org/10.1136/bjophthalmol-2020-318367

Berdeaux G, Alio JL, Martinez JM, et al. (2002). Socioeconomic aspects of laser in situ keratomileusis, eyeglasses, and contact lenses in mild to moderate myopia. Journal of Cataract & Refractive Surgery. 28(11): 1914-23. doi: https://doi.org/10.1016/S0886-3350%2802%2901496-7

BNF. (2023). Ranibizumab [specialist drug]: medicinal forms. Available at: https://bnf.nice.org.uk/drugs/ranibizumab/medicinal-forms/ [Accessed 06 Jan 2023. Website link updated to https://bnf.nice.org.uk/drugs/ranibizumab-specialist-drug/medicinal-forms/ Accessed 05 July 2023].

Bourne RRA, Flaxman SR, Braithwaite T, et al. (2017). Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. Lancet Global Health. 5(9): e888-e97. doi: https://doi.org/10.1016/s2214-109x(17)30293-0

Bruce A, Fairley L, Chambers B, et al. (2016). Impact of visual acuity on developing literacy at age 4–5 years: a cohort-nested cross-sectional study. BMJ Open 6(2): e010434. doi: http://dx.doi.org/10.1136/bmjopen-2015-010434

Bullimore MA, Brennan NA. (2019). Myopia control: why each diopter matters. Optometry and Vision Science. 96(6): 463-5. doi: https://doi.org/10.1097/OPX.0000000000001367

Bullimore MA, Sinnott LT, Jones-Jordan LA. (2013). The risk of microbial keratitis with overnight corneal reshaping lenses. Optometry and Vision Science. 90(9): 937-44. doi: https://doi.org/10.1097/OPX.0b013e31829cac92

Busbee BG, Brown MM, Brown GC, et al. (2002). Incremental cost-effectiveness of initial cataract surgery. Ophthalmology. 109(3): 606-12. doi: https://doi.org/10.1016/S0161-6420(01)00971-X

Chen Z, Zhang Z, Xue F, et al. (2023). The relationship between myopia progression and axial elongation in children wearing orthokeratology contact lenses. Contact Lens & Anterior Eye. 46(1): Article 101517. doi: https://doi.org/10.1016/j.clae.2021.101517

Cheng X, Brennan NA, Toubouti Y, et al. (2020). Safety of soft contact lenses in children: retrospective review of six randomized controlled trials of myopia control. Acta Ophthalmologica. 98(3): e346-e51. doi: https://doi.org/10.1111/aos.14283

Cheng X, Xu J, Chehab K, et al. (2016). Soft contact lenses with positive spherical aberration for myopia control. Optometry and Vision Science. 93(4): 353-66. doi: https://doi.org/10.1097/OPX.0000000000000773

Christ SL, Lee DJ, Lam BL, et al. (2008). Assessment of the effect of visual impairment on mortality through multiple health pathways: structural equation modeling. Investigative Ophthalmology & Visual Science. 49(8): 3318-23. doi: https://doi.org/10.1167/iovs.08-1676

College of Optometrists. (2022). Childhood-onset myopia management: guidance for optometrists. The College of Optometrists. Available at: https://www.college-optometrists.org/category-landing-pages/clinical-topics/myopia/myopia-management-%E2%80%93-guidance-for-optometrists#Management [Accessed 18 April 2023].

COMET Group. (2013). Myopia stabilization and associated factors among participants in the Correction of Myopia Evaluation Trial (COMET). Investigative Ophthalmology & Visual Science. 54(13): 7871-83. doi: https://doi.org/10.1167/iovs.13-12403

Deeks JJ, Higgins JPT, Altman DG. (2022). Chapter 10: Analysing data and undertaking meta-analyses. In: Higgins JPT, Thomas J, Chandler J, et al. Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane. Available at: www.training.cochrane.org/handbook [Accessed 18 Apr 2023].

Department of Health. (2002). Memorandum of understanding on the frequency of NHS sight tests. Department of Health. Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/+/www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Dearcolleagueletters/DH_4002763 [Accessed 16 Jan 2023].

Donovan L, Sankaridurg P, Ho A, et al. (2012). Myopia progression rates in urban children wearing single-vision spectacles. Optometry and Vision Science. 89(1): 27-32. doi: https://doi.org/10.1097/OPX.0b013e3182357f79

Fang J, Huang Z, Long Y, et al. (2022). Retardation of myopia by multifocal soft contact lens and orthokeratology: a 1-year randomized clinical trial. Eye & Contact Lens: Science & Clinical Practice. 48(8): 328-34. doi: https://doi.org/10.1097/ICL.0000000000000911

Flaxman SR, Bourne RRA, Resnikoff S, et al. (2017). Global causes of blindness and distance vision impairment 1990-2020: a systematic review and meta-analysis. Lancet Global Health. 5(12): e1221-e34. doi: https://doi.org/10.1016/s2214-109x(17)30393-5

Flitcroft DI. (2012). The complex interactions of retinal, optical and environmental factors in myopia aetiology. Progress in Retinal and Eye Research. 31(6): 622-60. doi: https://doi.org/10.1016/j.preteyeres.2012.06.004

Flitcroft DI, He M, Jonas JB, et al. (2019). IMI – defining and classifying myopia: a proposed set of standards for clinical and epidemiologic studies. Investigative Ophthalmology & Visual Science. 60: M20-M30. doi: https://doi.org/10.1167/iovs.18-25957

Foo LL, Lanca C, Wong CW, et al. (2021). Cost of myopia correction: a systematic review. Frontiers in Medicine. 8: 718724. doi: https://doi.org/10.3389/fmed.2021.718724

Fricke TR, Sankaridurg P, Naduvilath T, et al. (2022). Establishing a method to estimate the effect of antimyopia management options on lifetime cost of myopia. British Journal of Ophthalmology. Epub ahead of print. doi: https://doi.org/10.1136/bjophthalmol-2021-320318

Garcia-Del Valle AM, Blazquez V, Gros-Otero J, et al. (2021). Efficacy and safety of a soft contact lens to control myopia progression. Clinical & Experimental Optometry. 104(1): 14-21. doi: https://doi.org/10.1111/cxo.13077

Haarman AEG, Enthoven CA, Tideman JWL, et al. (2020). The complications of myopia: a review and meta-analysis. Investigative Ophthalmology & Visual Science. 61(4): 49. doi: https://doi.org/10.1167/iovs.61.4.49

Hernández Alava M, Pudney S, Wailoo A. (2022). Estimating EQ-5D by age and sex for the UK. NICE DSU Report. Available at: https://www.sheffield.ac.uk/nice-dsu/methods-development/estimating-eq-5d [Accessed 25 Oct 2022].

Higgins JPT, Savović J, Page MJ, et al. (2022). Chapter 8: Assessing risk of bias in a randomized trial. In: Higgins JPT, Thomas J, Chandler J, et al. Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane. Available at: www.training.cochrane.org/handbook [Accessed 18 Apr 2023].

Holden BA, Fricke TR, Wilson DA, et al. (2016). Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. Ophthalmology. 123(5): 1036-42. doi: https://doi.org/10.1016/j.ophtha.2016.01.006

Hong CA-O, Boyd MA-O, Wilson G, et al. (2022). Photorefraction screening plus atropine treatment for myopia is cost-effective: a proof-of-concept markov analysis. Clinical Ophthalmology. 16: 1941-52. doi: https://doi.org/10.2147/OPTH.S362342

Hopkins RB, Tarride JE, Bowen J, et al. (2008). Cost-effectiveness of reducing wait times for cataract surgery in Ontario. Canadian Journal of Ophthalmology. 43(2): 213-7. doi: https://doi.org/10.3129/i08-002

Jakobsen TM, Gehr NL, Møller F. (2021). Correlation between change in cycloplegic spherical equivalent refractive error and change in axial length in Danish children aged 6 to 12 year. Acta Ophthalmologica. 99(7): e1249-e50. doi: https://doi.org/10.1111/aos.14736

Jampel HD. (2001). Glaucoma patients' assessment of their visual function and quality of life. Transactions of the American Ophthalmological Society. 99: 301-17. doi: https://doi.org/10.1097/00061198-200204000-00012

Jones KC, Weatherley H, Birch S. (2023). Unit costs of health and social care 2022. Personal Social Services Research Unit (University of Kent) & Centre for Health Economics (University of York), Kent, UK. Available at: https://www.pssru.ac.uk/unitcostsreport/ [Accessed 07 Feb 2023].

Kandel H. (2022). Quality-of-life outcomes of long-term contact lens wear: a systematic review. Contact Lens & Anterior Eye. 45(1): 101521. doi: https://doi.org/10.1016/j.clae.2021.101521

Kanthan GL, Mitchell P, Rochtchina E, et al. (2014). Myopia and the long-term incidence of cataract and cataract surgery: the Blue Mountains Eye Study. Clinical & Experimental Ophthalmology. 42(4): 347-53. doi: https://doi.org/10.1111/ceo.12206

Kay S, Ferreira A. (2014). Mapping the 25-item National Eye Institute Visual Functioning Questionnaire (NEI VFQ-25) to EQ-5D utility scores. Ophthalmic Epidemiology. 21(2): 66-78. doi: https://doi.org/10.3109/09286586.2014.888456

Kearney S, Strang NC, Lewsey J, et al. (2022). Socio-economic differences in accessing NHS spectacles amongst children with differing refractive errors living in Scotland. Eye. 36(4): 773-80. doi: https://doi.org/10.1038/s41433-021-01536-8

Kleinstein RN, Mutti DO, Sinnott LT, et al. (2021). Uncorrected refractive error and distance visual acuity in children aged 6 to 14 years. Optometry and Vision Science. 98(1): 3-12. doi: https://doi.org/10.1097/OPX.0000000000001630

Lawrenson JG, Shah R, Huntjens B, et al. (2023). Interventions for myopia control in children: a living systematic review and network meta-analysis. Cochrane Database of Systematic Reviews. Issue 2: Art. No.: CD014758. doi: https://doi.org/10.1002/14651858.CD014758.pub2

Li X. (2003). Incidence and epidemiological characteristics of rhegmatogenous retinal detachment in Beijing, China. Ophthalmology. 110(12): 2413-7. doi: https://doi.org/10.1016/s0161-6420(03)00867-4

Lim MC, Gazzard G, Sim EL, et al. (2009). Direct costs of myopia in Singapore. Eye. 23(5): 1086-9. doi: https://doi.org/10.1038/eye.2008.225

Lipson MJ, Boland B, McAlinden C. (2022). Vision-related quality of life with myopia management: a review. Contact Lens & Anterior Eye. 45(3): 101538. doi: https://doi.org/10.1016/j.clae.2021.101538

Liu X, Wang P, Xie Z, et al. (2023). One-year myopia control efficacy of cylindrical annular refractive element spectacle lenses. Acta Ophthalmologica. 00: 1– 7. doi: https://doi.org/10.1111/aos.15649

Lu Y, Lin Z, Wen L, et al. (2020). The adaptation and acceptance of defocus incorporated multiple segment lens for chinese children. American Journal of Ophthalmology. 211: 207-16. doi: https://doi.org/10.1016/j.ajo.2019.12.002

Malvankar-Mehta MS, Wilson R, Leci E, et al. (2018). Cost and quality of life of overlooked eye care needs of children. Risk Management and Healthcare Policy. 11: 25-33. doi: https://doi.org/10.2147/RMHP.S141659

McCullough SJ, O'Donoghue L, Saunders KJ. (2016). Six year refractive change among white children and young adults: evidence for significant increase in myopia among white UK children. PloS one. 11(1): e0146332. doi: https://doi.org/10.1371/journal.pone.0146332

Meads C, Hyde C. (2003). What is the cost of blindness? British Journal of Ophthalmology. 87(10): 1201-4. doi: https://doi.org/10.1136/bjo.87.10.1201

Mitchell P, Hourihan F, Sandbach J, et al. (1999). The relationship between glaucoma and myopia: the Blue Mountains Eye Study. Ophthalmology. 106(10): 2010-5. doi: https://doi.org/10.1016/s0161-6420(99)90416-5

Mitry D, Charteris DG, Fleck BW, et al. (2010). The epidemiology of rhegmatogenous retinal detachment: geographical variation and clinical associations. British Journal of Ophthalmology. 94(6): 678-84. doi: https://doi.org/10.1136/bjo.2009.157727

Moussa G, Hodson J, Gooch N, et al. (2021). Calculating the economic burden of presumed microbial keratitis admissions at a tertiary referral centre in the UK. Eye. 35(8): 2146-54. doi: https://doi.org/10.1038/s41433-020-01333-9

Naidoo KS, Fricke TR, Frick KD, et al. (2019). Potential lost productivity resulting from the global burden of myopia: systematic review, meta-analysis, and modeling. Ophthalmology. 126(3): 338-46. doi: https://doi.org/10.1016/j.ophtha.2018.10.029

Németh J, Tapasztó B, Aclimandos WA, et al. (2021). Update and guidance on management of myopia. European Society of Ophthalmology in cooperation with International Myopia Institute. European Journal of Ophthalmology. 31(3): 853-83. doi: https://doi.org/10.1177/1120672121998960

NHS England. (2022). National Cost Collection for the NHS 2020/21. National Health Service. Available at: https://www.england.nhs.uk/costing-in-the-nhs/national-cost-collection/ [Accessed 11 Aug 2022].

NHS Prescription Services. (2023). Electronic Drug Tariff. NHS Business Services Authority, Department of Health and Social Care. Available at: https://www.nhsbsa.nhs.uk/pharmacies-gp-practices-and-appliance-contractors/drug-tariff [Accessed 06 Feb 2023].

NICE. (2022). Glaucoma: diagnosis and management [Original Publication Date: 01 Nov 2017; Last updated: 26 Jan 2022]. Clinical guideline NG81. National Institute for Health and Care Excellence. Available at: https://www.nice.org.uk/guidance/ng81 [Accessed 6 Feb 2023].

Office for National Statistics. (2021). National life tables: Wales. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/datasets/nationallifetableswalesreferencetables [Accessed 13 July 2022].

Office for National Statistics. (2022). Estimates of the population for the UK, England, Wales, Scotland and Northern Ireland. Mid-2021 edition of this dataset. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland [Accessed 12 Jan 2023].

Ogawa A, Tanaka M. (1988). The relationship between refractive errors and retinal detachment--analysis of 1,166 retinal detachment cases. Japanese Journal of Ophthalmology. 32(3): 310-5.

Payakachat N, Summers KH, Pleil AM, et al. (2009). Predicting EQ-5D utility scores from the 25-item National Eye Institute Vision Function Questionnaire (NEI-VFQ 25) in patients with age-related macular degeneration. Quality of Life Research. 18(7): 801-13. doi: https://doi.org/10.1007/s11136-009-9499-6

Plowright AJ, Maldonado-Codina C, Howarth GF, et al. (2015). Daily disposable contact lenses versus spectacles in teenagers. Optometry and Vision Science. 92(1): 44-52. doi: https://doi.org/10.1097/opx.0000000000000454

Polkinghorne PJ, Craig JP. (2004). Northern New Zealand rhegmatogenous retinal detachment study: epidemiology and risk factors. Clinical & Experimental Ophthalmology. 32(2): 159-63. doi: https://doi.org/10.1111/j.1442-9071.2004.00003.x

Pomeda AR, Pérez-Sánchez B, Cañadas Suárez MdP, et al. (2018). MiSight assessment study Spain: a comparison of vision-related quality-of-life measures between Misight contact lenses and single-vision spectacles. Eye & Contact Lens: Science & Clinical Practice. 44: S99-S104. doi: https://doi.org/10.1097/icl.0000000000000413

Rah MJ, Walline JJ, Jones-Jordan LA, et al. (2010). Vision specific quality of life of pediatric contact lens wearers. Optometry and Vision Science. 87(8): 560-6. doi: https://doi.org/10.1097/OPX.0b013e3181e6a1c8

Rappon J, Chung C, Young G, et al. (2022). Control of myopia using diffusion optics spectacle lenses: 12-month results of a randomised controlled, efficacy and safety study (CYPRESS). British Journal of Ophthalmology. Published Online First: 01 September 2022. doi: https://doi.org/10.1136/bjo-2021-321005

Rebenitsch RL, Kymes SM, Walline JJ, et al. (2011). The lifetime economic burden of keratoconus: a decision analysis using a Markov model. American Journal of Ophthalmology. 151(5): 768-73.e2. doi: https://doi.org/10.1016/j.ajo.2010.10.034

Rentz AM, Kowalski JW, Walt JG, et al. (2014). Development of a preference-based index from the National Eye Institute Visual Function Questionnaire–25. JAMA Ophthalmology. 132(3): 310-8. doi: https://doi.org/10.1001/jamaophthalmol.2013.7639

Rose K, Harper R, Tromans C, et al. (2000). Quality of life in myopia. British Journal of Ophthalmology. 84(9): 1031-4. doi: https://doi.org/10.1136/bjo.84.9.1031

Rudnicka AR, Kapetanakis VV, Wathern AK, et al. (2016). Global variations and time trends in the prevalence of childhood myopia, a systematic review and quantitative meta-analysis: implications for aetiology and early prevention. British Journal of Ophthalmology. 100(7): 882-90. doi: https://doi.org/10.1136/bjophthalmol-2015-307724

Rudnicka AR, Owen CG, Nightingale CM, et al. (2010). Ethnic differences in the prevalence of myopia and ocular biometry in 10- and 11-year-old children: the Child Heart and Health Study in England (CHASE). Investigative Ophthalmology & Visual Science. 51(12): 6270-6. doi: https://doi.org/10.1167/iovs.10-5528

Ruiz-Pomeda A, Perez-Sanchez B, Valls I, et al. (2018). MiSight Assessment Study Spain (MASS). A 2-year randomized clinical trial. Graefe's Archive for Clinical and Experimental Ophthalmology. 256(5): 1011-21. doi: https://doi.org/10.1007/s00417-018-3906-z

Salomon JA, Haagsma JA, Davis A, et al. (2015). Disability weights for the Global Burden of Disease 2013 study. Lancet Global Health. 3(11): e712-23. doi: https://doi.org/10.1016/s2214-109x(15)00069-8

Sankaridurg P, Tahhan N, Kandel H, et al. (2021). IMI impact of myopia. Investigative Ophthalmology & Visual Science. 62(5): 2. doi: https://doi.org/10.1167/iovs.62.5.2

Shen EP, Chu HS, Cheng HC, et al. (2022). Center-for-near extended-depth-of-focus soft contact lens for myopia control in children: 1-year results of a randomized controlled trial. Ophthalmology and Therapy. 11(4): 1577-88. doi: https://doi.org/10.1007/s40123-022-00536-5

Specsavers. (2023a). Bifocal lenses. Available at: https://www.specsavers.co.uk/glasses/glasses-lenses/bifocals [Accessed 1 Feb 2023].

Specsavers. (2023b). What are gas permeable contact lenses? Available at: https://www.specsavers.co.uk/help-and-faqs/what-are-gas-permeable-contact-lenses [Accessed 1 Feb 023].

Specsavers. (2023c). What are progressive lenses? Available at: https://www.specsavers.co.uk/help-and-faqs/what-are-progressive-lenses [Accessed 25 Apr 2023].

Tideman JW, Snabel MC, Tedja MS, et al. (2016). Association of axial length with risk of uncorrectable visual impairment for Europeans with myopia. JAMA Ophthalmology. 134(12): 1355-63. doi: https://doi.org/10.1001/jamaophthalmol.2016.4009

Traverso CE, Walt JG, Kelly SP, et al. (2005). Direct costs of glaucoma and severity of the disease: a multinational long term study of resource utilisation in Europe. British Journal of Ophthalmology. 89(10): 1245-9. doi: https://doi.org/10.1136/bjo.2005.067355

VanderVeen DK, Kraker RT, Pineles SL, et al. (2019). Use of orthokeratology for the prevention of myopic progression in children: a report by the American Academy of Ophthalmology. Ophthalmology. 126(4): 623-36. doi: https://doi.org/10.1016/j.ophtha.2018.11.026

Verhoeven VJ, Wong KT, Buitendijk GH, et al. (2015). Visual consequences of refractive errors in the general population. Ophthalmology. 122(1): 101-9. doi: https://doi.org/10.1016/j.ophtha.2014.07.030

Vongphanit J, Mitchell P, Wang JJ. (2002). Prevalence and progression of myopic retinopathy in an older population. Ophthalmology. 109(4): 704-11. doi: https://doi.org/10.1016/s0161-6420(01)01024-7

Walline JJ, Gaume A, Jones LA, et al. (2007). Benefits of contact lens wear for children and teens. Eye & Contact Lens: Science & Clinical Practice. 33(6 Part 1 of 2): 317-21. doi: https://doi.org/10.1097/ICL.0b013e31804f80fb

Walline JJ, Lindsley KB, Vedula SS, et al. (2020a). Interventions to slow progression of myopia in children. Cochrane Database of Systematic Reviews. Issue 1: Art. No.: CD004916. doi: https://doi.org/10.1002/14651858.CD004916.pub4

Walline JJ, Walker MK, Mutti DO, et al. (2020b). Effect of high add power, medium add power, or single-vision contact lenses on myopia progression in children: the BLINK randomized clinical trial. JAMA. 324(6): 571-80. doi: https://doi.org/10.1001/jama.2020.10834

Welsh Government. (2021). NHS Wales eye health care: future approach for optometry services. Welsh Government. Available at: https://www.gov.wales/nhs-wales-eye-health-care-future-approach-optometry-services [Accessed 16 Jan 2023].

