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Research publications:
Myopia control spectacle lenses with aspherical lenslets

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01 Myopia control efficacy of Spectacle Lenses with Highly Aspherical Lenslets: results of a 5-year follow-up study

a. Citation: LI X, Huang Y, Liu C, Yin Z, Cui Z, Lim EW, Drobe B, Chen H, Bao J. Myopia control efficacy of Spectacle Lenses with Highly Aspherical Lenslets: results of a 5-year follow-up study. Investigative Ophthalmology & Visual Science. 2024 Jun 17;65(7):131.

b. Summary: This study investigated the myopia control efficacy of spectacle lenses with Highly Aspherical Lenslets (HAL) for five years in Chinese children. 43 out of 51 children who wore HAL lenses continuously for three years completed the five-year visit. As it was not ethical to continue to keep the control group in single vision lenses, the new single vision lens group recruited for the third year were given a pair of HAL lenses at the end of the third year , for two more years. An extrapolated control group was used, based on a model in which mean axial elongation decreases as age increases, by 15.0% per year (Shamp W, et al. IOVS 2022;63:ARVO E-Abstract A0111) and a model in which SER decreases by 9.7% per year on average (Smotherman C, et al. IOVS 2023;64:ARVO E-Abstract 811). The results showed that HAL lenses were effective in slowing down myopia progression and axial elongation over five years. The results also showed that myopia control efficacy with HAL lenses was sustained in older children (up to 18 years old).

c. Link to article:

https://iovs.arvojournals.org/article.aspx?articleid=2794414&resultClick=1

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02 Effect of spectacle lenses with aspherical lenslets on choroidal thickness in myopic children: a 3-year follow-up study

a. **Citation:** Huang Y, Li X, Zhuo Z, Zhang J, Que T, Yang A, Drobe B, Chen H, Bao J. Effect of spectacle lenses with aspherical lenslets on choroidal thickness in myopic children: a 3-year follow-up study. Eye and Vision. 2024 Apr 25;11(1):16.

b. **Summary:** This study was conducted to explore the effect of wearing spectacle lenses with Highly Aspherical Lenslets (HAL) for three years and the impact of switching from single-vision lenses (SVL) to HAL lenses on choroidal thickness. A total of 51 participants in the HAL group, 50 participants in the spectacle lenses with Slightly Aspherical Lenslets (SAL)-HAL group, 41 participants in the SVL-HAL group and 48 participants in the new-SVL group completed the third year of follow-up and all examinations. Choroidal thickness was measured every six months. The key outcomes from the study were that during the third year, children who consistently wore or switched to wearing HAL lenses demonstrated significantly less choroidal thinning compared to children wearing SVL. Children who wore HAL for 3 years tended to exhibit greater choroidal thickness than did those who switched from SVL or SAL to HAL.

c. **Link to article:**

https://eandv.biomedcentral.com/articles/10.1186/s40662-024-00383-4

03 Effects of Spectacle Lenses With Aspherical Lenslets on Peripheral Eye Length and Peripheral Refraction in Myopic Children: A 2-Year Randomized Clinical Trial

a. **Citation:** Huang Y, Zhang J, Yin Z, Yang A, Spiegel DP, Drobe B, Chen H, Bao J, Li X. Effects of Spectacle Lenses With Aspherical Lenslets on Peripheral Eye Length and Peripheral Refraction in Myopic Children: A 2-Year Randomized Clinical Trial. *Transl Vis Sci Technol.* 2023;12(11):15. DOI: 10.1167/tvst.12.11.15.

b. **Summary:** This study investigated changes in peripheral eye length (PEL) and peripheral refraction in 170 myopic children aged 8 to 13 years after wearing spectacle lenses with highly aspherical lenses (HAL), slightly aspherical lenses (SAL) or single vision lenses (SVL) for 2 years. PEL significantly (all $P < 0.001$) increased with time, with the greatest elongation in the SVL group and the least in the HAL group. In the SVL group, the retina steepened and the peripheral retinal defocus became more hyperopic with 2-year myopia progression. In the SAL group, the retina steepened and peripheral hyperopic defocus increased, but with less magnitude than in the SVL group. Participants wearing HAL spectacle lenses had faster PEL elongation than axial elongation, resulting in a flattened retina and decreased peripheral hyperopic defocus over 2 years.

c. **Link to article:**

https://tvst.arvojournals.org/article.aspx?articleid=2793005

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04 Eye growth pattern of myopic children wearing spectacle lenses with aspherical lenslets compared with non-myopic children

a. Citation: Wong YL, Li X, Huang Y, Yuan Y, Ye Y, Lim EW, Yang A, Spiegel DP, Drobe B, Bao J, Chen H. Eye growth pattern of myopic children wearing spectacle lenses with aspherical lenslets compared with non-myopic children. *Ophthalmic Physiol Opt*. 2023; 00: 1–8. https://doi.org/10.1111/opo.13232

b. Summary: This study used longitudinal data from a randomized clinical trial and a cohort study to evaluate the eye growth of children wearing spectacle lenses with aspherical lenslets and with single-vision lenses, in comparison to eye growth patterns in non-myopic children in Wenzhou, China. The randomized trial, conducted in Wenzhou, China, had 170 myopic children (aged 8–13years) randomly assigned to wear highly aspherical lenslets (HAL), slightly aspherical lenslets (SAL), or single-vision lenses (SVL). Normal eye growth was examined using 700 non-myopic schoolchildren (aged 7–9years) in the Wenzhou Medical University-Essilor Progression and Onset of Myopia (WEPrOM) cohort study using logistic function models. The study found that the eye growth pattern in approximately 90% of children wearing HAL full time (compared with about 10% wearing SVL full time) was similar or slower than that of non-myopic children both after 1- and 2-year periods. Therefore, after the first year and the second year, the eye growth of approximately 9 out of 10 children wearing HAL lenses was similar or slower than non-myopic children.

c. Link to article:

https://onlinelibrary.wiley.com/doi/10.1111/opo.13232

05 Spectacle lenses with highly aspherical lenslets for myopia control: 4-year clinical trial results

This data was presented as a poster at the annual Association for Research in Vision and Ophthalmology (ARVO) meeting, 2023. The below summary is an abstract.

a. Citation: Drobe B, Xue L, Huang Y, Lim EW, Bao J. Spectacle lenses with highly aspherical lenslets for myopia control: 4-year clinical trial results, *Investigative Ophthalmology & Visual Science*. 2023;64(8):4162. Presented at the 2023 ARVO Annual Meeting, New Orleans.

b. Summary: This study was an extension of a randomized myopia control clinical trial, designed to assess the 4-year increase in myopia and axial length (AL) with highly aspherical lenslets (HAL). Change in AL in the HAL group was compared to a single vision lens (SVL) model. This model was based on SVL data from the first two years of the same clinical trial, with an average decrease in AL change by 15% per year applied (Shamp W, et al. IOVS 2022;63:ARVO E-Abstract A0111). As the change in spherical equivalent refraction (SER) and AL were highly correlated in the SVL group in the second year, the same model was applied to SER. Results of the study demonstrated that myopia progression and axial elongation in children wearing HAL was slower than in the modeled control SVL group during year 4 of this clinical trial. Furthermore, myopia control efficacy with HAL is sustained in older children (11-16 years) over a four-year period.