Welsh Government. (2022a). Get help with NHS eye care costs [Guidance]. Welsh Government. Available at: https://www.gov.wales/get-help-nhs-eye-care-costs [Accessed.

Welsh Government. (2022b). Participation of young people in education and the labour market: 2020 and 2021 (provisional). Welsh Government. Available at: https://www.gov.wales/participation-young-people-education-and-labour-market-2020-and-2021-provisional-html#section-107349 [Accessed 16 Jan 2023].

Weng R, Lan W, Bakaraju R, et al. (2022). Efficacy of contact lenses for myopia control: insights from a randomised, contralateral study design. Ophthalmic & Physiological Optics. 42(6): 1253-63. doi: https://doi.org/10.1111/opo.13042

WHO. (2020). WHO methods and data sources for global burden of disease estimates 2000-2019. Global Health Estimates Technical Paper WHO/ DDI/DNA/GHE/2020.3. World Health Organization. Available at: https://cdn.who.int/media/docs/default-source/gho-documents/global-health-estimates/ghe2019_daly-methods.pdf?sfvrsn=31b25009_7 [Accessed 20 Dec 2022].

Wildsoet CF, Chia A, Cho P, et al. (2019). IMI – interventions for controlling myopia onset and progression report. Investigative Ophthalmology & Visual Science. 60(3): M106-M31. doi: https://doi.org/10.1167/iovs.18-25958

Williams KM, Bertelsen G, Cumberland P, et al. (2015). Increasing prevalence of myopia in Europe and the impact of education. Ophthalmology. 122(7): 1489-97. doi: https://doi.org/10.1016/j.ophtha.2015.03.018

Williams KM, Kraphol E, Yonova-Doing E, et al. (2019). Early life factors for myopia in the British Twins Early Development Study. British Journal of Ophthalmology. 103(8): 1078-84. doi: http://dx.doi.org/10.1136/bjophthalmol-2018-312439

Wolffsohn JS, Kollbaum PS, Berntsen DA, et al. (2019). IMI - clinical myopia control trials and instrumentation report. Investigative Ophthalmology & Visual Science. 60: M132-M60. doi: https://doi.org/10.1167/iovs.18-25955

Wong TY, Ferreira A, Hughes R, et al. (2014). Epidemiology and disease burden of pathologic myopia and myopic choroidal neovascularization: an evidence-based systematic review. American Journal of Ophthalmology. 157(1): 9-25.e12. doi: https://doi.org/10.1016/j.ajo.2013.08.010

Wong TY, Tielsch JM, Schein OD. (1999). Racial difference in the incidence of retinal detachment in Singapore. Archives of Ophthalmology. 117(3): 379-83. doi: https://doi.org/10.1001/archopht.117.3.379

World Council of Optometry. (2021). The standard of care for myopia management by optometrists (World Council of Optometry Resolution). World Council of Optometry. Available at: https://worldcouncilofoptometry.info/resolution-the-standard-of-care-for-myopia-management-by-optometrists/ [Accessed 18 Apr 2023].

Yu Z, Zhong A, Zhao X, et al. (2022). Efficacy and safety of different add power soft contact lenses on myopia progression in children: a systematic review and meta-analysis. Ophthalmic Research. 65(4): 398-416. doi: https://doi.org/10.1159/000523675

ZEISS. (2023). ZEISS myopia management now available in Europe. Zeiss. Available at: https://www.zeiss.com/vision-care/int/about-us/newsroom/articles/myopia-causes-treatment-and-intervention-options.html [Accessed 25 Apr 2023].

Zhu Q, Yin J, Li X, et al. (2023). Effects of long-term wear and discontinuation of orthokeratology lenses on the eyeball parameters in children with myopia. International Journal of Medical Sciences. 20(1): 50-6. doi: https://doi.org/10.7150/ijms.79496

Zhu X, Wang D, Li N, et al. (2022). Effects of customized progressive addition lenses vs. single vision lenses on myopia progression in children with esophoria: a randomized clinical trial. Journal of ophthalmology. Article ID 9972761. doi: https://doi.org/10.1155/2022/9972761

11. Evidence review methods

We searched for evidence that could be used to answer the review question: what is the clinical and cost effectiveness of myopia-control spectacle lenses and contact lenses to slow the progression of myopia in children and adolescents (up to and including 18 years old), compared to standard care?

The criteria used to select evidence for the appraisal are outlined in Appendix 4. These criteria were developed following comments from the Health Technology Wales (HTW) Assessment Group and UK experts. The Cochrane review by Lawrenson et al. (2023) investigated myopia-control interventions to slow the progression of myopia in children. The Cochrane review only included randomised controlled trials (RCTs), and similar inclusion/exclusion criteria to our appraisal. We therefore searched for secondary evidence, RCTs and economic evidence as a means to supplement the Cochrane review. We only included outcomes from the secondary evidence (other than the Cochrane review) when the data were not pooled in the Cochrane review, or when they were outcomes not included in the Cochrane review.

The systematic search followed HTW's standard rapid review methodology. A search was undertaken of Medline, Embase, Cumulated Index to Nursing and Allied Health Literature (CINAHL), KSR Evidence, Cochrane Library, the International Network of Agencies for Health Technology Assessment (INAHTA) HTA database, and Epistemonikos. Additionally, searches were conducted of key websites and clinical trials registries. The searches were conducted in October 2022, with an update search of Medline, Embase, CINAHL, KSR Evidence, Cochrane Library and INAHTA HTA database run in April 2023. Appendix 5 gives details of the search strategy used for MEDLINE. Search strategies for other databases are available on request.

Appendix 6 (the PRISMA diagram) summarises the selection of articles for inclusion in the review.

Appendix 1. Outcome estimates from network meta-analysis by Lawrenson et al. (2023)

Table A1.1 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Difference in change in spherical equivalent refraction at 1-year in network meta-analysis

Intervention	Comparator	Evidence source	Absolute effect (95% CI)
Multifocal spectacle lenses	Single-vision spectacle lenses	4 RCTs in NMA by Lawrenson et al. (2023) (n = 445 in multifocal spectacle lenses group)	MD: 0.14 D (−0.04 to 0.32) **No significant difference between groups**
Peripheral plus spectacle lenses	Single-vision spectacle lenses	n of RCTs in NMA by Lawrenson et al. (2023): NR	MD: 0.28 D (0.05 to 0.51) **Favours peripheral plus spectacle lenses**
Multifocal soft contact lenses	Single-vision soft contact lenses	9 RCTs in NMA by Lawrenson et al. (2023) (n = 723 in multifocal soft contact lenses group)	MD: 0.23 D (0.09 to 0.37) **Favours multifocal soft contact lenses**
Rigid gas-permeable contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	2 RCTs in NMA by Lawrenson et al. (2023) (n = 176 in rigid gas-permeable contact lenses group)	MD: 0.17 D (-0.12 to 0.46) **No significant difference between groups**

CI: confidence interval; D: dioptres; MA: meta-analysis; MD: mean difference; n: number of study participants; NMA: network meta-analysis; NR: not reported; RCT: randomised controlled trial

Table A1.2 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Difference in change in spherical equivalent refraction at two years in network meta-analysis

Intervention	Comparator	Evidence source	Absolute effect (95% CI)
Multifocal spectacle lenses	Single-vision spectacle lenses	7 RCTs in NMA by Lawrenson et al. (2023) (n = 622 in multifocal spectacle lenses group)	MD: 0.19 D (0.03 to 0.36) **Favours multifocal spectacle lenses**
Peripheral plus spectacle lenses	Single-vision spectacle lenses	2 RCTs in NMA by Lawrenson et al. (2023) (n = 188 in peripheral plus spectacle lenses group)	MD: 0.34 D (0.05 to 0.63) **Favours peripheral plus spectacle lenses**
Multifocal soft contact lenses	Single-vision soft contact lenses	5 RCTs in NMA by Lawrenson et al. (2023) (n = 540 in multifocal soft contact lenses group)	MD: 0.31 D (0.12 to 0.49) **Favours multifocal soft contact lenses**
Rigid gas-permeable contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	2 RCTs in NMA by Lawrenson et al. (2023) (n = 154 in rigid gas-permeable contact lenses group)	MD: 0.22 D (−0.09 to 0.53) **No significant difference between groups**

CI: confidence interval; D: dioptres; MD: mean difference; n: number of study participants; NMA: network meta-analysis; NR: not reported; RCT: randomised controlled trial

Table A1.3 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Difference in change in axial length at one year in network meta-analysis

Intervention	Comparator	Evidence source	Absolute effect (95% CI)
Multifocal spectacle lenses	Single-vision spectacle lenses	4 RCTs in NMA by Lawrenson et al. (2023) (n = 445 in multifocal spectacle lenses group)	MD: −0.04 mm (−0.16 to 0.08) **No significant difference between groups**
Peripheral plus spectacle lenses	Single-vision spectacle lenses	3 RCTs in NMA by Lawrenson et al. (2023) (n = 340 in peripheral plus spectacle lenses group)	MD: −0.14 mm (−0.20 to −0.07) **Favours peripheral plus spectacle lenses**
Multifocal soft contact lenses	Single-vision soft contact lenses	9 RCTs in NMA by Lawrenson et al. (2023) (n = 723 in multifocal soft contact lenses group)	MD: −0.11 mm (−0.14 to −0.07) **Favours multifocal soft contact lenses**
Orthokeratology	Single-vision spectacle lenses or single-vision soft contact lenses	5 RCTs in NMA by Lawrenson et al. (2023) (n = 234 in orthokeratology group)	MD: −0.18 mm (−0.24 to −0.12) **Favours orthokeratology**
Rigid gas-permeable contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	2 RCTs in NMA by Lawrenson et al. (2023) (n = 176 in rigid gas-permeable contact lenses group)	MD: 0.02 mm (−0.07 to 0.12) **No significant difference between groups**

CI: confidence interval; MD: mean difference; mm: millimetres; n: number of study participants; NMA: network meta-analysis; NR: not reported; RCT: randomised controlled trial

Table A1.4 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Difference in change in axial length at two years in network meta-analysis

Intervention	Comparator	Evidence source	Absolute effect (95% CI)
Multifocal spectacle lenses	Single-vision spectacle lenses	3 RCTs in NMA by Lawrenson et al. (2023) (n = 404 in multifocal spectacle lenses group)	MD: −0.09 mm (−0.17 to −0.01) **Favours multifocal spectacle lenses**
Peripheral plus spectacle lenses	Single-vision spectacle lenses	2 RCTs in NMA by Lawrenson et al. (2023) (n = 188 in peripheral plus spectacle lenses group)	MD: −0.23 mm (−0.33 to −0.12) **Favours peripheral plus spectacle lenses**
Multifocal soft contact lenses	Single-vision soft contact lenses	5 RCTs in NMA by Lawrenson et al. (2023) (n = 540 in multifocal soft contact lenses group)	MD: −0.16 mm (−0.22 to −0.10) **Favours multifocal soft contact lenses**
Orthokeratology	Single-vision spectacle lenses	2 RCTs in NMA by Lawrenson et al. (2023) (n = 49 in orthokeratology group)	MD: −0.29 mm (−0.41 to −0.16) **Favours orthokeratology**
Rigid gas-permeable contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	2 RCTs in NMA by Lawrenson et al. (2023) (n = 154 in rigid gas-permeable contact lenses group)	MD: 0.03 mm (−0.08 to 0.15) **No significant difference between groups**

CI: confidence interval; MD: mean difference; mm: millimetres; n: number of study participants; NMA: network meta-analysis; NR: not reported; RCT: randomised controlled trial

Appendix 2. Outcomes for randomised controlled trials published since the network meta-analysis by Lawrenson et al. (2023)

Table A2.1 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses or contact lenses: difference in change in spherical equivalent refraction at one year

Intervention	Comparator	Evidence source (n)	Population	Absolute effect (MD ± SD)	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses	1 RCT by Fang et al. (2022) (n = 52)	• Age: 12.8 years (SD: ± 0.1) • % female: 54 • Baseline SER: -3.144 D (SD: ± 0.303) • Baseline AL: 24.85 mm (SD: ± 0.14) • Defocus amount of multifocal soft contact lenses: +6.00 D	• Multifocal soft contact lenses: -0.591 ± 0.106 D • Single-vision spectacle lenses: -0.938 ± 0.117 D p = 0.032 **Favours multifocal soft contact lenses**	• ITT analysis done, which includes those who dropped out of the study • The study was done in China and applicability to NHS Wales is uncertain • There were significantly more females completing the study in the multifocal soft contact lenses group than in the single-vision spectacle lenses group • This was a single-masked RCT, where only the investigators analysing the outcomes were masked
	Single-vision soft contact lenses in contralateral eye	1 RCT by Shen et al. (2022) (n = 72)	• EDOF CL in one eye • Age: 12.36 years (SD: ± 1.46) • % female: 44.4 • Baseline SER: -3.60 D (SD: ± 1.39) • Baseline AL: 24.97 mm (SD: ± 0.66)	• EDOF CL: -0.70 ± 0.49 D • Single-vision soft contact lenses: -0.88 ± 0.51 D p < 0.001 **Favours multifocal soft contact lenses**	• The study was done in Taiwan and applicability to NHS Wales in uncertain • The efficacy analyses were performed on the evaluable population (EP), who had worn contact lenses for a minimum of 9 months, and in the per-protocol population (PP), a subset of the EP population comprising all patients who fulfilled all of the inclusion and exclusion criteria and without major protocol deviations during the study period. Safety evaluations were conducted on the ITT population, which comprised all randomised subjects • The contralateral eye comparison design does not reflect the real-world situation, and the possibility of inter-ocular interactions could not be eliminated

Intervention	Comparator	Evidence source (n)	Population	Absolute effect (MD ± SD)	Comments on reliability
	Single-vision soft contact lenses	1 RCT by Weng et al. (2022) (n = 95)	• EDOF • Age: 10.8 years (SD: ± 1.5) • % female: 55 • Baseline SER: −2.01 D (SD: ± 0.68) • Baseline AL: 24.6 mm (SD: ± 1.0)	• Group I (control) SVCL: −0.25 ± 0.27 D • Group II SVCL: −0.30 ± 0.15 D • Group II EDOF CL: -0.11 ± 0.20 D	• Significance between groups unclear • Group I wore SVSF CL for 1-year. In Group II and III, myopia control CLs were worn in one and a SVCL in the other eye. CLs were crossed over at 6-months and worn for a further 6-months • The study was done in China and applicability to NHS Wales in uncertain • There was a significant amount of discontinuations in this study, 42 of 95 participants (44%)
	Single-vision soft contact lenses	1 RCT by Weng et al. (2022) (n = 34)	• Dual focus CL (MiSight) • Age: 10.8 years (SD: ± 1.6) • % female: 53 • Baseline SER: −1.91 D (SD: ± 0.72) • Baseline AL: 24.5 mm (SD: ± 0.8)	• Group I (control) SVCL: −0.25 ± 0.27 D • Group III SVCL: −0.26 ± 0.18 D • Group III dual focus CL: -0.18 ± 0.17 D	• Significance between groups unclear • Group I wore SVCL for 1-year. In Group II and III, myopia control CLs were worn in one and a SVCL in the other eye. CLs were crossed over at 6-months and worn for a further 6-months • The study was done in China and applicability to NHS Wales in uncertain • There was a significant amount of discontinuations in this study, 42 of 95 participants (44%)

CI: confidence interval; CL: contact lenses; D: dioptres; EDOF: extended depth of focus; ITT: intention-to-treat; MD: mean difference; mm: millimetres; n: number of study participants; PAL: progressive addition lens; SD: standard deviation; SER: spherical equivalent refractive error;

Table A2.2 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses or contact lenses: difference in change in spherical equivalent refraction at two years

Intervention	Comparator	Evidence source (n)	Population	Absolute effect (MD ± SD)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	1 RCT by Zhu et al. (2022) (n = 93)	• Customised PAL lenses • Age: 11.02 years (SD ± 0.24) • % female: 57 • Baseline SER: -1.91 D (SD: ± 0.13) • Baseline AL: 24.43 mm (SD: ± 0.11)	MD: 0.23 ± 0.08 D (0.04 to 0.42) p < 0.05 **Favours multifocal spectacle lenses**	• The study was done in China and applicability to NHS Wales is uncertain • Assessing myopic children with near esophoria

CI: confidence interval; D: dioptres; MD: mean difference; n: number of study participants; mm: millimetres; PAL: progressive addition lens; SD: standard deviation; SER: spherical equivalent refractive error

Table A2.3 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses or contact lenses: difference in change in axial length at one year

Intervention	Comparator	Evidence source (n)	Population	Absolute effect (MD ± SD)	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses	1 RCT by Fang et al. (2022) (n = 52)	• Age: 12.8 years (SD: ± 0.1) • % female: 54 • Baseline SER: -3.144 D (SD: ± 0.303) • Baseline AL: 24.85 mm (SD: ± 0.14) • Defocus amount of multifocal soft contact lenses: +6.00 D	• Multifocal soft contact lenses: 0.30 ± 0.03 mm • Single-vision spectacle lenses: 0.41 ± 0.04 mm p = 0.027 **Favours multifocal soft contact lenses**	• ITT analysis done, which includes those who dropped out of the study • The study was done in China and applicability to NHS Wales is uncertain • There were significantly more females completing the study in the multifocal soft contact lenses group than in the single-vision spectacle lenses group • This was a single-masked RCT, where only the investigators analysing the outcomes were masked
	Single-vision soft contact lenses in contralateral eye	1 RCT by Shen et al. (2022) (n = 72)	• EDOF CL in one eye • Age: 12.36 years (SD: ± 1.46) • %female: 44.4 • Baseline SER: -3.60 D (SD: ± 1.39) • Baseline AL: 24.97 mm (SD: ± 0.66)	• Multifocal soft contact lenses: 0.34 ± 0.19 mm • SVCL: 0.38 ± 0.19 mm p < 0.001 **Favours multifocal soft contact lenses**	• The study was done in Taiwan and applicability to NHS Wales is uncertain • The efficacy analyses were performed on the evaluable population (EP), who had worn contact lenses for a minimum of 9 months, and in the per-protocol population (PP), a subset of the EP population comprising all patients who fulfilled all of the inclusion and exclusion criteria and without major protocol deviations during the study period. Safety evaluations were conducted on the ITT population, which comprised all randomised subjects • The contralateral eye comparison design does not reflect the real-world situation, and the possibility of inter-ocular interactions could not be eliminated
	Single-vision soft contact lenses	1 RCT by Weng et al. (2022) (n = 31)	• EDOF • Age: 10.8 years (SD: ± 1.5) • %female: 55 • Baseline SER: -2.01 D (SD: ± 0.68) • Baseline AL: 24.6 mm (SD: ± 1.0)	• Group I (control) SVCL: 0.16 ± 0.09 mm • Group II SVCL: 0.15 ± 0.07 mm • Group II EDOF CL: 0.06 ± 0.09 mm	• Significance between groups unclear • Group I wore SVCL for 1-year. In Group II and III, myopia control CLs were worn in one and a SVCL in the other eye. CLs were crossed over at 6-months and worn for a further 6-months • The study was done in China and applicability to NHS Wales is uncertain • There was a significant amount of discontinuations in this study, 42 of 95 participants (44%)

Intervention	Comparator	Evidence source (n)	Population	Absolute effect (MD ± SD)	Comments on reliability
	Single-vision soft contact lenses	1 RCT by Weng et al. (2022) (n = 34)	• Dual focus CL (MiSight) • Age: 10.8 years (SD: ± 1.6) • %female: 53 • Baseline SER: −1.91 D (SD: ± 0.72) • Baseline AL: 24.5 mm (SD: ± 0.8)	• Group I (control) SVCL: 0.16 ± 0.09 mm • Group III SVCL: 0.14 ± 0.08 mm • Group III dual focus CL: 0.08 ± 0.07 mm	• Significance between groups unclear • Group I wore SVCL for 1-year. In Group II and III, myopia control CLs were worn in one and a SVCL in the other eye. CLs were crossed over at 6-months and worn for a further 6-months • The study was done in China and applicability to NHS Wales is uncertain • There was a significant amount of discontinuations in this study, 42 of 95 participants (44%)
Orthokeratology	Single-vision spectacle lenses	1 RCT by Fang et al. (2022) (n = 55)	• Age: 12.5 years (SD: ± 0.2 years) • % female: 41 • Baseline SER: −2.659 D (SD: ± 0.208) • Baseline AL: 24.85 mm (SD: ± 0.14)	• Orthokeratology: 0.31 ± 0.04 mm • single-vision spectacle lenses: 0.41 ± 0.04 mm p = 0.049 **Favours orthokeratology**	• ITT analysis done, which includes those who dropped out of the study • More children in the orthokeratology group discontinued the study than in the multifocal soft contact lenses group • The study was done in China and applicability to NHS Wales is uncertain • There were significantly more females completing the study in the multifocal soft contact lenses group than in the SVS group • This was a single-masked RCT, where only the investigators analysing the outcomes were masked
		1 RCT by Zhu et al. (2023) (n = 308)	• Average age: 9.20 years (SD ± 1.51) • Baseline AL: 23.53 ± 0.19 mm (ortho-K group) and 23.40 (SD ± 0.16 mm (control group)	• Orthokeratology: 0.22 ± 0.11 mm • Single-vision spectacle lenses: 0.35 ± 0.08 mm p < 0.001 **Favours orthokeratology**	• 29 children lost to follow-up (279 completed the study) • RCT not double-masked

CI: confidence interval; CL: contact lenses; EDOF: extended depth of focus; MD: mean difference; mm: millimetres; n: number of study participants; SD: standard deviation; SER: spherical equivalent refractive error

Table A2.4 Myopia control spectacle lenses and contact lenses compared to single-vision spectacle lenses or contact lenses: difference in change in axial length at two years

Intervention	Comparator	Evidence source (n)	Population	Absolute effect (MD ± SD)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	1 RCT by Zhu et al. (2022) (n = 44)	• Customised PALs • Age: 11.02 years (SD ± 0.24) • %female: 57 • Baseline SER: -1.91 D (SD: ± 0.13) • Baseline AL: 24.43 mm (SD: ± 0.11)	• Multifocal spectacle lenses: 0.61 ± 0.04 mm • single-vision spectacle lenses: 0.68 ± 0.05 mm p = 0.021 **Favours multifocal spectacle lenses**	• The study was done in China and applicability to NHS Wales is uncertain • Assessing myopic children with near esophoria

CI: confidence interval; D: dioptres; MD: mean difference; mm: millimetres; PAL: progressive addition lens; SD: standard deviation; SER: spherical equivalent refractive error

Table A2.5 Myopia control spectacle lenses and contact lenses compared to single-vision spectacle lenses or contact lenses: treatment adherence

Intervention	Comparator	Evidence source (n)	Population	Absolute values	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses	1 RCT by Fang et al. (2022) (n = 52)	• Age: 12.8 years (SD: ± 0.1) • % female: 54 • Baseline SER: −3.144 D (SD: ± 0.303) • Baseline AL: 24.85 mm (SD: ± 0.14) • Defocus amount of multifocal soft contact lenses: +6.00 D	• Multifocal soft contact lenses group: 4/26 (15.4%) children discontinued: - 2/26 lost to follow-up before 6-month visit - 2/26 not reported • Single-vision spectacle lenses group: 2/26 (8%) discontinued: - 1/26 lost to follow-up before 6-month visit - 1/26 lost to follow-up before 12-month visit	• The reasons for study discontinuation were not clearly reported • The study was done in China and applicability to NHS Wales is uncertain • There were significantly more females completing the study in the multifocal soft contact lenses group than in the single-vision spectacle lenses group • This was a single-masked RCT, where only the investigators analysing the outcomes were masked

D: dioptres; MD: mean difference; mm: millimetre; n: number of participants; PAL: progressive addition lens; SD: standard deviation; SER: spherical equivalent refractive error; SD: standard deviation;

Appendix 3. Subgroup analyses of spherical equivalent refraction and axial length (by age, baseline myopia level, ethnicity and lens design type)

Table A3.1 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Subgroup analysis - change in spherical equivalent refraction by age

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	1 RCT by Zhu et al. (2022) (n = 93)	• Follow-up time: 2 years • Multifocal spectacle lenses were customised PAL • Myopia children with near esophoria • Mean age: 11.02 years (SD ± 0.24) • Mean baseline SER: −1.91 D (SD: ± 0.13)	• Age 7 to 11 years: MD: 0.22 (SE: ± 0.13) (−0.07 to 0.52) D **No significant difference between groups** • 11 to 14 years: MD: 0.26 (SE: ± 0.10) (−0.08 to 0.61) D **No significant difference between groups** **No significant difference in treatment effect between age subgroups**	• Data were adjusted for age, gender, and baseline covariates, including SER, accommodative lag, number of myopic parents, and near phoria • The study was done in China and applicability to NHS Wales is uncertain • A questionnaire and telephone follow-up twice a year were the only ways spectacle-wear habits were monitored once the children left the clinic

D: dioptres; MD: mean difference; n: number of study participants; RCT: randomised controlled trial; PAL: progressive-addition lenses; SD: standard deviation; SE: standard error of mean; SER: spherical equivalent refraction

Table A3.2 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Subgroup analysis - change in spherical equivalent refraction by baseline spherical equivalent refraction

Intervention	Comparator	Evidence source	Population	Absolute effect (95% CI)	Comments on reliability
Multifocal spectacle lenses	Single-vision spectacle lenses	1 RCT by Zhu et al. (2022) (n = 93)	• Follow-up time: 2 years • Multifocal spectacle lenses were customised PAL • Myopia children with near esophoria • Mean age: 11.02 years (SD ± 0.24) • Mean baseline SER: −1.91 D (SD: ± 0.13)	• Less myopia (> −2.00 D): MD: 0.33 (SE: ± 0.09) (0.14 to 0.52) D **Favours multifocal spectacle lenses** • More myopia (≤−2.00 D): MD: 0.09 (SE: ± 0.12) (−0.15 to 0.33) D **No significant difference between groups** **Significant difference in treatment effect between myopia-level subgroups**	• Data were adjusted for age, gender, and baseline covariates, including SER, accommodative lag, number of myopic parents, and near phoria • The study was done in China and applicability to NHS Wales is uncertain • A questionnaire and telephone follow-up twice a year were the only ways spectacle-wear habits were monitored once the children left the clinic

D: dioptres; MD: mean difference; n: number of study participants; RCT: randomised controlled trial; PAL: progressive-addition lenses; SD: standard deviation; SE: standard error of mean; SER: spherical equivalent refraction

Table A3.3 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Subgroup analysis - change in spherical equivalent refraction by ethnicity

Intervention	Comparator	Evidence source	Population	Follow-up time	Absolute effect (95% CI)	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	MA by Yu et al. (2022) of 7 RCTs (n = 1,006 [n = 415 in Asian population, n = 591 in White population)	• Children 7 to 16 years • Asian and White children • Multifocal spectacle lenses included BFs or PAL with near additions between +0.50 and +2.50 D • Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group	1 year	• MD in Asian population: 0.12 (0.05 to 0.20) D **Favours multifocal soft contact lenses** • MD in White population: 0.18 (0.11 to 0.25) D **Favours multifocal soft contact lenses** • Total MD: 0.15 (0.10 to 0.20) D **Favours multifocal soft contact lenses** p = 0.31 **No significant difference between Asian and White populations**	• Authors of the MA stated that the RoB of the included studies was low overall • No significant publication bias was found for all trials • I2 = 26% (see Appendix 8 for description) • I2 = 4.8% for subgroup differences (see Appendix 8 for description) • Data for reasons for study drop out were not reported • There was disparity in the reporting of the number of participants, with the main text reporting n = 805 participants but the forest plots reporting n = 1,006 • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing. None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain
		Meta-analysis by Yu et al. (2022) of 4 RCTs (n = 783 [n = 320 in Asian population, n = 463 in White population)		2 years	• MD in Asian population: 0.22 (0.10 to 0.34) D **Favours multifocal soft contact lenses** • MD in White population: 0.19 (0.08 to 0.31) D **Favours multifocal soft contact lenses** • Total MD: 0.21 (0.12 to 0.29) D **Favours multifocal soft contact lenses**	• Authors of the MA stated that the RoB of the included studies was low overall • No significant publication bias was found for all trials • I2 = 0% (see Appendix 8 for description) • Data for reasons for study drop out were NR • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing • None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain

Intervention	Comparator	Evidence source	Population	Follow-up time	Absolute effect (95% CI)	Comments on reliability
					p = 0.77 **No significant difference between Asian and White populations**	

BF: bifocal; CI: confidence interval; D: dioptres; MA: meta-analysis; MD: mean difference; n = number of study participants; PAL: progressive-addition lenses; RCT: randomised controlled trial; RoB: risk of bias; SER: spherical equivalent refraction; SR: systematic review

Table A3.4 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Subgroup analysis - change in spherical equivalent refraction by lens design type

Intervention	Comparator	Evidence source(s)	Population	Follow up	Absolute effect (95% CI)	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	MA by Yu et al. (2022) of 7 RCTs (n = 1,006)	• Multifocal soft contact lenses included: - BF CL (n = 198) - MFCL (including MiSight CL) (n = 463) - Progressive power/varifocal power CLs (n = 345) • Children 7 to 16 years • Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group	1 year	• MD in BF CL group: 0.18 (0.07 to 0.30) D **Favours multifocal soft contact lenses** • MD in MFCL group: 0.14 (0.06 to 0.23) D **Favours multifocal soft contact lenses** • MD in progressive power/varifocal power CL group: **0.14 (0.06 to 0.22) D** **Favours multifocal soft contact lenses** • Total MD: 0.15 (0.10 to 0.20) D **Favours multifocal soft contact lenses** p = 0.84 **No significant difference between CL lens design types**	• Authors of the MA stated that the RoB of the included studies was low overall • No significant publication bias was found for all trials • I2 = 26% (see Appendix 8 for description) • I2 = 0% for subgroup differences (see Appendix 8 for description) • Data for reasons for study drop out were not reported • There was disparity in the reporting of the number of participants, with the main text reporting n = 805 participants but the forest plots reporting n = 1,006 • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing • None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain
		MA by Yu et al. (2022) of 4 RCTs (n = 783)	• Multifocal soft contact lenses included: - BF CL (n = 128) - MFCL (including MiSight CL) (n =	2 years	• MD in BF CL group: 0.21 (−0.01 to 0.43) D **No significant difference between groups** • MD in MFCL group: 0.24 (0.10 to 0.37) D **Favours multifocal soft contact lenses**	• Authors of the MA stated that the RoB of the included studies was low overall • No significant publication bias was found for all trials • I2 = 0%

Intervention	Comparator	Evidence source(s)	Population	Follow up	Absolute effect (95% CI)	Comments on reliability
			266) - Progressive power/varifocal power CLs (n = 389) • Children 7 to 13 years Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group		• MD in progressive power/varifocal power CL group: 0.18 (0**.05 to 0.31) D** **Favours multifocal soft contact lenses** • Total MD: 0.21 (0.12 to 0.29) D **Favours multifocal soft contact lenses** p = 0.81 **No significant difference between CL lens design types**	• Data for reasons for study drop out were not reported • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing • None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain
BF: bifocal; CI: confidence interval; CL: contact lens; D: dioptres; MA: meta-analysis; MD: mean difference; n = number of study participants; RCT: randomised controlled trial; SER: spherical equivalent refraction; SR: systematic review						

Table A3.5 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Subgroup analysis - change in axial length by ethnicity

Intervention	Comparator	Evidence source	Population	Follow-up time	Absolute effect (95% CI)	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	MA by Yu et al. (2022) of 7 RCTs (n = 617 [n = 215 in Asian population, n = 202 in White population)	• Children 7 to 16 years • Asian and White children • Multifocal spectacle lenses included BFs or PALs with near additions between +0.50 and +2.50 D • Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group	1 year	• MD in Asian population: −0.09 (−0.12 to −0.06) mm **Favours multifocal soft contact lenses** • MD in White population: −0.11 (−0.14 to −0.07) mm **Favours multifocal soft contact lenses** • Total MD: −0.10 (−0.12 to −0.07) mm **Favours multifocal soft contact lenses** **p = 0.46 No significant difference between Asian and White populations**	• Authors of the MA stated that the RoB of the included studies was low overall • There was heterogeneity in the AL data. The authors of the MA suggested that the RCT by Walline et al. (2020b) might have been the source of heterogeneity as AL measurement was performed after ciliary muscle paralysis, whereas several others did not. This RCT also had the smallest dropout rate and a mean age of 10.3 years, whilst the mean age in other RCTs ranged from 11.4 to 14.3 years • No significant publication bias was found for all trials • I2 = 0% (see Appendix 8 for description) • Data for reasons for study drop out were not reported • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing • None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain
		Meta-analysis by Yu et al. (2022) of 4 RCTs (n = 783 [n = 320 in Asian population, n = 463 in White population)		2 years	• MD in Asian population: −0.12 (−0.18 to −0.06) mm **Favours multifocal soft contact lenses** • MD in White population: −0.21 (−0.28 to −0.15) mm **Favours multifocal soft contact lenses**	• Authors of the MA stated that the RoB of the included studies was low overall • AL data revelated heterogeneity. The authors of the MA suggested that the RCT by Walline et al. (2020b) might have been the source of heterogeneity as AL measurement was performed after ciliary muscle paralysis, whereas several others did not. This RCT also had the smallest dropout rate and a mean age of 10.3 years, whilst the mean age in other RCTs ranged from 11.4 to 14.3 years • No significant publication bias was found for all trials

Intervention	Comparator	Evidence source	Population	Follow-up time	Absolute effect (95% CI)	Comments on reliability
					• Total MD: −0.16 (−0.21 to −0.11) mm **Favours multifocal soft contact lenses** **p = 0.05** **No significant difference between Asian and White populations**	• I2 = 17% (see Appendix 8 for description) • I2 = 73.1% for subgroup differences (see Appendix 8 for description) • Data for reasons for study drop out were NR • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing • None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain

AL: axial length; BF: bifocal; CI: confidence interval; MA: meta-analysis; MD: mean difference; mm: millimetres; n = number of study participants; RCT: randomised controlled trial; RoB: risk of bias; SER: spherical equivalent refraction; SR: systematic review

Table A3.6 Myopia-control spectacle lenses and contact lenses compared to single-vision spectacle lenses and single-vision contact lenses: Subgroup analysis - change in axial length by lens design type

Intervention	Comparator	Evidence source(s)	Population	Follow up	Absolute effect (95% CI)	Comments on reliability
Multifocal soft contact lenses	Single-vision spectacle lenses or single-vision soft contact lenses	MA by Yu et al. (2022) of 7 RCTs (n = 617)	• Multifocal soft contact lenses included: - BF CL (n = 198) - MFCL (including MiSight CL) (n = 337) - Progressive power/varifocal power CLs (n = 82) • Children 7 to 16 years • Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group	1 year	• MD in BF CL group: −0.10 (−0.14 to −0.07) mm **Favours multifocal soft contact lenses** • MD in MFCL group: −0.11 (−0.14 to −0.07) mm **Favours multifocal soft contact lenses** • MD in progressive power/varifocal power CL group: −0.07 (−0.12 to −0.02) mm **Favours multifocal soft contact lenses** • Total MD: -0.10 (−0.12 to −0.07) mm **Favours multifocal soft contact lenses** p = 0.41 **No significant difference between CL lens design types**	• Authors of the MA stated that the RoB of the included studies was low overall • AL data revelated heterogeneity. The authors of the MA suggested that the RCT by Walline et al. (2020b) might have been the source of heterogeneity as AL measurement was performed after ciliary muscle paralysis, whereas several others did not. This RCT also had the smallest dropout rate and a mean age of 10.3 years, whilst the mean age in other RCTs ranged from 11.4 to 14.3 years • No significant publication bias was found for all trials • AL data revealed heterogeneity • I2 = 0% (see Appendix 8 for description) • Data for reasons for study drop out were NR • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing • None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain
		MA by Yu et al. (2022) of 4 RCTs (n = 588)	• Multifocal soft contact lenses included: - BF CL (n = 128) - MFCL (including MiSight CL) (n = 266)	2 years	• MD in BF CL group: −0.11 (−0.20 to −0.02) mm **Favours multifocal soft contact lenses** • MD in MFCL group: −0.14 (−0.21 to −0.08) mm	• Authors of the MA stated that the RoB of the included studies was low overall • AL data revelated heterogeneity. The authors of the MA suggested that the RCT by Walline et al. (2020b) might have been the source of heterogeneity as AL measurement was performed after ciliary muscle paralysis, whereas several others

Intervention	Comparator	Evidence source(s)	Population	Follow up	Absolute effect (95% CI)	Comments on reliability
			- Progressive power/varifocal power CLs (n = 194) • Children 7 to 13 years Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group		**Favours multifocal soft contact lenses** • MD in progressive power/varifocal power CL group: −0.23 (−0.31 to −0.15) mm **Favours multifocal soft contact lenses** • Total MD: -0.16 (−0.21 to −0.11) mm **Favours multifocal soft contact lenses** p = 0.10 **No significant difference between CL lens design types**	did not. This RCT also had the smallest dropout rate and a mean age of 10.3 years, whilst the mean age in other RCTs ranged from 11.4 to 14.3 years • No significant publication bias was found for all trials • AL data revealed heterogeneity • I2 = 17% (see Appendix 8 for description) • I2 = 57.2% for subgroup differences (see Appendix 8 for description) • Data for reasons for study drop out were NR • Authors of the SR commented that studies without a clear added value of multifocal soft contact lenses were excluded and statistical analyses of these studies were missing • None of the studies were conducted in the UK and so applicability to NHS Wales is uncertain

AL: axial length; BF: bifocal; CI: confidence interval; CL: contact lens; D: dioptres; MA: meta-analysis; MD: mean difference; n = number of study participants; RCT: randomised controlled trial; SER: spherical equivalent refraction; SR: systematic review

Appendix 4. Inclusion and exclusion criteria for evidence included in the review

	Inclusion criteria	Exclusion criteria
Population	Children and adolescents with developmental myopia, without pathological changes	• Adults (over 18 years old) with myopia • Children with congenital myopia, where pathological changes have already occurred (congenital myopia may or may not occur with systemic disease or other ocular disease that can cause pathological structural changes)
Intervention	Myopia control spectacles and contact lenses, including: • Multifocal spectacles (either bifocal or progressive addition lenses) • Single-vision peripheral defocus spectacles • Concentric bifocal soft contact lenses • Multifocal soft contact lenses • Rigid gas permeable contact lenses • Spherical aberration soft contact lenses • Orthokeratology contact lenses	
Comparison/ Comparators	Current standard of care in Wales is prescription single or mono vision spectacles or contact lenses. At present, children under 16 years old are entitled to help towards the cost of single/mono vision spectacles and contact lenses in the form of a GOS 3 voucher from the NHS	• Undercorrection of myopia • Pharmaceutical agents, such as atropine eye drops, pirenzepine gel and cyclopentolate • Environmental interventions, such as time spent outdoors or modifications to the performance of near work
Outcome measures	• Progression of myopia (mean change in refractive error from baseline and mean change in axial length) • Visual acuity • Safety (e.g. incidence of adverse events) • Treatment adherence • Quality of life and patient satisfaction (e.g. EQ-5D, visual function as a patient-reported outcome) • Economic outcomes or other data (e.g. cost of intervention, resource use)	

Study design	We will prioritise the following study types, in the order listed: • Systematic reviews of randomised controlled trials. • Randomised controlled trials. • Non-randomised comparative trials. • Single-arm (no control group) trials that report any relevant outcome. We will only include evidence from "lower priority" sources where this is not reported by a "higher priority" source. This could be because higher priority evidence: • Does not cover all relevant populations • Does not compare the technology of interest to all relevant comparators • Does not cover all outcomes of interest • Reports over short-term follow up periods, and longer follow up data is required to facilitate decision making. Where relevant and well-conducted systematic reviews exist we will use these by: • Reporting or adapting their reported outcome measures where these are fully relevant to the scope of our review, and appropriate synthesis methods have been used • Using these reviews as a source of potentially relevant studies where the review cannot be used as a source of outcome data We will prioritise systematic reviews in terms of the sources of evidence they include, using the order described above.
Search date limits	We will search for evidence to supplement the Cochrane review
Language limits	English language only
Publication status	We will include evidence from studies that are published in full. We will only include evidence from conference abstracts if there are critical gaps in the fully published evidence. We will include details of any ongoing trials that have a planned completion or reporting date within 24 months of the date searches are carried out. We will only include trials of a design that is likely to add to the existing evidence in terms of certainty; for example, if we report evidence from randomised controlled trials in the EAR, we will only report details of ongoing trials if they also use a randomised design.
Subgroup analysis	Where the evidence allows, we will report outcomes separately according to: • Type of myopia control spectacle or contact lens • Age of participants • Ethnicity of participants • Degree of myopia at baseline

Appendix 5. MEDLINE search strategy

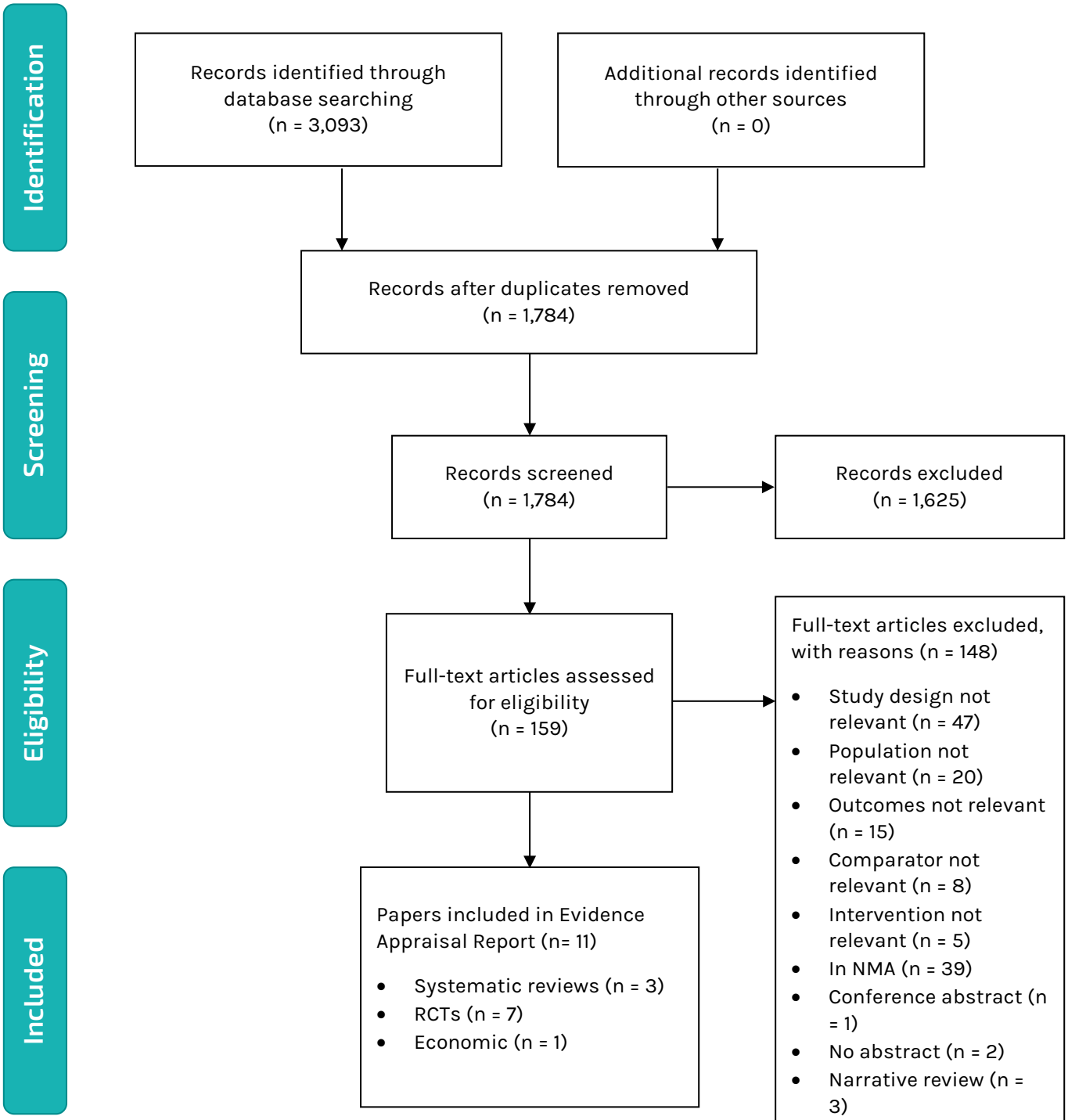
Ovid MEDLINE(R) ALL 1946 to March 31, 2023		
Myopia		
1	exp Myopia/	20851
2	(myopia or myopic or myopics or myope or myopes).tw,kf.	25807
3	((short or near) adj3 sight*).tw,kf.	482
4	(nearsight* or shortsight*).tw,kf.	306
5	or/1-4	31135
Myopia-control lenses		
6	Eyeglasses/	8074
7	exp Contact Lenses/	13921
8	(spectacles or glasses or eyeglass*).tw,kf.	19314
9	((progressive or single or vision or addition or bifocal or multifocal or spectacle or corrective) adj2 lens*).tw,kf.	4072
10	positive lens*.tw,kf.	178
11	(peripheral adj2 defocus adj4 lens*).tw,kf.	25
12	(multi-zone* adj2 lens*).tw,kf.	4
13	(base-in adj3 prism*).tw,kf.	96
14	(extend* adj2 depth adj3 focus).tw,kf.	466
15	EDOF.tw,kf.	261
16	(contact adj2 lens*).tw,kf.	16874
17	(MiSight or Biofinity Multifocal or Proclear Multifocal or MyoVision or MyopiLux or Myosmart).tw,kf.	75
18	Orthokeratologic Procedures/	440
19	(orthokeratolog* or ortho-k).tw,kf.	842
20	or/6-19	44815
Search Set Combinations		
21	5 and 20	4087
22	limit 21 to english language	3562
23	exp animals/ not humans/	5107928
24	22 not 23	3378
HTW Systematic Review filter		
25	systematic review.pt.	224833
26	systematic reviews as topic/	10253
27	((systematic$ or evidence$) adj (review$1 or overview$1)).tw,kf,kw.	288814
28	meta-analysis.pt.	178511
29	exp meta-analysis as topic/	26697
30	(meta-analy$ or metaanaly$ or metanaly$).tw,kf,kw.	267203
31	exp review literature as topic/	22113
32	or/25-31	466208
33	(medline or pubmed or medlars).ab.	311427
34	embase.ab.	148473
35	cochrane.ab,jw.	131553
36	(cinahl or cinhal).ab.	44399
37	(psychlit or psyclit or psychinfo or psycinfo).ab.	57355
38	science citation index.ab.	3724
39	cancerlit.ab.	638
40	british nursing index.ab.	418
41	hmic.ab.	360
42	current contents.ab.	1265
43	or/33-42	352200

44	reference list$.ab.	21803
45	bibliograph$.ab.	22183
46	(handsearch$ or hand-search$).ab.	11002
47	relevant journals.ab.	1335
48	manual search$.ab.	5920
49	(search adj (strategy or criteria)).ab.	24215
50	(search$ adj4 literature).ab.	95206
51	or/44-50	157595
52	review.pt.	3131711
53	((selection or inclusion or exclusion) adj criteria).ab.	186040
54	data extraction.ab.	31424
55	52 and (53 or 54)	74197
56	32 or 43 or 51 or 55	634796
57	comment.pt.	1001991
58	letter.pt.	1212000
59	editorial.pt.	644376
60	or/57-59	2146472
61	56 not 60	614775
HTW Guidelines/HTA filter		
62	exp Evidence-Based Medicine/	76445
63	practice guideline/	30304
64	guideline/	16553
65	exp guidelines as topic/	172709
66	guideline$.ti,kf.	105244
67	exp technology assessment, biomedical/	12086
68	((technology adj (apprais$ or assess$)) or HTA or HTAs).tw,kf,kw.	11160
69	rapid review*.ti,kf,kw.	1186
70	(evidence* adj2 (base* or synthes*)).ti,kf,kw.	45927
71	or/62-70	357442
HTW RCT filter		
72	Randomized Controlled Trials as Topic/	161329
73	randomized controlled trial/	589902
74	Random Allocation/	106916
75	Double-Blind Method/	174739
76	Single-Blind Method/	32597
77	Clinical Trial/	537573
78	clinical trial, phase i.pt.	24753
79	clinical trial, phase ii.pt.	39489
80	clinical trial, phase iii.pt.	21550
81	clinical trial, phase iv.pt.	2399
82	controlled clinical trial.pt.	95240
83	randomized controlled trial.pt.	589902
84	multicenter study.pt.	332284
85	clinical trial.pt.	537573
86	exp Clinical Trials as Topic/	381400
87	or/72-86	1556740
88	(clinical adj trial$).tw.	469046
89	((singl$ or doubl$ or treb$ or tripl$) adj (blind$3 or mask$3)).tw.	195756
90	PLACEBOS/	35926
91	placebo$.tw.	244701
92	(random$ adj allocat$).tw.	38519
93	(allocat$ adj2 random$).tw.	43057

94	or/88-93	772608
95	87 or 94	1895845
96	case report.tw.	389197
97	letter/	1212000
98	historical article/	369162
99	or/96-98	1951632
100	95 not 99	1853549
HTW Economics evidence filter (1)		
101	Economics/	27497
102	"costs and cost analysis"/	51240
103	Cost allocation/	2018
104	Cost-benefit analysis/	92060
105	Cost control/	21660
106	Cost savings/	12693
107	Cost of illness/	31387
108	Cost sharing/	2728
109	"deductibles and coinsurance"/	1850
110	Medical savings accounts/	547
111	Health care costs/	43976
112	Direct service costs/	1217
113	Drug costs/	17358
114	Employer health costs/	1097
115	Hospital costs/	11928
116	Health expenditures/	23818
117	Capital expenditures/	2001
118	Value of life/	5804
119	exp economics, hospital/	25693
120	exp economics, medical/	14387
121	Economics, nursing/	4013
122	Economics, pharmaceutical/	3098
123	exp "fees and charges"/	31338
124	exp budgets/	14097
125	(low adj cost$).mp.	86402
126	(high adj cost$).mp.	26113
127	(health?care adj cost$).mp.	16090
128	(fiscal or funding or financial or finance).tw.	193439
129	(cost adj estimate$).mp.	2700
130	(cost adj variable$).mp.	193
131	(unit adj cost$).mp.	3085
132	(economic$ or pharmacoeconomic$ or price$ or pricing).tw.	398921
133	or/101-132	919619
HTW Economics evidence filter (2)		
134	Economics/	27497
135	exp "Costs and Cost Analysis"/	263614
136	Economics, Nursing/	4013
137	Economics, Medical/	9242
138	Economics, Pharmaceutical/	3098
139	exp Economics, Hospital/	25693
140	Economics, Dental/	1920
141	exp "Fees and Charges"/	31338
142	exp Budgets/	14097
143	budget*.ti,ab,kf.	35466

144	(economic* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic* or pharmaco-economic* or expenditure or expenditures or expense or expenses or financial or finance or finances or financed).ti,kf.	276532
145	(economic* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic* or pharmaco-economic* or expenditure or expenditures or expense or expenses or financial or finance or finances or financed).ab. /freq=2	372713
146	(cost* adj2 (effective* or utilit* or benefit* or minimi* or analy* or outcome or outcomes)).ab,kf.	204943
147	(value adj2 (money or monetary)).ti,ab,kf.	2985
148	exp models, economic/	16187
149	economic model*.ab,kf.	4126
150	markov chains/	15926
151	markov.ti,ab,kf.	28502
152	monte carlo method/	32038
153	monte carlo.ti,ab,kf.	59187
154	exp Decision Theory/	13151
155	(decision* adj2 (tree* or analy* or model*)).ti,ab,kf.	36352
156	or/134-155	882414
157	61 or 71 or 100 or 133 or 156	3722875
Final Search Set Combination		
158	24 and 157	773

Appendix 6. Flow diagram outlining selection of relevant evidence sources



Appendix 7. Full sources of evidence and outcome data

Table A7.1 Included systematic reviews: design and characteristics

Review	Design, search period	Eligibility criteria	Trial/patient characteristics	Outcomes measured	Comments
Kandel (2022)	• SR of 2 RCTs (n = 190) • Searched up to 16 August 2020	• RCTs and non-RCTs were included • Studies were excluded if they evaluated the indirect impact of CL wear on QoL • Studies that used questionnaires on lens cleanliness, lens dryness, and lens handling were excluded • Articles which described the use of their own developed questionnaires without the minimum criteria for questionnaire development were excluded • Mixed population studies were excluded if they did not explicitly provide PROs of CL wear • Studies that used PRO measures for classifying but not for evaluating PROs of CL wear were excluded	• Comparisons included: - multifocal soft contact lenses vs single-vision spectacle lenses - rigid gas-permeable contact lenses CL vs single-vision soft contact lenses • Follow up: 2 to 3 years • Age: 8 to 12 years old • PREP and NEI-VFQ used to assess QoL • 1 RCT done in Spain and 1 in USA	QoL	• PREP categories included: Appearance, Satisfaction, Activities, Handling, Peer perceptions, Total score, Near vision Overall vision, Far vision, and Academics scores • NEI-VFQ included Pain or Comfort subscales
Lawrenson et al. (2023)	• NMA, pairwise MA and SR of 40 RCTs • 3/40 RCTs used a cross-over design (Anstice	• RCT studies of interventions intended to control myopia progression in children ≤ 18 years • Five RCTs restricted recruitment to those demonstrating a minimum myopia progression rate of at least 0.50 D in the year	• Comparisons included: - multifocal spectacle lenses vs single-vision spectacle lenses (13 RCTs) - peripheral plus spectacle lenses vs single-vision spectacle lenses (6 RCTs) - multifocal soft contact lenses vs single-vision soft contact lenses (9 RCTs)	• NMA and MA: - Change in SER and AL at 1 and 2 years • MA only: - Change in SER and AL at 3 years - Change in SER and AL following	• Most participants were recruited from academic clinic settings, hospitals and in a few cases from private optometry or ophthalmology practices

Review	Design, search period	Eligibility criteria	Trial/patient characteristics	Outcomes measured	Comments
	2011, Fujikado 2014, and Hasebe 2008 in Lawrenson et al. (2023)) • Searched for studies up to 4 February 2022	prior to enrolment (Anstice 2011, Cheng 2010, CONTROL Study 2016, Lu 2015, Zhu 2021)	- Orthokeratology vs single-vision soft contact lenses or single-vision spectacle lenses (9 RCTs) - rigid gas-permeable contact lenses contact lenses vs single-vision soft contact lenses or single-vision spectacle lenses (2 RCTs) • Follow-up time: 1 to 3 years • Age: 4 to 18 years • Baseline myopia level: low to moderate myopes (≤ –6.00 D) in 37/40 RCTs. Three RCTs (Charm 2013, Garcia-del Valle 2021, Lyu 2020) included children with myopia up to –8.75 D • Upper astigmatism limit: 1.00 D or 1.50 D for most studies • Children with myopia and esophoria: 3/40 RCTs (Fulk 1996, Fulk 2002, STAMP 2012) • Children with anisomyopia and interocular difference of ≥ 1.00 D: 1/40 RCTs (Zhang 2021) • Most trials took place in China or other Asian countries. They also took place in USA, Europe and Australia	cessation of treatment • SR only (narrative synthesis): - AEs - Treatment adherence	• Participants were sufficiently similar to satisfy the transitivity assumption for the NMA (i.e. that there were no systematic differences between the available comparisons other than the treatments being compared)
Yu et al. (2022)	• MA of 7 RCTs (n = 805) • Searched for studies up to 10 July 2021	• RCTs of children aged 6 to 18 years	• Intervention group: multifocal soft contact lenses with specific add powers (+0.50 D to +2.50 D). multifocal soft contact lenses included BF CL, dual focus CL, and progressive power/varifocal power CL • Control group: single-vision soft contact lenses or single-vision spectacle lenses • Follow-up time: 10 months to 3 years • Age: 7 to 16 years • 346 Asian children and 459 White children • Location: 2 RCTs from Spain, 1 from New Zealand, 1 from Hong Kong, 1 from Japan, 1 from China, 1 from USA	• Change in SER (reported overall change plus according to ethnicity and multifocal soft contact lenses design) • Change in AL • reported overall change plus according to ethnicity and multifocal soft	

Review	Design, search period	Eligibility criteria	Trial/patient characteristics	Outcomes measured	Comments
			• Baseline SER ranged from −2.16±0.44 D to −2.90±1.05 D in the multifocal soft contact lenses group, and −1.75±0.94 D to −3.31±1.76 D in the single-vision soft contact lenses and single-vision spectacle lenses group	contact lenses design)	

AE: adverse events; AL: axial length; BF: bifocal; CL: contact lens; D: dioptres; MA: meta-analysis; n: number of study participants; NEI-VFQ: National Eye Institute Visual Function Questionnaire; NMA: network meta-analysis; PREP: Paediatric Refractive Error Profile; PRO: patient-reported outcome; QoL: quality of life; RCT: randomised controlled trial; SER: spherical equivalent refraction; SR: systematic review; vs: versus

Table A7.2 Randomised controlled trials of myopia control contact lenses: design and characteristics

Study reference	Setting	Participants	Interventions	Outcomes	Follow-up	Comments
Fang et al. (2022)	China (2 hospitals)	• n = 88 • Age: 7 to 15 years • % female: 31% to 54% in each of the groups • Baseline SER: -1.00 D to -8.00 D • Baseline astigmatism: • ≤1.00 D • Recent myopia progression: ≥ 0.75 D in the last year or ≥ 0.50 D in the last 6-months • BCVA: not less than 20/20 • Exclusion criteria: history of ocular injury, ocular surgery, tumour, chronic ocular disease, contraindication, previous experience in contact lens wearing, previous myopia treatment, unwilling/unable to participate in follow-up visits, poor compliance with treatment, chronic systemic disease	• **Control**: SVS (Zeiss [Carl Zeiss Jena GmbH]) (n = 26) • **Intervention**: - multifocal soft contact lenses (BioThin [Bio Optic Inc.]) (n = 26), or - orthokeratology CLs (Paragon CRT [Paragon]) (n = 29)	• SER • AL • Treatment adherence	1-year	• Parallel, longitudinal, single-masked RCT • Subjects in the multifocal soft contact lenses group had to wear their lenses for 8-hours per day (8 a.m. to 8 p.m.) and wear their spectacles at other times • Subjects in the orthokeratology group had to wear their lenses before going to bed until waking up the next morning, ensuring the CL was worn for at least 8 hours during sleep • Subjects in the SVS group had to wear their spectacles beginning 8 a.m. every day until going to bed • AL was measured using IOLMaster 700 (Carl Zeiss Jena GmbH) • Cycloplegia was achieved using 1% cyclopentolate hydrochloride (Alcon) • Cycloplegic refraction was performed using Humphrey Autorefractor Keratometer HARK-599 (Carl Zeiss Meditec AG) • ITT analysis used to analyse data of subjects who dropped out of the study
Liu et al. (2023)	China	• n = 118 • Children 8 to 12 years old • Approximately 50% female • SER between -1.00 D to -4.00 D • Astigmatism < 1.50 D • Anisometropia < 1.00 D based on SER • BCVA: +11 logMAR or batter in each eye • No use of myopia-control measures in last 6 months	• **Control**: SVS • **Intervention**: CARE spectacle lenses	• SER • AL • Visual acuity • Adherence and discontinuation	1 year	• SER measured with NIDEK ARK-510A • AL measured with IOL Master700 (Carl Zeiss Meditec AG) • Visual acuity measured using NIDEK RT-5100 (Eye Vision Development)

Study reference	Setting	Participants	Interventions	Outcomes	Follow-up	Comments
Rappon et al. (2022)	14 sites in North America	• n = 256 • Age: 6 to 10 years. Mean age: 8.1 years • %female/male: 58.2% female • Baseline SER: ranged from -0.75 D to -4.50 D • Baseline astigmatism: ≤1.25 D • Baseline anisometropia: ≤1.50 D • BCVA: +0.10 logMAR or better in each eye Exclusion criteria: current or prior use of contact lenses (>1 month), bifocals, progressive lenses or myopia control treatment (including atropine); amblyopia, ocular or systemic conditions that could influence refractive development or status, and strabismus by cover test at far (4 m) or near (40 cm) when wearing distance correction.	• **Control**: SVS (PPG Trivex monomer lenses (PPG Industries) with a light, green tint that reduced light transmission by 5%) (n = 93) • **Intervention**: - Test 1: DOT technology applied to PPG Trivex monomer lenses (PPG Industries) with 0.365 mm spacing (n = 88), or - Test 2: DOT technology applied to PPG Trivex monomer lenses (PPG Industries) with 0.240 mm spacing (n = 75)	• SER (focussed on least-squared difference) • AL (focussed on least-squared difference) • Adherence • AEs	1 year	• The Control of Myopia Using Peripheral Diffusion Lenses Efficacy and Safety Study (CYPRESS) is a 36-month, randomised controlled trial evaluating the efficacy and safety of SightGlass Vision DOT spectacle lenses for slowing the progression of juvenile myopia. • Subject-masked and observer-masked. • SER was measured by cycloplegic autorefraction using open-field auto refractometers (WR-5100K - Grand Seiko) or equivalent. • Cycloplegia was achieved using one drop of 0.5% proparacaine or tetracaine in both eyes followed by two drops of 1.0% tropicamide, given 5 min apart, in both eyes. Cycloplegic autorefractor measurements were taken 25 min after the final drop of tropicamide was instilled. • AL was measured using the Lenstar 900 (Haag-Streit Diagnostics). • Likert-style subject questionnaires were administered at each visit to monitor the visual and social impact of study spectacles, including visual artefacts such as glare, halos and hazy vision. Parent questionnaires were administered to monitor compliance and the visual impact of study spectacles.
Shen et al. (2022)	Taiwan	• n = 72 • Age: 9 to 14 years. Mean 12.36 (SD 1.46) years • %female: 44.4 • Baseline SER: ranged from -1.00 D to -8.00 D • Baseline astigmatism: ≤1.75 D	• **Control:** SVCL in one eye (Ticon Daily Disposable Aspherical Soft Contact Lens [2-hydroxyethyl methacrylate and methacrylic acid, St.	• SER • AL	1 year	• Prospective, multicentre, randomised, double-masked, placebo-controlled, contralateral-eye comparison clinical trial • CLs worn at least 8 hours per day, 5 days a week, for 52 weeks. Each contact lens was worn and then replaced daily • Cycloplegia was achieved using one drop of a 0.5% tropicamide and 0.5% phenylephrine

Study reference	Setting	Participants	Interventions	Outcomes	Follow-up	Comments
		• Recent myopia progression: at least 0.75 D in the past 12 months • BCVA: 0.1 logMar or better Exclusion criteria: anisometropia > 2.00 D, ocular disease preventing contact lens wear, severe ocular or systemic allergies, the use of any medications that might interfere with contact lens wear or ocular refraction, ocular or systemic conditions that might affect refractive development, use of atropine or pirenzepine treatment for myopia control within the past month, prior use of orthokeratology lenses, dry eye (Schirmer's test < 5 mm/5 min), or other physical conditions that prevented the use of contact lenses.	Shine Optical Co., Ltd]) (n = 72) • **Intervention**: EDOF CL in subjects' other eye (experimental soft daily lens [2-hydroxyethyl methacrylate and methacrylic acid, App Vision Care Co., Ltd]) (n = 72)			hydrochloride solution (Mydrin-P®, Santen Pharmaceutical Co., Ltd • Cycloplegic refraction was performed three times at 5-min intervals using the Topcon KR-8800 autorefractor • Axial length was measured using LENSTAR LS 900 all-in-one biometer, Haag-Streit AG • The contact lens prescription could be changed based on the investigator's judgment or when the BCVA decreased by one or more lines or below 0.1 logMAR
Weng et al. (2022)	China	• n = 95 (Group I: n = 30; Group II: n = 31; Group III: n = 34) • Age: 7 to 13 years. Mean age: 10.8 (SD: 1.5) years • %female/male: 43:57 (Group 1), 55:45 (Group II), 53:47 (Group III) • Baseline SER: ranged from -0.75 D to -3.50 D • Baseline astigmatism: < 0.75 D • Baseline anisometropia: ≤0.75 D	• **Group I (control):** SVCL (1 day Acuvue Moist [etafilcon A, Johnson & Johnson Vision Care Inc.]) in both eyes • **Group II**: EDOF CL (hydrogel Aquamax [etafilcon A, pegavision.com]) in 1 eye and SVCL in the contralateral eye for 6-months. Participants	• SER • AL • Visual acuity • Adherence	1-year (Group I wore SVCL for 1-year. In Group II and III, CLs were crossed over at 6-months and worn for a further 6-months): - SER was measured at	• Prospective, masked, randomised cross over clinical trial • All CLs were hydrogel materials • Participants were required to apply the CL on waking and wear them until disposing of them prior to sleep. Participants were advised not to sleep in CLs overnight but short naps in the CL during the day were allowed • All children were required to have an up-to-date pair of spectacles for any occasion where they were unable to wear CLs • Participants could dispose of their own CLs. They were required to collect and bring in the

Study reference	Setting	Participants	Interventions	Outcomes	Follow-up	Comments
		Exclusion criteria: known allergy to cycloplegic or anaesthetic eye drops, previous history of myopia control treatments	swapped the EDOF CL and SVCL between the eyes for the next 6-months • **Group III**: dual-focus CL (MiSight [Omafilcon A]) in 1 eye and SVCL in the contralateral eye for 6-months. Participants swapped the EDOF CL and SVCL between the eyes for the next 6-months		baseline and every 6-months thereafter AL was measured at baseline and every 3-months thereafter	foils of the lens blister packs for each lens worn to check for compliance • Participants were advised to use 0.9% sodium chloride (Pfizer) as necessary for lens rinsing, as an in-eye lubricant or for storing lenses removed due to an AE • Cycloplegia was achieved using 1% cyclopentolate hydrochloride (Alcon) preceded by proxymetacaine hydrochloride (Alcon) • AL measurements were assessed using Lenstar 900 (haag-streit.com) • Cycloplegic refraction measurements were assessed using Shin Nippon K 5001
Zhu et al. (2022)	China	• n = 93 • Multifocal spectacle lenses were customised PALs • Myopia children with near esophoria • Mean age: 11.02 years (SD ± 0.24) • %female: 57 • Baseline SER: -1.91 D (SD: ± 0.13) • Baseline AL: 24.43 mm (SD: ± 0.11)	• **Intervention**: PAL (multifocal spectacle lenses) • **Control**: single-vision spectacle lenses	• SER (overall change plus change by age and baseline SER) • AL • Treatment adherence	2 years	• Data were adjusted for age, gender, and baseline covariates, including SER, accommodative lag, number of myopic parents, and near phoria • A questionnaire and telephone follow-up twice a year were the only ways spectacle-wear habits were monitored once the children left the clinic
Zhu et al. (2023)	China	• n = 308 (29 lost to follow-up so 279 children completed study) • Average age: 9.20 years (SD ± 1.51) • % female: 72 (ortho-K group) and 69 (control group)	• **Intervention**: orthokeratology • **Control**: single-vision spectacle lenses	• AL	13 months	• At 1 year, children went through withdrawal of orthokeratology for 1 month

Study reference	Setting	Participants	Interventions	Outcomes	Follow-up	Comments
		• Baseline SER: -2.74 ± 0.39 D (ortho-K group) and -2.73 ± 0.41 D (control group) • Baseline AL: 23.53 ± 0.19 mm (ortho-K group) and 23.40 ± 0.16 mm (control group)				

< less than; ≤less than or equal to

AE: adverse event; AL: axial length; BCVA: best-corrected visual acuity; CARE: cylindrical annular refractive element; CL: contact lens; D: dioptres; EDOF: extended depth of focus; HAL: highly aspherical lenslet; logMAR: Logarithm of the Minimum Angle of Resolution; MFVA: multifunctional visual acuity test; n: number of participants; ortho-K: orthokeratology; PAL: progressive addition lenses; SAL: slightly aspherical lenslet; SD: standard deviation; SE: spherical equivalent refractive error; SV: single-vision; SVS: single-vision spectacle lenses

Appendix 8. Description of certainty of evidence categories

ROB2 tool (Higgins et al. 2022):

- Low risk of bias: low risk of bias for all domains*
- Some concerns: some concerns in at least one domain*, but not at high risk of bias for any domain*
- High risk of bias: high risk of bias in at least one domain* or the study is judged to have some concerns for multiple domains* in a way that substantially lowers confidence in the result

*Domains include: bias arising from randomisation process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of the outcome, and bias in selection of the reported result

I^2 to assess statistical heterogeneity (Deeks et al. 2022):

- 0% to 40% may not be important
- 30% to 60% may represent moderate heterogeneity
- 50% to 90% may represent substantial heterogeneity
- 75% to 100% represents considerable heterogeneity

Appendix 9. Ongoing studies

Table A9.1 Summary of ongoing primary studies

Study information	Status	Study characteristics and outcomes
Multifocal spectacle lenses		
Registration: NCT05477329 **Country:** Israel **Target recruitment:** 136 participants **Follow-up:** NR **Estimated study completion date:** December 31, 2024	Active, not recruiting **Last updated:** August 1, 2022	**Population**: Children aged six to 12 years with SER between −0.50 D and −5.00 D **Intervention**: PAL **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER **Secondary Outcome Measure:** Change in AL
Peripheral plus spectacle lenses		
Registration: NCT05373693 **Country:** China **Target recruitment:** 160 participants **Follow-up:** two years **Estimated study completion date:** September 30, 2022	Active, not recruiting **Last updated:** May 13, 2022	**Population**: Children aged six to 15 years with SER between −1.00 D and −5.00 D **Intervention**: PDL (three different power addition lenses) **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER at two years **Secondary Outcome Measure:** Change in AL at two years and visual acuity
Registration: NCT05331378 **Country:** Singapore **Target recruitment:** 80 participants **Follow-up:** one year **Estimated study completion date:** June 2023	Active, not recruiting **Last updated:** November 4, 2022	**Population**: Children aged eight to 13 years with SER between −0.75 D and −4.75 D **Intervention**: myopia-control spectacle lenses with aspherical lenslets **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in AL **Secondary Outcome Measure:** Change in SER
Registration: ChiCTR1800017683 **Country:** China **Target recruitment:** 218 participants **Follow-up:** NR **Estimated study completion date:** NR	Recruiting **Last updated:** NR	**Population**: Children aged eight to 15 years **Intervention**: Defocus lenses **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER, AL, visual acuity

Study information	Status	Study characteristics and outcomes
Multifocal soft contact lenses		
Registration: NCT05159765 **Country:** China, Singapore, USA, Canada **Target recruitment:** 114 participants **Follow-up:** three years **Estimated study completion date:** August 2025	Recruiting **Last updated**: October 6, 2022	**Population**: Children aged seven to 13 years with SER between –0.75 D and –5.00 D **Intervention**: NaturalVue multifocal soft contact lenses **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER **Secondary Outcome Measure:** Change in AL
Registration: ACTRN12620000159954 **Country:** Australia **Target recruitment:** 72 participants **Follow-up:** one year **Estimated study completion date:** August 2025	Recruiting **Last updated**: NR	**Population**: Children aged six to 12 years with SER between –0.50 D and –5.00 D **Intervention**: ACUVUE OASYS for presbyopia multifocal soft contact lenses **Comparator**: single-vision soft contact lenses **Primary Outcome Measure**: Change in AL and SER **Secondary Outcome Measure:** Change in AL
Orthokeratology		
Registration: NCT05192824 **Country:** China **Target recruitment:** 200 participants **Follow-up:** Two years **Estimated study completion date:** December 31, 2025	Recruiting **Last updated**: January 14, 2022	**Population**: Children aged eight to 13 years with SER between –1.00 D and 4.00 D **Intervention**: Orthokeratology (four different types of optical zone) **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in AL and SER at one year **Secondary Outcome Measure:** Visual acuity
Novel lenses		
Registration: NCT05340699 **Country:** China **Target recruitment:** 168 participants **Follow-up:** two years **Estimated study completion date:** May 20, 2023	Active, not recruiting **Last updated**: December 7, 2022	**Population**: Children aged six to 13 years with SER between –1.00 D and 5.00 D **Intervention**: Defocus distributed multi-point lens **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER and AL at one year **Secondary Outcome Measure:** Change in SER and AL at two years

Study information	Status	Study characteristics and outcomes
Novel lenses		
Registration: NCT05740904 **Country:** China **Target recruitment:** 172 participants **Follow-up:** one year **Estimated study completion date:** June 30, 2024	Not yet recruiting **Last updated:** February 23, 2023	**Population**: Children aged six to 14 years with SER between –1.00 D and –3.50 D **Intervention**: Defocus spectacles **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER at one year **Secondary Outcome Measure:** Change in AL, visual acuity, visual scale quality of life score (Chinese version of PREP2), Adherence and safety
Registration: NCT04947735 **Country:** USA **Target recruitment:** 200 participants **Follow-up:** three years **Estimated study completion date:** June 30, 2025	Active, not recruiting **Last updated:** September 29, 2022	**Population**: Children aged six to 17 years with myopia **Intervention**: DOT spectacle lenses **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER and AL at three years **Secondary Outcome Measure:** Change in SER at five years and AL at 42 months
Registration: NCT05562622 **Country:** China **Target recruitment:** 200 participants **Follow-up:** one year **Estimated study completion date:** June 30, 2025	Active, not recruiting **Last updated:** September 29, 2022	**Population**: Children aged six to 17 years with myopia **Intervention**: DOT spectacle lenses **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in SER and AL at three years **Secondary Outcome Measure:** Change in SER at five years and AL at 42 months
Registration: NCT05288335 **Country:** China **Target recruitment:** 240 participants **Follow-up:** one year **Estimated study completion date:** January 31, 2024	Not yet recruiting **Last updated:** November 2, 2022	**Population**: Children aged six to 13 years with SER between –0.75 D and –5.00 D **Intervention**: DOT spectacle lenses **Comparator**: single-vision spectacle lenses **Primary Outcome Measure**: Change in AL at one year

AL: axial length; D: dioptres; DOT: diffusion optics technology; NR: not reported; PAL: progressive addition lens; PDL: peripheral defocus lens; SER: spherical equivalent refraction

Appendix 10. HTW cost utility analysis

1. Background and objective

A cost utility analysis was performed to estimate the cost effectiveness of myopia-control spectacles and contact lenses for children and adolescents in Wales.

2. Methods

2.1 Model approach

A cohort-level state transition model was developed in Microsoft Excel to estimate myopia progression in childhood and the incidence of long-term myopia-related complications in later adulthood. An overview of the model structure is provided in Figure 1 which was implemented over 6-month cycles.

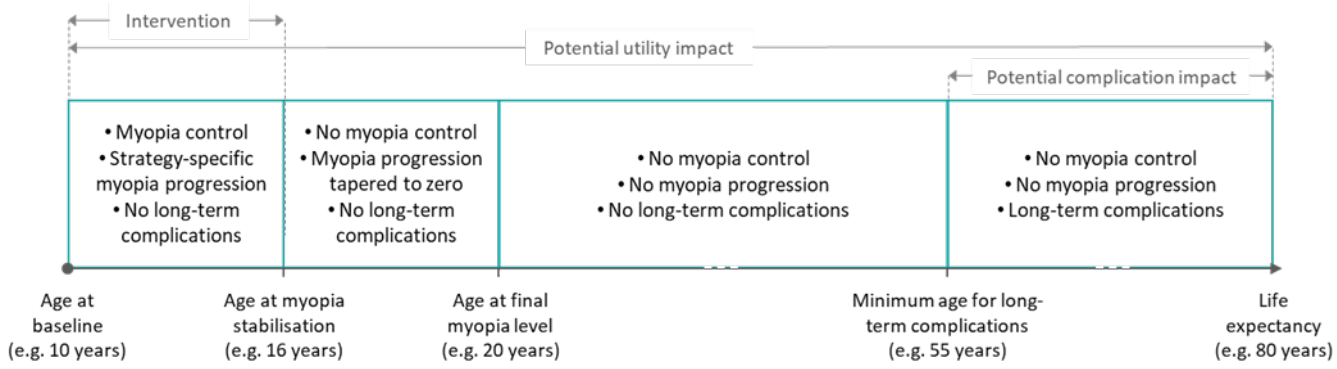


Figure 1. Overview of model structure over modelled life course

Myopia progression was modelled in terms of spherical equivalent refractive error (SER). Severity was defined by SER thresholds, with SER of more than -3 dioptres (D) but no more than -0.5 D corresponding to mild, SER more than -6 D but no more than -3 D corresponding to moderate, and SER no more than -6 D corresponding to high myopia (Figure 2). The risk of retinal detachment, cataract, glaucoma, myopic macular degeneration (MMD) and low vision were modelled adjusting for severity of myopia.

The impact of different myopia-control strategies was captured via reduced rates of myopia progression and later complications, with costs and health-related utility decrements (or disutilities) applied. The model took the perspective of the UK NHS and personal social services (PSS). Costs and quality-adjusted life years (QALYs) were evaluated over a lifetime horizon and discounted at an annual rate of 3.5%.

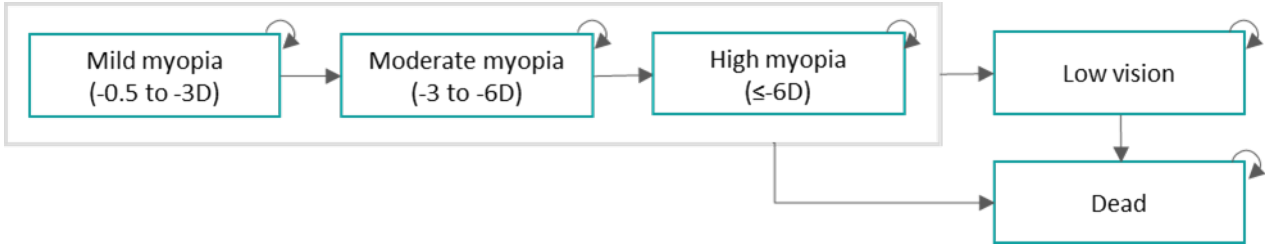


Figure 2. Modelled health states

The following strategies were modelled:

- Single-vision lens spectacles or contact lenses (SVL)
- Multifocal soft contact lenses (MFSCL) – progressive or concentric ring design
- Peripheral plus spectacle lenses (PPSL) – peripheral defocus lenses, including defocus incorporated multiple segments or highly aspherical lenslet target technology
- Orthokeratology (Ortho-K)

Rigid gas-permeable contact lenses were not modelled as they were found to have little to no benefit in the review by Lawrenson et al. (2023). Though multifocal spectacle lenses (MFSL) were estimated to have statistically significant effects at year 1 and year 2, Lawrenson et al. (2023) reported the effects were not clinically significant at either time point. Experts contacted by HTW advised that MFSL should not be considered in the health economic analysis for this reason. Diffusion optics technology (DOT) and cylindrical annular refractive element (CARE) spectacle lenses were not considered because they are not currently available in the UK and no prices were identified.

We compared all strategies against each other within a fully incremental analytical framework. The strategies were first ranked in order of outcomes, from lowest to highest QALYs. Any strategy with both lower QALYs and higher costs than an alternative (i.e., dominated) or offering worse value for money than the next, more effective strategy (i.e., extendedly dominated) was removed from consideration. Then incremental costs, QALYs, health benefit and cost effectiveness ratios (ICERs) were estimated for each strategy compared to the previously ranked option. The strategy associated with the highest total health benefit at a willingness to pay threshold of £20,000 per QALY was considered the optimal strategy.

2.2 Clinical data

2.2.1 Baseline characteristics

The baseline cohort profile was based on studies included in the review by Lawrenson et al. (2023) (Table A10.1).

Table A10.1 Baseline characteristic inputs

Input	Mean	SE / α, β, distribution	Source
Male (%)	48%	5,576, 6,040, beta	Lawrenson et al. (2023)
Age (years)	10.4	1.1, normal	Lawrenson et al. (2023); SE estimated from study means
SER (D)	-2.7	1.2, normal	Approximated from baseline characteristics of studies included in meta-analyses
CI: confidence interval; D: dioptres; SE: standard error; SER: spherical equivalent refractive error			

2.2.2 Efficacy and safety

The primary source for model inputs describing the efficacy and safety of interventions was the review by Lawrenson et al. (2023). The limitations of these data are discussed in Section 5.

2.2.2.1 Myopia progression

The modelled effects of myopia-control strategies were controlled by absolute differences in myopia progression, defined at years 1 and 2 from baseline. Lawrenson et al. (2023) based their

comparisons on classical pairwise meta-analyses because the network underpinning the network meta-analysis (NMA) was poorly connected. We therefore used estimates from the meta-analysis in our base case (Table A10.2) and NMA in scenario analysis (Table A10.3).

We did not model a difference between PPSL and SVL in SER change from baseline to year 2 because the meta-analysed estimate was not statistically significant. For completeness, all other estimated effects were modelled regardless of effect size. However, it was noted that while the effects of MFSCL exceeded the thresholds for clinically significant differences referred to by Lawrenson et al. (2023) of at least 0.25 D or 0.1 millimetres (mm) at year 1, they were less than 0.50 D or 0.2 mm at year 2.

Table A10.2 Efficacy estimates from meta-analysis (base case)

Mean (SE)	SER change from baseline (D)		Axial length change from baseline (mm)	
	Year 1	Year 2	Year 1	Year 2
SVL	-0.65	-1.02	0.31	0.56
Difference v SVL				
MFSCL	0.26 (0.05)	0.30 (0.06)	-0.11 (0.01)	-0.15 (0.02)
PPSL	0.51 (0.16)	0.34 (0.21, NS)	-0.13 (0.05)	-0.20 (0.13, NS)
Ortho-K	N/A	N/A	-0.19 (0.02)	-0.28 (0.05)

D: dioptres; MFSCL: multifocal soft contact lenses; mm: millimetre; N/A: not applicable; NS: not statistically significant; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; SER: spherical equivalent refractive error; SVL: single-vision lenses

Table A10.3 Efficacy estimates from network-meta analysis (scenario analysis)

Difference v SVL Mean (SE)	SER change from baseline (D)		Axial length change from baseline (mm)	
	Year 1	Year 2	Year 1	Year 2
MFSCL	0.23 (0.07)	0.31 (0.09)	-0.11 (0.02)	-0.16 (0.03)
PPSL	0.28 (0.12)	0.34 (0.15)	-0.14 (0.03)	-0.23 (0.05)
Ortho-K	N/A	N/A	-0.18 (0.03)	-0.29 (0.06)

D: dioptres; MFSCL: multifocal soft contact lenses; mm: millimetre; N/A: not applicable; NS: not statistically significant; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; SE: standard error; SER: spherical equivalent refractive error

The interpretation of SER measurements for ortho-K is complicated because overnight wear of these lenses reshapes the cornea, temporarily reducing SER. The impact of ortho-K on SER progression can only be assessed when the cornea returns to its pre-treatment shape after lens wear has ended. For this reason, Lawrenson et al. (2023) did not assess SER changes associated with ortho-K. We followed the modelling approach of Fricke et al. (2022) and assumed that ortho-K had the same proportional effect on SER as axial length (Table A10.4). Though this approach is associated with considerable uncertainty, it is supported by published correlations between progression of SER and axial length which were used to estimate SER effects for ortho-K in sensitivity analysis (Table A10.4).

Table A10.4 Modelled effects of Ortho-K on SER

Difference v SVL	SER change from baseline (D)				Basis for association between progression of SER and axial length
	MA, Year 1	MA, Year 2	NMA, Year 1	NMA, Year 2	
Base case	0.40 (-61%)	0.51 (-50%)	0.38 (-58%)	0.53 (-52%)	Fricke et al. (2022) assumed SER and AL effects proportionally equal
Scenario A	0.44	0.52	0.42	0.54	Jakobsen et al. (2021), ortho-K and SVL: -1D per 0.53 (female) to 0.6mm (male)
Scenario B	0.36	0.48	0.35	0.49	Chen et al. (2023), ortho-K: $\Delta SER = -0.094 - 1.608*\Delta AL$

AL: axial length; D: dioptres; Ortho-K: orthokeratology; MA: meta-analysis; NMA: network meta-analysis; SER: spherical equivalent refractive error; SVL: single-vision lenses; Δ: change

Most studies included in the review followed children for up to two years and there was limited evidence on whether benefits are sustained after this time. Longer-term data were only available for MFSCL but suggested this intervention continues to slow myopia progression. It was therefore necessary to extrapolate the modelled effects of myopia controls after the first two years.

In the base case, we assumed that the rate of myopia progression modelled over the second year was maintained in following years. This approach accounts for the possibility that most of the intervention effect happens in the first year of treatment. However, it may overestimate the effect of myopia controls if their effectiveness diminishes further over time. We tested alternative assumptions in scenario analysis, including no extrapolation of effects and ending all interventions after two years.

2.2.2.2 Adverse events, discontinuation and adherence

Adherence was not considered in the model because the review by Lawrenson et al. (2023) found adherence to be similar between control and intervention arms for MFSCL, and there were no data for PPSL or ortho-K.

There is uncertainty around the incidence of adverse events because of inconsistency in reporting across trials. Lawrenson et al. (2023) found that adverse events were generally mild with similar rates reported in control and intervention arms for MFSCL and PPSL. However, adverse events were more common with ortho-K. Corneal staining was the most common adverse event (36/254 ortho-K, 3/62 SVL), with four cases of grade 3 or worse. Rates of discontinuation due to adverse events were not reported for PPSL, were low for MFSCL (<1%), but more common for ortho-K (5%).

We modelled 5% discontinuation due to adverse events in the first cycle of ortho-K use. In the base case, no adverse events or discontinuations were modelled for other arms. However, the incidence of adverse events with MFSCL use and microbial keratitis with ortho-K use were considered in a sensitivity analysis. A higher rate of discontinuation with ortho-K was also tested.

In the base case, PPSL was stopped after two years because no difference in SER compared with SVL was modelled. Otherwise myopia controls were stopped for all arms at age 16, to coincide with the age that myopia progression typically begins to stabilise. We tested a younger age in sensitivity analysis to reflect the entry criteria of RCTs included in the meta-analyses, most with upper age limits between 11 and 15 years.

2.2.2.3 Rebound

The studies included in the review by Lawrenson et al. (2023) found no evidence of rebound one year after the cessation of MFSCL. No studies assessing rebound following cessation of PPSL or ortho-K were described. We therefore assumed that no rebound occurred, and after discontinuation of myopia controls, myopia progressed at the same rate as the SVL arm.

2.2.3 Stabilisation of myopia

Progression of myopia typically stabilises in adolescence. However, experts noted that individuals may experience progression into their twenties. Slowing rates of myopia progression were modelled by gradually tapering the rate of SER change to zero between the ages of around 16 and 20 years in the base case (Table A10.5), or 24 years in a scenario analysis. Figure 3 illustrates modelled SER progression for the control arm and two intervention strategies.

Table A10.5 Myopia progression inputs

Input (years)	Mean	SE, distribution	Source
Age when myopia begins to stabilise	15.6	0.2, normal	COMET Group (2013)
Age at final myopia level	20	2, normal	Assumption based on COMET Group (2013); SE chosen to allow variation between 16 and 24
COMET: Correction of Myopia Evaluation Trial; SE: standard error			

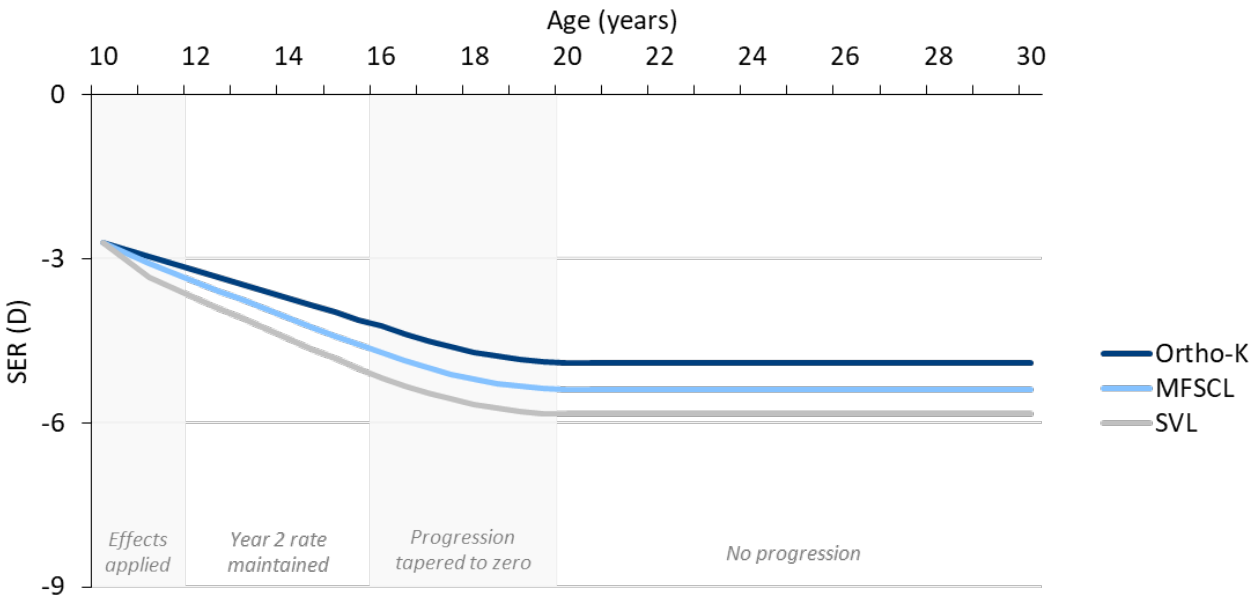


Figure 3. Illustration of modelled SER progression for selected strategies

2.2.4 Long-term complications

Long-term complications were modelled from age 55 because the available evidence comes from older populations. The incidence of cataract was estimated by applying odds ratios for mild, moderate and high myopia (Haarman et al. 2020) to a baseline for people with normal vision in

an Australian cohort study (Kanthan et al. 2014). All other complications were modelled according to the approach described by Fricke et al. (2022) for the Australian setting (Table A10.6).

Occupancy of the low-vision health state was modelled according to prevalence of vision impairment (base case) or blindness (sensitivity analysis) from Fricke et al. (2022) (Table A10.7). Cataract, glaucoma and retinal detachments were not modelled for people in this health state.

Table A10.6 Cataract, glaucoma, MMD and retinal detachment inputs

Myopia severity	Mean	Description and source
PSC cataract		
-3 D < SER ≤ -0.5 D	1.56	Odds ratios meta-analysed by Haarman et al. (2020); these were applied to incidence for emmetropia (4.3%) reported by Kanthan et al. (2014) at 10 years from the Blue Mountains Eye Study in Australia
-6 D < SER ≤ -3 D	2.55	
SER ≤ -6 D	4.55	
Nuclear cataract		
-3 D < SER ≤ -0.5 D	1.79	Odds ratios meta-analysed by Haarman et al. (2020); these were applied to incidence for emmetropia (18.0%) reported by Kanthan et al. (2014) at 10 years from the Blue Mountains Eye Study in Australia
-6 D < SER ≤ -3 D	2.39	
SER ≤ -6 D	2.87	
Glaucoma		
SER > -1 D	0%	Prevalence modelled by Fricke et al. (2022), citing Mitchell et al. (1999) as source data
-3D < SER ≤ -1 D	2.7%	
SER ≤ -3 D	2.9%	
MMD		
SER > -1 D	0%	Prevalence modelled by Fricke et al. (2022), citing Vongphanit et al. (2002) as source data
-3 D < SER ≤ -1 D	0.7%	
-5 D < SER ≤ -3 D	3.0%	
-7 D < SER ≤ -5 D	11.4%	
-9 D < SER ≤ -7 D	28.6%	
SER ≤ -9 D	52.4%	
Retinal detachment		
SER > -3 D	0%	Incidence between ages 55 and 83 years modelled by Fricke et al. (2022), citing Flitcroft (2012), Li (2003), (2010), Ogawa & Tanaka (1988), Polkinghorne & Craig (2004), Wong et al. (1999) as source data; converted to annual probability within the model
-6 D < SER ≤ -3 D	0.09%	
-9 D < SER ≤ -6 D	1.8%	
-15 D < SER ≤ -9 D	28.6%	
SER ≤ -15 D	74.6%	

<: less than; ≤: less than or equal to; >: greater than; D: dioptres; MMD: myopic macular degeneration; PSC: Posterior subcapsular; SER: spherical equivalent refractive error

Table A10.7 Low-vision inputs used in base case or scenario analysis

Myopia severity	Vision impairment		Blindness		Description and source
	Age < 60	Age ≥ 60	Age < 60	Age ≥ 60	
-3D < SER ≤ -0.5D	0%	0%	0%	0%	Prevalence modelled by Fricke et al. (2022), citing Bourne et al. (2017), Flaxman et al. (2017), Tideman et al. (2016), Verhoeven et al. (2015)
-6D < SER ≤ -3D	0.95%	1.03%	0.09%	0.10%	
-10D < SER ≤ -6D	2.94%	6.01%	0.29%	0.60%	
SER ≤ -10D	14.01%	28.88%	1.40%	3.20%	
D: dioptres; SER: spherical equivalent refractive error					

Background mortality for the general population was modelled according to 2017-2019 (pre-pandemic) life tables for Wales (Office for National Statistics 2021). Age-specific probabilities of all-cause mortality were weighted according to the sex-distribution of the cohort at baseline. Hazard ratios of 1.23 and 1.54 were applied to those with visual impairment and blindness, respectively (Christ et al. 2008).

2.3 Resource use and costs

Costs captured in the model include myopia controls and correction, optometry visits, and management of long-term complications. Only the costs of sight tests and correction provided by the NHS were included. Expenses incurred by people with myopia and their families fall outside the NHS and PSS perspective taken in our analysis.

Wales General Ophthalmic Services contract

Under current standard of care, NHS sight tests and optical vouchers toward the cost of corrective spectacles or contact lenses are available for children aged less than 16 years and those aged 16 to 18 in full-time education. Costs applicable under the Wales General Ophthalmic Services (WGOS) contract were provided by Welsh Government (Table A10.8 and Table A10.9). NHS fees to community optometry practices include £43 for a standard sight test, and it was assumed that cycloplegic refraction, contact lens after care and annual reassessments would cost £53, while specialist fittings would cost £91. The value of optical vouchers starts at £22 for single-vision lenses and increases with the requirement for stronger prescriptions or specialist lenses. There is no provision for the higher cost of myopia-control lenses under the current system.

Table A10.8 Wales General Ophthalmic Services clinical fees

Clinical service	Fee
WGOS Level 1 (Sight Test)	£43
WGOS Level 2 (Previously EHEW Band 1)	£70
WGOS Level 2 (Previously EHEW Band 2)	£53
WGOS Level 2 (Previously EHEW Band 3)	£26
WGOS Level 3 (Previously LVSW Initial Assessment and Annual Review)	£90 £43 eye exam

Clinical service	Fee
	£53 LV exam
WGOS Level 4 (Referral Refinement or Monitoring)	£91
WGOS Level 5 (Independent Prescribing)	£125
WGOS Level 5 (Follow up Independent Prescribing)	£62
WGOS Level 5 (Monitoring)	£94
WGOS Domiciliary Fee	£26

EHEW: Eye Health Examination Wales; LV: low vision; LVSW: Low Vision Service Wales; WGOS: Wales General Ophthalmic Service

Table A10.9 Wales General Ophthalmic Services optical vouchers

Voucher	Value
1. Glasses with single-vision lenses of a spherical power ≤ 6D with a cylindrical power ≤ 2D	£22
2. Glasses with single-vision lenses: (a) of a spherical power > 6D but < 10D with a cylindrical power ≤ 6D; (b) of a spherical power < 10D with a cylindrical power > 2D but ≤ 6D	£42
3. Glasses with single-vision lenses of a spherical power ≥ 10D but ≤ 14D with a cylindrical power ≤ 6D.	£155
4. Glasses with single-vision lenses: (a) of a spherical power > 14D but ≤ 20D with any cylindrical power; (b) of a cylindrical power > 6D but ≤ 10D with any spherical power	£276
5. Glasses with single-vision lenses: (a) of a spherical power > 20D with any cylindrical power; (b) of a cylindrical power > 10D with any spherical power	£377
6. Glasses with multifocal lenses of a spherical power ≤ 6D with a cylindrical power ≤ 2D	£40
7. Glasses with multifocal lenses: (a) of a spherical power > 6D but < 10D with a cylindrical power ≤ 6D; (b) of a spherical power < 10D with a cylindrical power > 2D but ≤ 6D	£77
8. Glasses with multifocal lenses of a spherical power ≥ 10D but ≤ 14D with a cylindrical power ≤ 6D	£299
9. Glasses with prism-controlled multifocal lenses of any power or with multifocal lenses: (a) of a spherical power > 14D but ≤ 20D with any cylindrical power; (b) of a cylindrical power > 6D but ≤ 10D with any spherical power	£387
10. Glasses with multifocal lenses: (a) of a spherical power > 20D with any cylindrical power; (b) of cylindrical power > 10D with any spherical power	£530
11. Glasses not falling within paragraphs 1 to 10 for which a prescription is given in consequence of a sight test by a Local Health Board	£530
12. Contact lenses for which a prescription is given in consequence of a sight test by a Local Health Board	£57

D: dioptres

2.3.1 Myopia correction and control

In the control arm, we applied the costs of NHS sight tests and optical vouchers to all children aged less than 16 years and to a percentage of 16 to 18 year olds according to participation in full-time education: 73% of 16 year olds, 67% of 17 year olds and 54% of 18 year olds (Welsh Government 2022b). In the intervention arms, we applied these costs after each myopia-control strategy was stopped.

There are no list prices for myopia controls because they are not currently available through the NHS. We therefore estimated model inputs from costs published online by private opticians. Myopia controls are commonly offered via monthly payment plans, with an upfront cost for spectacle lenses or fitting. Prices varied considerably, so we tested a lower and upper cost scenario (Table A10.11). The costs of specialist equipment or training were not explicitly costed in our analysis; we assumed these would be accounted for within the prices set by private opticians.

A cost of £5.36 was applied to ortho-K discontinuations to represent the cost of hypromellose eye drops and a paraffin-based eye ointment used to treat corneal staining (NHS Prescription Services 2023). The application of this cost was considered conservative because experts advised that for many children, corneal staining would be resolved without treatment. We assumed that any associated optometry visits would be covered by the monthly cost of the intervention applied in the first 6-month cycle.

The costs of sight tests and vision correction after age 18 years were not modelled. We assumed that NHS provision in later adult life (e.g. free sight tests from age 60) would be the same in all modelled arms. This may bias against interventions that slow myopia progression if reduced myopia levels lead to the requirement for lower-value optical vouchers for a minority of people eligible for them in later life.

Table A10.10 Strategy resource use

Strategy	Resource use
SVL	• WGOS optical vouchers: assumed voucher 1 if SER > -6D and voucher 2 if SER ≤ -6D • NHS sight tests and optical vouchers assumed annual for children under 16 years; then once every two years subject to participation in FTE for ages 16 to 18 years • Sensitivity analysis tested 6-monthly testing under age 16 for fast progressing myopia in line with memorandum of understanding on sight test intervals (Department of Health 2002)
PPSL	• Initial assessment including cycloplegic refraction • 6-monthly follow-up appointments • Spectacles, with replacement assumed annually for children under 16 years
MFSCL	• Initial assessment including cycloplegic refraction • Specialist contact lens fitting • Lenses and 6-monthly follow-up appointments typically provided as part of a package • Spectacles, assumed to be provided in line with SVL optical vouchers as back-up
Ortho-K	• Initial assessment including cycloplegic refraction • Ortho-K lenses and fitting • Replacement lenses and 6-monthly follow-up appointments typically provided as part of a package; assume lenses replaced annually

D: dioptres; FTE: full time education; MFSCL: multifocal soft contact lenses; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; SER: spherical equivalent refractive error; SVL: single-vision lens spectacles or contact lenses; WGOS: Wales General Ophthalmic Service

Table A10.11 Intervention cost inputs (January 2023)

Input	Base case	Lower scenario	Upper scenario	Frequency	Rationale and sources
SVL					
WGOS voucher SER > -6D SER ≤ -6D	 £22 £42	As base	As base	Annually <16 years, then every two years	Assumed WGOS voucher 1 or 2
Sight test	£43	As base	As base		WGOS (Welsh Government 2021)
PPSL					
Regular payment	£44	£8.25	£44	Monthly	Estimated from private opticians with different payment structures to provide MiYOSMART or Stellest lenses, fitting and follow-up (Cardiff University, Donner, Rawlings, Tomlinson, 2020 eyes, Wilson, Wilson & Hancock)
Lump-sum payment	£0	£238.90	£117.14	Annually	
MFSCL					
Regular payment	£40	£23.62	£60	Monthly	Estimated from private opticians offering MiSight or NaturalVue lenses (Cardiff University, Central Vision, Martin Reynolds, Plymouth University). WGOS visits and average manufacturer prices of NaturalVue and Mylo used in lower scenario
Assessment and fitting	£100	£134	£300	Once at initiation only	
Spectacles SER > -6D SER ≤ -6D	 £22 £42	As base	As base	As per SVL	Assumed required as back-up; WGOS voucher 1 or 2
Ortho-K					
Regular payment	£40	£30	£60	Monthly	Estimated from private opticians (Cardiff University, Central vision, iGO, Martin Reynolds, Plymouth University)
Assessment and fitting	£200	£165	£400	Once at initiation only	

D: dioptres; MFSCL: multifocal soft contact lenses; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; SER: spherical equivalent refractive error; SVL: single-vision lens spectacles or contact lenses; WGOS: Wales General Ophthalmic Service

2.3.2 Long-term complications

Other health state and complication costs were obtained from the British National Formulary (BNF), NHS Reference Costs (2020/21) and the literature. Costs were inflated to 2021/22 prices where necessary (Jones et al. 2023).

Table A10.12 Health state and complication cost inputs

Input	Mean	SE, distribution	Source
Low vision (annual)	£7,959	£796, gamma	Cost for severe vision impairment health state in NG81 (NICE 2022), citing Meads & Hyde (2003) inflated from £7,046.85 (2015/16 prices)
MMD (annual)	£60	£6, gamma	Assumed that 8% (Wong et al. 2014) treated for myopic choroidal neovascularisation with ranibizumab (£537 for single dose, BNF (2023)) and out-patient minor vitreous retinal procedure (BZ87A, NHS England (2022))
Glaucoma (annual)	£631	£63, gamma	Cost for early glaucoma in NG81 (NICE 2022), citing Traverso et al. (2005) inflated from £559 (2015/16 prices)
Retinal detachment (event)	£1,708	£171, gamma	NHS England (2022); non-elective minor (BZ87A), intermediate (BZ86B) or major CC score 0-1 (BZ84B) vitreous retinal procedures, weighted by activity
PSC or nuclear cataract (event)	£1,741	£174, gamma	NHS England (2022); phacoemulsification cataract extraction and lens implant, any CC score (BZ34A-C), weighted by activity

BNF: British National Formulary; CC: complications and co-morbidities; MMD: myopic macular degeneration; NG: NICE guideline; NICE: National Institute for Health and Care Excellence; PSC: Posterior subcapsular; SE: standard error
Standard errors assumed to be 10% of the mean

2.4 Health-related quality of life

The model summarises health effects in terms of QALYs. These are estimated by combining life year estimates with a baseline utility and health state or event-related utility decrements. In the base case analysis, baseline utility was adjusted for age and utility decrements were applied additively.

We did not find published health-related quality of life data that met the National Institute for Health and Care Excellence (NICE) preference for utility estimates collected from the target population, using a generic measure (e.g. EQ-5D) and valued using UK preference weights. There was a general lack of appropriate quality of life data collected from children and adolescents. Myopia studies typically collect vision-specific measures, such as vision-related quality of life (VR-QoL), National Eye Institute 25-Item Visual Function Questionnaire (NEI-VFQ-25), Pediatric Eye Questionnaires (PedEyeQ), or Pediatric Refractive Error Profile (PREP). Although we did identify utility mapping studies for NEI-VFQ (Kay & Ferreira 2014, Payakachat et al. 2009, Rentz et al. 2014), it was not possible to use these to produce robust utility estimates from summary information. The sensitivity of EQ-5D to capture differences in quality of life associated with visual impairment has also been criticised. Consequently, there is uncertainty around the model inputs used in our analysis (Table A10.14).

2.4.1 Myopia correction and control strategies

The systematic review by Kandel (2022) described in Section 5.11 is among literature that suggests myopia-control and correction strategies may not be equal in terms of patient satisfaction and aspects of quality of life. For example, better vision-specific quality of life has been shown among children and teens using contact lenses compared with spectacles (Lipson et al. 2022, Plowright et al. 2015, Pomeda et al. 2018, Rah et al. 2010, Walline et al. 2007) and for ortho-K compared with SVL (Lipson et al. 2022). However, without studies that quantify

intervention-specific benefits in terms of health-related utility, these differences could not be included in our analysis.

We did not apply a utility decrement to the discontinuation of ortho-K due to adverse events because appropriate utility estimates were not identified and it was assumed that corneal staining would be resolved within a few days.

2.4.2 Severity of myopia

Quality of life has been shown to worsen with severity of myopia among adults in the UK (Rose et al. 2000) using a vision-specific measure. Utilities estimated via EQ-5D or time trade-off (TTO) methods are available for other ophthalmic conditions, including age-related macular degeneration, diabetic retinopathy, vision loss from any cause, or general refractive error. However, these estimates can be highly variable across studies. They typically come from older populations and describe relationships between utility and visual acuity (measured via minimum angle of resolution (MAR), log of MAR (logMAR), Snellen, or ETDRS letters).

Visual acuity is less commonly reported as an outcome of myopia studies. The relationship between refractive error and visual acuity has been described for children participating in the Collaborative Longitudinal Evaluation of Ethnicity and Refractive Error (CLEERE) Study (Kleinstein et al. 2021). On average, visual acuity fell by around 0.5 MAR per 0.3 to 0.4 D in myopic SER. However, the authors noted there was considerable variability in this relationship. They also grouped all children with SER no more than -3 D together in their analysis. This limits our ability to use visual acuity as a means of linking myopia progression to utility.

We therefore followed the approach taken by a previous cost utility analysis of screening for myopia in New Zealand (Hong et al. 2022) to apply WHO disability weights to myopia health states and the presence of myopia-related abnormalities (e.g., MMD). Like a utility decrement, the WHO disability weights represent a percentage reduction from perfect health. However, the weights could overestimate the impact of refractive error in high income countries where correction is widely accessible. Table A10.13 shows the most recently published values for impaired distance vision, which were estimated via discrete choice experiments in several European countries: Hungary, Italy, the Netherlands and Sweden (WHO 2020).

Table A10.13 Disability weights applied in the 2019 WHO Global Burden of Disease and Global Health Estimates (WHO 2020)

Level of VI	Description	Visual acuity	Disability weight
Mild VI	Has some difficulty with distance vision, e.g. reading signs, but no other problems with eyesight	Worse than 6/12 but no worse than 6/18	0.005
Moderate VI	Has vision problems that make it difficult to recognize faces or objects across a room	Worse than 6/18 but no worse than 6/60	0.089
Severe VI	Has severe vision loss, which causes difficulty in daily activities, some emotional impact (e.g. worry), and some difficulty going outside the home without assistance	Worse than 6/60 but no worse than 3/60	0.314
Blind	Is completely blind, which causes great difficulty in some daily activities, worry and anxiety, and great difficulty going outside the home without assistance	Worse than 3/60	0.338
VI: visual impairment of distance vision			

Hong et al. (2022) made the following assumptions:

- Mild to moderate myopia ~ WHO mild impairment of distance vision
- High myopia ~ WHO moderate impairment of distance vision
- Pathological myopia ~ average of WHO moderate and severe impairment of distance vision

2.4.3 Long-term complications

Utility decrements associated with long-term complications were sourced from the literature. Utility decrements associated with retinal detachment and cataract events were defined as absolute losses, accounting for the assumed duration of their impact; others were defined as weights applied to the prevalence of each condition in each cycle.

Table A10.14 Health-related utility inputs

Input	Mean	α, β, distribution	Source
Baseline utility (age dependent)	0.924	109, 9, beta	Hernández Alava et al. (2022); EQ-5D (UK value set) from England general population; assumed equal to utility at age 16, weighted by percentage male
Utility decrement			
Mild myopia	0.005	3, 549, beta	WHO, mild VI
Moderate myopia	0.005	3, 549, beta	WHO, mild VI
High myopia	0.089	15, 152, beta	WHO, moderate VI
MMD	0.202	21, 84, beta	Average of WHO, moderate and severe VI; applied instead of myopia decrements
Low vision	0.326	19, 39, beta	Average of WHO, severe VI and blind
Glaucoma	0.061	29, 439, beta	Jampel (2001); TTO US population with glaucoma
Retinal detachment (event)	0.0325	97, 2,879, beta	0.13 (Busbee et al. (2002), TTO US) assumed to last 3 months (NICE TA346, TA613, TA824); standard error assumed 10% of mean
PSC or nuclear cataract (event)	0.037	96, 2,505, beta	0.148 (Busbee et al. (2002), TTO US) assumed to last 3 months; standard error assumed 10% of mean

MMD: myopic macular degeneration; PSC: posterior subcapsular; TA: technology appraisal; TTO: time trade-off; VI: visual impairment
Sampling distributions for WHO disability weights were assumed based on size of variances reported for earlier estimates reported for WHO Global Burden of Disease (2015)

3. Results

3.1 Base case results

The base case analysis was performed using mean values for all model inputs, except for baseline SER, which was sampled to model variation in starting values. The results of pairwise and fully incremental analyses are summarised in Table A10.15 and Table A10.16

All myopia-control strategies were estimated to increase costs compared with SVL, and all but PPSL provided small QALY gains. PPSL was estimated to have little benefit because its modelled use was ended after two years, when no SER difference was modelled between PPSL and SVL, based on non-significant results of the meta-analysis.

The higher intervention costs of MFSCL and ortho-K were partially offset by the avoidance of more expensive optical vouchers and long-term complications, including entering the low-vision health state. QALY gains were driven by the avoidance of progression to high myopia. Cost effectiveness estimates improved over longer modelled time horizons, as more of these QALY gains were captured.

Over a lifetime horizon, MFSCL and ortho-K were estimated to be cost effective compared to SVL at a threshold of £20,000 per QALY gained. In fully incremental analysis, ortho-K was estimated to be the optimal strategy, providing the highest total health benefit of the strategies considered and better value for money than MFSCL.

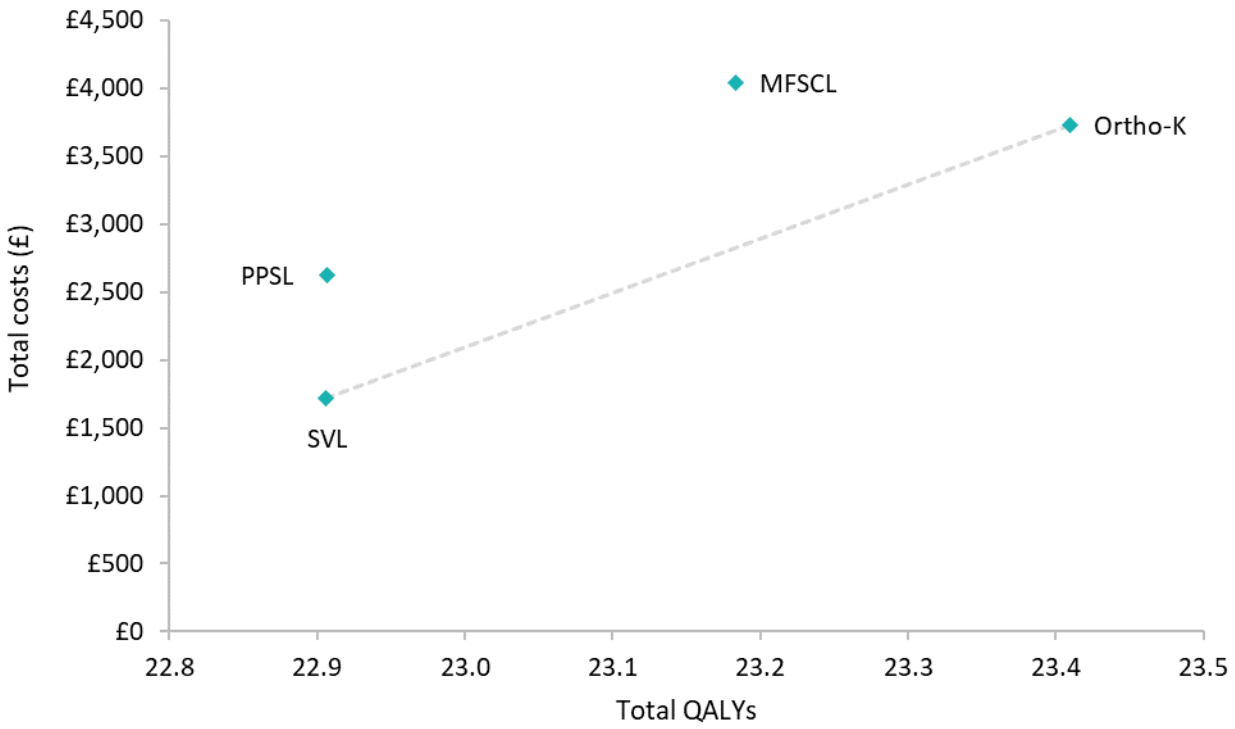


Figure 4. Base case results with efficiency frontier shown as dashed line

Table A10.15 Summary of base case pairwise analysis

Strategy	Total costs	Total QALYs	Total health benefit	Incremental costs	Incremental QALYs	Net health benefit	ICER (£/QALY)
SVL	£1,718	22.91	22.82	N/A	N/A	N/A	N/A
MFSCL	£4,040	23.18	22.98	£2,322	0.28	0.16	£8,367
PPSL	£2,628	22.91	22.78	£910	0.00	-0.04	> £1M
Ortho-K	£3,732	23.41	23.22	£2,014	0.50	0.40	£3,995

ICER: incremental cost effectiveness ratio; M: million; MFSCL: multifocal soft contact lenses; N/A: not applicable; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; QALY: quality-adjusted life-year; SVL: single-vision lens spectacles or contact lenses
Results estimated over 1.000 iterations. Total and net health benefit estimated at a willingness to pay threshold of £20,000 per QALY.

Table A10.16 Summary of base case fully incremental analysis

Strategy	Comparator on efficiency frontier	Total costs	Total QALYs	Total health benefit	Incremental costs	Incremental QALYs	Net health benefit	ICER (£/QALY)
SVL	Reference strategy	£1,718	22.91	22.82	N/A	N/A	N/A	N/A
PPSL	N/A	£2,628	22.91	22.78	N/A	N/A	N/A	N/A
MFSCL	N/A	£4,040	23.18	22.98	N/A	N/A	N/A	N/A
Ortho-K	SVL	£3,732	23.41	23.22	£2,014	0.50	0.40	£3,995

ICER: incremental cost effectiveness ratio; MFSCL: multifocal soft contact lenses; N/A: not applicable; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; QALY: quality-adjusted life-year; SVL: single-vision lens spectacles or contact lenses
Results estimated over 1.000 iterations. Total and net health benefit estimated at a willingness to pay threshold of £20,000 per QALY.

3.2 Scenario analyses

We used scenario analyses to assess the impact of alternative inputs and assumptions (Table A10.17) on cost-effectiveness estimates. Table A10.18 and Figure 5 summarise these results.

Table A10.17 Description of scenario analyses

Area	Analysis
Effects and duration of intervention	NMA estimates applied (Table A10.3); PPSL continued up to age 16 as for other strategies
	SER effect of ortho-K varied (Table A10.4)
	Average annual change in SER over first two years applied to later years
	All strategies stopped after two years to reflect trial durations (i.e. no extrapolation)
	All myopia controls stopped at age 13 to reflect lower entry criteria in some trials
	MFSCL and ortho-K continued for 16- to 18-year olds, irrespective of education status
Adverse events and discontinuation	4.5 adverse events per 100 patient years with MFSCL (Cheng et al. 2020); cost £5.36 and no utility decrement per event. Note that no adverse events were applied to the SVL arm, despite single-vision contact lens use for some children in this arm.
	13.9 microbial keratitis events per 10,000 patient years with ortho-K (Bullimore et al. 2013); cost £4,211 (Moussa et al. 2021) and utility decrement 0.03 (assumed 0.1 for 3 months based on Arunga et al. (2019))
	Adverse events resolved without treatment when ortho-K discontinued due to adverse events
	No discontinuation due to adverse events in the ortho-K arm
	50% discontinuation of ortho-K in first cycle
Strategy costs	Costs of myopia control strategies varied (Table A10.11)
	One-off cost of cycloplegic refraction applied to SVL arm
SER progression	Baseline SER and timing of stabilisation and final myopia level sampled
	No progression after age of stabilisation
	Progression continued until age 24 years
	Fast progressing cohort: -0.75 D annual progression and 6-monthly sight tests and optical vouchers under the age of 16 years in SVL arm; no change to the effect inputs
Long-term complications	Prevalence and mortality for low vision health state informed by data for blindness
	Minimum age for long-term complications assumed 40 years
Utilities	Assume that moderate myopia corresponds to WHO moderate VI
	Use disability weights from WHO 2015 Global Burden of Disease: mild VI 0.003, moderate VI 0.031, severe VI 0.184, blind 0.187 (Salomon et al. 2015)
	Glaucoma utility decrement varied between 0.02 and 0.10 to reflect values applied to early and moderate glaucoma in NG81 (NICE 2022)
	Cataract utility decrement of 0.08 applied to reflect decrement of 0.28 for 109 days (Hopkins et al. 2008)
	Fixed baseline utility value instead of age-dependent
	Multiplicative application of utilities

D: dioptres; MFSCL: multifocal soft contact lenses; NG: NICE guideline; NMA: network meta-analysis; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; SER: spherical equivalent refractive error; SVL: single-vision lens spectacles or contact lenses; VI: visual impairment

The pairwise conclusions from the base case remained unchanged across scenario analyses, except for three cases:

- PPSL was estimated to be cost effective compared with SVL when effects from the NMA were applied and PPSL continued up to age 16 years, as for the other myopia controls
- MFSCL was estimated not to be cost effective compared with SVL when the utility decrements applied to moderate and high myopia were assumed equal
- MFSCL was estimated not to be cost effective compared with SVL when utility inputs were informed by alternative WHO disability weights

However, the conclusions of the fully incremental analysis remained unchanged throughout. Ortho-K was estimated to be the optimal strategy of those considered at £20,000 per QALY gained.

Table A10.18 Summary of scenario analysis results

Scenario	Pairwise ICER versus SVL			Fully incremental outcome	
	MFSCL	PPSL	Ortho-K	Efficiency frontier	Optimal
Base case	£8,367	>£1M	£3,995	SVL, Ortho-K	Ortho-K
NMA effects and PPSL up to age 16	£5,861	£6,334	£3,462	SVL, Ortho-K	Ortho-K
Ortho-K effects (scenario A and B)	£8,367	>£1M	£3,996 to £4,410	SVL, Ortho-K	Ortho-K
Extrapolation of 2-year average change in SER	£3,695	>£1M	£1,981	SVL, Ortho-K	Ortho-K
All strategies stopped after two years	£4,531	>£1M	£2,565	SVL, Ortho-K	Ortho-K
All myopia controls stopped at age 13 years	£6,042	>£1M	£3,006	SVL, Ortho-K	Ortho-K
MFSCL and ortho-K continued for 16 to 18 year olds	£10,240	>£1M	£5,238	SVL, Ortho-K	Ortho-K
Adverse events with MFSCL	£8,372	>£1M	£3,995	SVL, Ortho-K	Ortho-K
Microbial keratitis with ortho-K	£8,367	>£1M	£4,057	SVL, Ortho-K	Ortho-K
Ortho-K adverse events resolved at no cost	£8,367	>£1M	£3,995	SVL, Ortho-K	Ortho-K
No discontinuation due to adverse events	£8,367	>£1M	£3,958	SVL, Ortho-K	Ortho-K
50% discontinuation of ortho-K in first cycle	£8,367	>£1M	£4,674	SVL, Ortho-K, MFSCL	Ortho-K
Lower and upper intervention cost scenarios	£4,585 to £13,855	£774,258 to >£1M	£2,673 to £6,898	SVL, Ortho-K	Ortho-K
Cost of cycloplegic refraction with SVL	£8,176	>£1M	£3,890	SVL, Ortho-K	Ortho-K
Ages at stabilisation and final myopia level sampled	£8,051	>£1M	£4,000	SVL, Ortho-K	Ortho-K
No progression after age at stabilisation	£12,379	>£1M	£7,260	SVL, Ortho-K	Ortho-K
Progression to age 24 years	£8,059	>£1M	£3,454	SVL, Ortho-K	Ortho-K
Fast progressing cohort	£13,606	£686,124	£5,225	SVL, Ortho-K	Ortho-K
Low vision state informed by blindness data	£9,012	>£1M	£4,627	SVL, Ortho-K	Ortho-K
Long-term complications from 40 years	£7,474	>£1M	£3,294	SVL, Ortho-K	Ortho-K
WHO moderate VI applied to moderate myopia	£43,009	£65,974	£10,035	SVL, Ortho-K	Ortho-K
WHO 2015 disability weights	£23,681	>£1M	£11,285	SVL, Ortho-K	Ortho-K
Glaucoma utility decrement (0.02 to 0.10)	£8,366 to £8,368	>£1M	£3,995 to £3,996	SVL, Ortho-K	Ortho-K
Cataract utility decrement 0.08	£8,358	>£1M	£3,990	SVL, Ortho-K	Ortho-K

Scenario	Pairwise ICER versus SVL			Fully incremental outcome	
	MFSCL	PPSL	Ortho-K	Efficiency frontier	Optimal
Fixed baseline utility	£8,361	>£1M	£3,993	SVL, Ortho-K	Ortho-K
Multiplicative application of utilities	£9,650	>£1M	£4,614	SVL, Ortho-K	Ortho-K

ICER: incremental cost effectiveness ratio; M: million; MFSCL: multifocal soft contact lenses; NMA: network meta-analysis; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; QALY: quality-adjusted life-year; SER: spherical equivalent refractive error; SVL: single-vision lens spectacles or contact lenses; VI: visual impairment

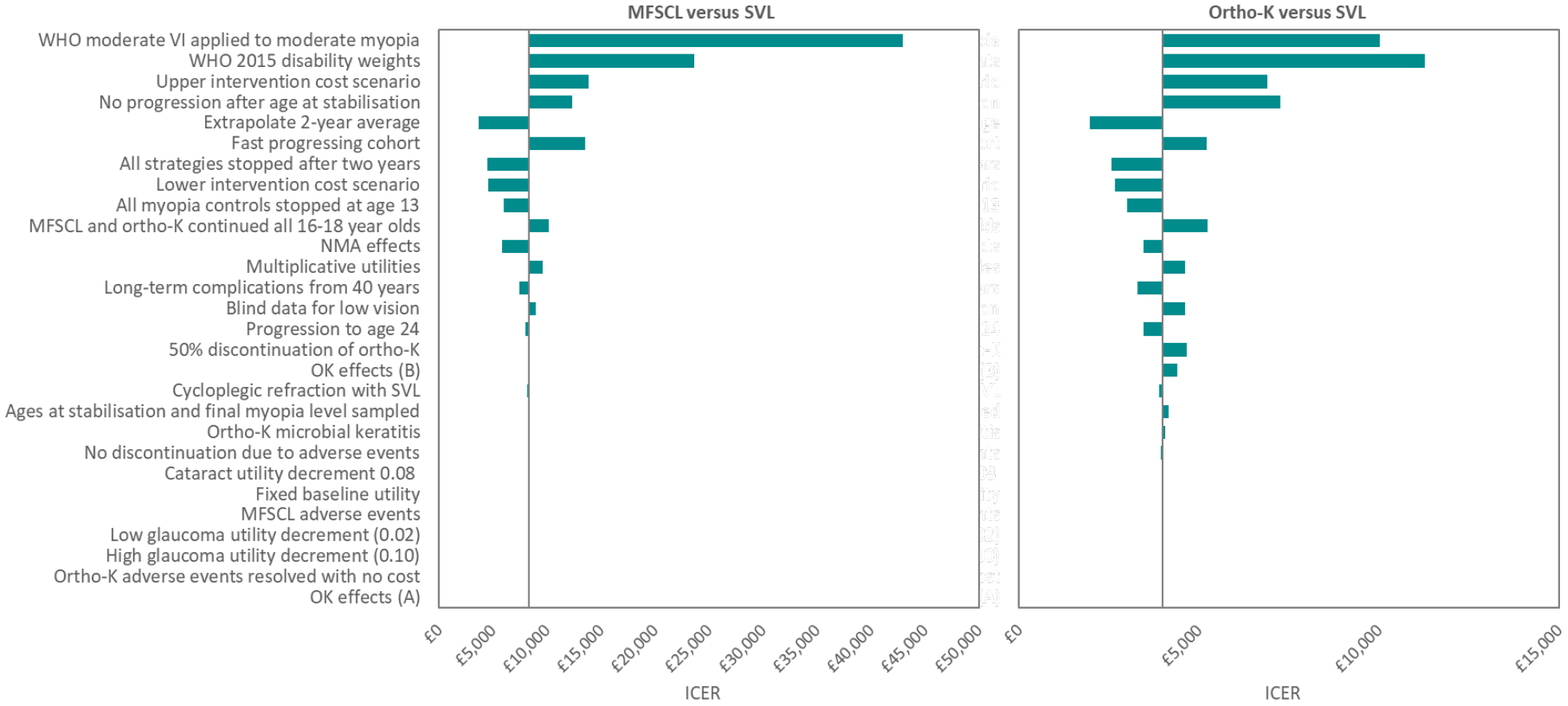


Figure 5. Pairwise ICER estimates from scenario analyses

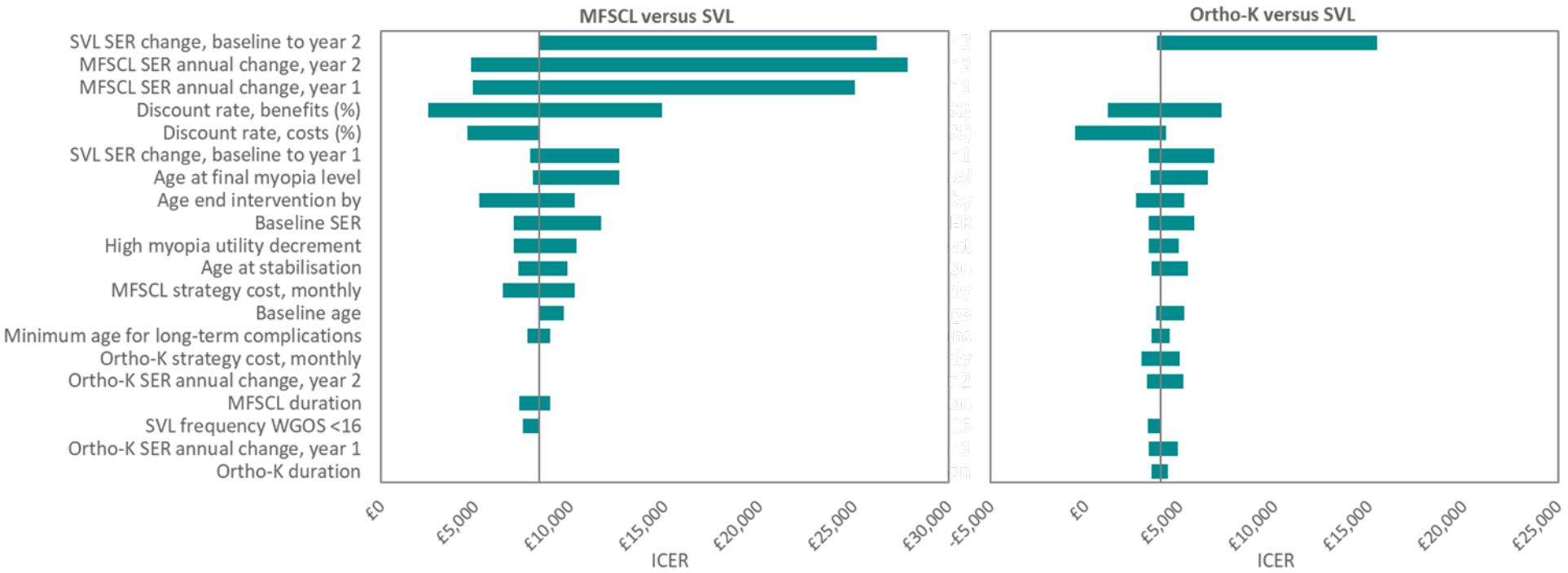


Figure 6. Pairwise ICER estimates for twenty most influential parameters across MFSCL and ortho-K comparisons in deterministic sensitivity analyses

3.3 Deterministic sensitivity analysis results

A series of deterministic sensitivity analyses were performed to assess the relative influence of each input parameter and determine the key drivers of modelled estimates. Discount rates of 0% and 6%, and WGOS voucher frequencies of six to 24 months were tested. We varied all other parameter values by 20%.

Figure 6 presents results for the 20 most influential parameters across MFSCL and ortho-K comparisons against SVL. ICERs for PPSL compared with SVL were more than £1 million per QALY throughout these analyses.

As well as the discount rates applied to costs and QALYs, parameters in the following areas had the largest impact on estimated cost effectiveness:

- parameters controlling SER progression
- strategy costs and duration of intervention
- the impact of high myopia on quality of life
- the incidence of long-term complications

3.4 Probabilistic sensitivity analysis results

Probabilistic sensitivity analysis (PSA) was conducted to assess the combined parameter uncertainty in the model. In this analysis, the mean values that were utilised in the base case were replaced with values drawn from distributions around the mean values. Table A10.19 and Table A10.20 present the mean health economic results from the PSA.

The cost-effectiveness outcomes of 1,000 PSA iterations are presented using cost-effectiveness acceptability curves (CEACs). The pairwise CEACs in Figure 7 show the probability of each strategy being considered cost effective compared with SVL across a range of willingness to pay thresholds. At a threshold of £20,000 per QALY, MFSCL, PPSL and ortho-K were estimated to be cost effective in 71%, 0%, and 90% of iterations, respectively.

The fully incremental CEACs in Figure 8 show the probability of each strategy being considered the optimal strategy. At a threshold of £20,000 per QALY, MFSCL, PPSL and ortho-K were estimated to be the optimal strategy in 18%, 0%, and 76% of iterations, respectively.

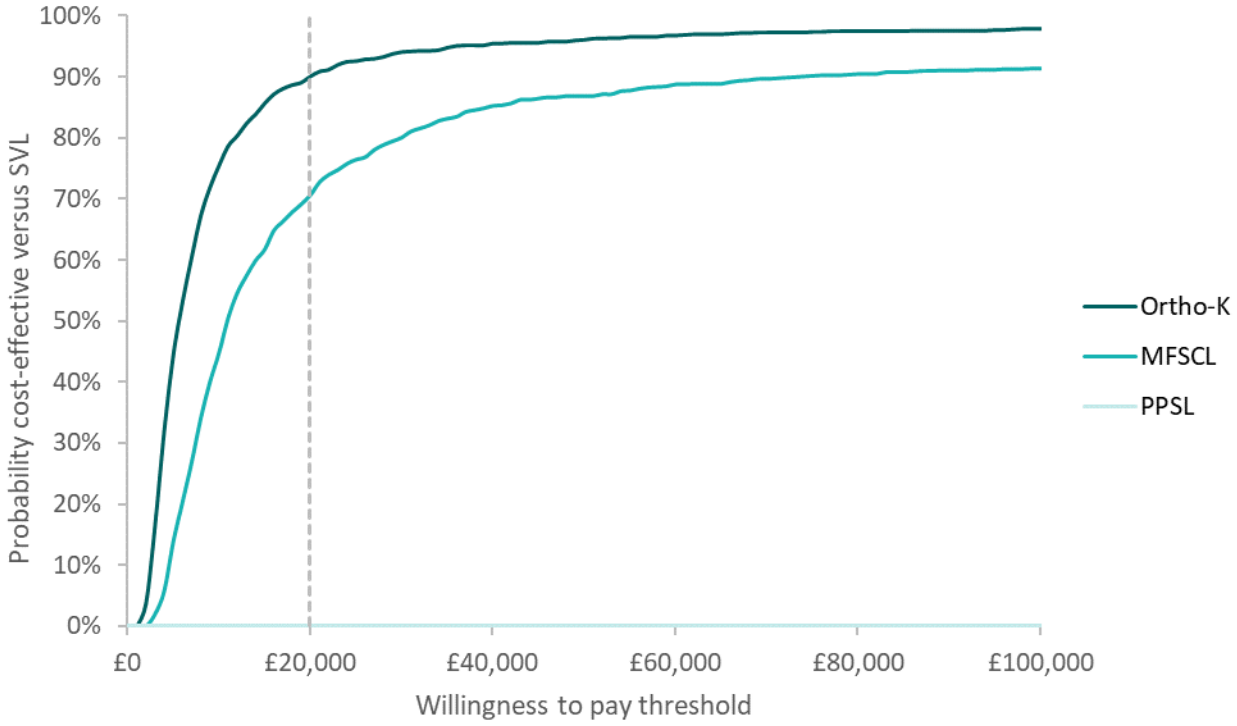


Figure 7. Pairwise cost effectiveness acceptability curves

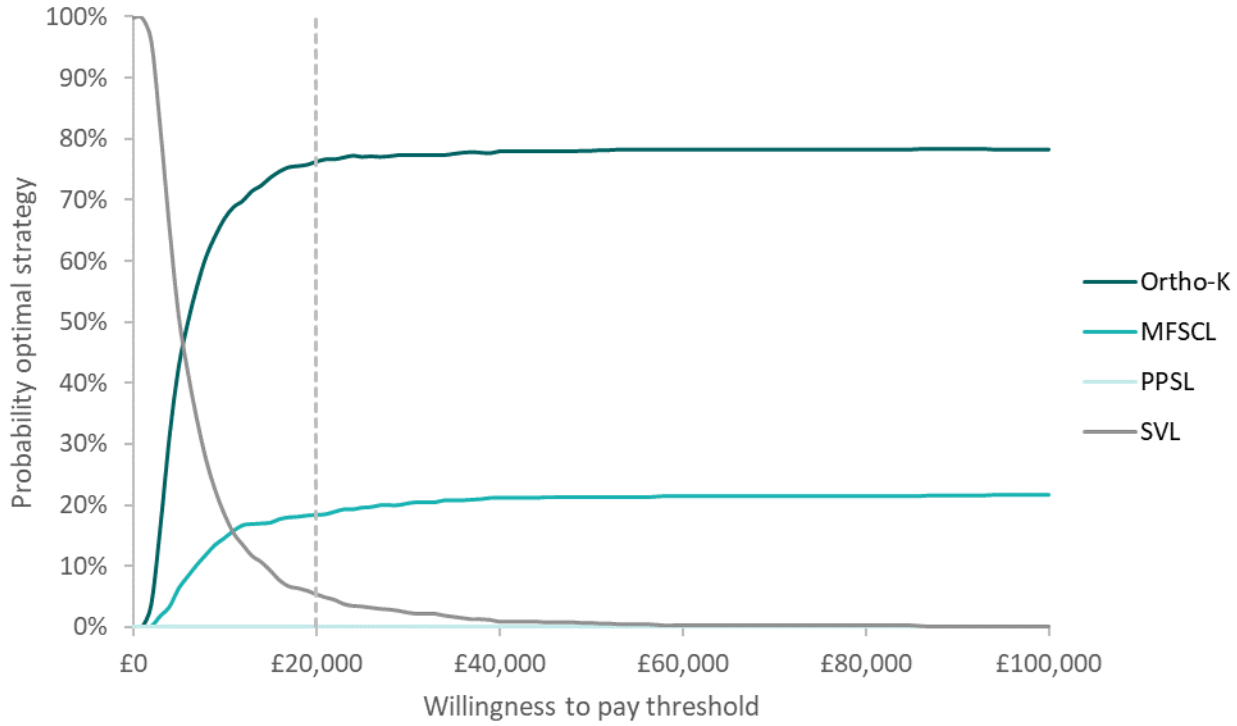


Figure 8. Fully incremental cost effectiveness acceptability curves

Table A10.19 Summary of pairwise probabilistic sensitivity analysis

Strategy	Total costs	Total QALYs	Total health benefit	Incremental costs	Incremental QALYs	Net health benefit	ICER (£/QALY)	% cost effective at £20,000 per QALY
SVL	£1,730	22.88	22.80	N/A	N/A	N/A	N/A	N/A
MFSCL	£3,971	23.10	22.91	£2,241	0.22	0.11	£10,049	71%
PPSL	£2,640	22.88	22.75	£910	0.00	-0.04	>£1M	0%
Ortho-K	£3,706	23.27	23.08	£1,976	0.39	0.29	£5,088	90%

ICER: incremental cost effectiveness ratio; M: million; MFSCL: multifocal soft contact lenses; N/A: not applicable; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; QALY: quality-adjusted life-year; SVL: single-vision lens spectacles or contact lenses
Results estimated over 1.000 iterations. Total and net health benefit estimated at a willingness to pay threshold of £20,000 per QALY.

Table A10.20 Summary of fully incremental probabilistic sensitivity analysis

Strategy	Comparator on efficiency frontier	Total costs	Total QALYs	Total health benefit	Incremental costs	Incremental QALYs	Net health benefit	ICER (£/QALY)	% optimal at £20,000 per QALY
SVL	Reference strategy	£1,730	22.88	22.80	N/A	N/A	N/A	N/A	5%
PPSL	N/A	£2,640	22.88	22.75	N/A	N/A	N/A	N/A	0%
MFSCL	N/A	£3,971	23.10	22.91	N/A	N/A	N/A	N/A	18%
Ortho-K	SVL	£3,706	23.27	23.08	£1,976	0.39	0.29	£5,088	76%

ICER: incremental cost effectiveness ratio; MFSCL: multifocal soft contact lenses; N/A: not applicable; Ortho-K: orthokeratology; PPSL: peripheral plus spectacle lenses; QALY: quality-adjusted life-year; SVL: single-vision lens spectacles or contact lenses
Results estimated over 1.000 iterations. Total and net health benefit estimated at a willingness to pay threshold of £20,000 per QALY.

4. Limitations

The economic analysis is subject to several limitations:

- See discussion of limitations of the clinical data available to inform the cost utility analysis, outlined in Section 5.
- SER was used to capture myopia progression rather than axial length because of the availability of evidence. This required mapping of ortho-K effects to modelled SER.
- Short-term (2-year) efficacy data were applied over a longer period (around six years). Without long-term studies, the likely impact of this assumption is unknown.
- By using meta-analysed effect estimates, we did not consider differences between technologies within the same group, for example, MFSCL of different designs. Nor were combinations of interventions considered. An expert contacted by HTW said that some practitioners may suggest PPSL as a back-up to MFSCL, rather than SVL as modelled in our base case.
- Base case fully incremental results were informed by pairwise meta-analyses of intervention effects and therefore do not account for any differences between trials.
- Rates of myopia progression were assumed to be linear and heterogeneity was not fully considered. Gompertz curves have been reported to provide good fits to longitudinal SER data and capture changing rates of myopia progression over time. It is uncertain what impact our simplified approach is likely to have on results.
- Most available evidence was from outside the UK. It is unknown how well this data generalises to Wales.
- Uncertainty exists around the incidence of adverse events with long-term use of contact lenses outside of trial settings.
- A simplified approach to modelling discontinuation was applied to the ortho-K arm (only), because of limited data describing timing of dropouts.
- Long-term complication data were only available in older adults.
- Relationships between myopia and the incidence of long-term complications were modelled based on observations in the absence of myopia controls. It is not yet known whether the impact of myopia controls on SER translates into prevention of long-term complications. This cannot be proven until myopia controls have been in use for a number of decades, because of the delay between myopia in childhood and increased risk of vision-related complications.
- The negative relationship between myopia progression and success rates for retinal reattachment was not modelled.
- Corrective surgery in adulthood was not modelled. We did not consider whether reduced progression of myopia in childhood may make adults better candidates for corrective surgery such as laser-assisted in situ keratomileusis (LASIK).
- Age-related degeneration of sight was not modelled.
- Expected costs of myopia-control strategies to the NHS in Wales are uncertain. As myopia controls are only currently available from private practices, there are no standardised price lists and prices are highly variable between practices.

- Costs of NHS sight tests and optical vouchers for adults were not considered, for example, for prisoners, those with diabetes, at risk of glaucoma or entitled to particular benefits.
- The impact of myopia progression on health-related quality of life is uncertain. This led to reliance on assumptions to link myopia progression to disutilities via WHO definitions of visual impairment and associated disability weights. It is unknown how well the use of these weights in countries where correction is widely available corresponds to the impact of myopia.
- Utility data were rarely available from children. Measuring health-related quality of life in children and young people may require different measures to those for adults.
- The potential impact of improvements in treatment satisfaction, education, and quality of life aspects related to appearance and comfort were not captured. Nor was the impact of reduced reliance on glasses or contact lenses during the daytime with ortho-K use.
- Correlation between sampled parameters was not captured within PSA.