c. Link to article:

https://iovs.arvojournals.org/article.aspx?articleid=2788660

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06 Myopia control efficacy of spectacle lenses with aspherical lenslets: results of a 3-year follow-up study

a. **Citation:** Li X, Huang Y, Yin Z, Liu C, Zhang S, Yang A, Drobe B, Chen H, Bao J. Myopia Control Efficacy of Spectacle Lenses with Aspherical Lenslets: Results of a 3-year Follow-up Study. *American Journal of Ophthalmology*. 2023;253:160-168. DOI: https://doi.org/10.1016/j.ajo.2023.03.03

b. **Summary:** This study was an extension of a two-year randomized myopia control clinical trial. The objective of the study was to evaluate myopia control efficacy in children who continued to wear spectacle lenses with highly aspherical lenslets (HAL) or switched from spectacle lenses with slightly aspherical lenslets (SAL) and single-vision spectacle lenses (SVL) to HAL for one year, after completion of the two-year trial. The study concluded that HAL effectively slows down myopia progression and axial elongation in myopic children when compared with SVL over three years. In addition, when the children switched from SVL to HAL in the third year, there was a significant decrease in myopia progression and axial elongation.

c. **Link to article:**

https://www.ajo.com/article/S0002-9394(23)00147-2/fulltext

07 Impact of myopia control spectacle lenses with highly aspherical lenslets on peripheral visual acuity and central visual acuity with peripheral gaze

a. **Citation:** Gao, Y, Lim, EW, Drobe, B. Impact of myopia control spectacle lenses with highly aspherical lenslets on peripheral visual acuity and central visual acuity with peripheral gaze. *Ophthalmic Physiol Opt*. 2023;43:566–571. DOI: https://doi.org/10.1111/opo.13127

b. **Summary:** The objective of the study was to evaluate the impact of a myopia control spectacle lens with highly aspherical lenslets (HAL) on central visual acuity with peripheral gaze and peripheral visual acuity. In this study, two lens designs, HAL and a standard single-vision lens (SVL) were evaluated in counterbalanced order for each test conducted. The study had sixteen adults (27–52 years of age; spherical equivalent refraction (SER), -8.75 D to +0.50 D) wearing their habitual visual correction, who carried out all tests monocularly. Based on the results, the study concluded that under the high-contrast and low-luminance condition, HAL reduced central visual acuity with peripheral gaze by approximately one line, but did not affect peripheral visual acuity, compared with SVL. The impact on central visual acuity did not alter with age, gaze direction, or SER.

c. **Link to article:**

https://onlinelibrary.wiley.com/doi/full/10.1111/opo.13127

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08 Spectacles with highly aspherical lenslets for myopia control do not change visual sensitivity in automated static perimetry

a. Citation: Gao Y, Spiegel DP, Muzahid IA, Lim EW, Drobe B. Spectacles with highly aspherical lenslets for myopia control do not change visual sensitivity in automated static perimetry. *Frontiers in Neuroscience*. 2022;16:996908. DOI: 10.3389/fnins.2022.996908

b. Summary: The objective of the study was to evaluate the possible impact of wearing spectacle lenses with highly aspherical lenslets (HAL) on the visual field sensitivity. In order to measure the detection sensitivity in the visual field, an automated static perimetry test was used with 21 adults (age 23–61, spherical equivalent refractive error (SER) -8.75 D to +0.88 D) to measure the sensitivities through HAL and a single vision lens (SVL) as the control lens, in random order. The study showed no significant correlation between the difference in sensitivity and age or SER. It concluded that compared to SVL, HAL did not change detection sensitivity to static targets across the visual field in automated static perimetry.

c. Link to article:

https://www.frontiersin.org/articles/10.3389/fnins.2022.996908/full

09 Spectacle lenses with highly aspherical lenslets for slowing myopia: a randomized, double-blind, cross-over clinical trial

a. Citation: Sankaridurg P, Weng R, Tran H, Spiegel DP, Drobe B, Ha T, Tran YH, Naduvilath T. Spectacle Lenses With Highly Aspherical Lenslets for Slowing Myopia: A Randomized, Double-Blind, Cross-Over Clinical Trial. *American Journal of Ophthalmology*. 2023;247:18-24. DOI: https://doi.org/10.1016/j.ajo.2022.10.021

b. Summary: The objective of the study was to evaluate myopia progression with spectacles with highly aspherical lenslets (HAL) compared to single vision spectacle lenses. The randomized, double-masked, cross-over clinical trial demonstrated that HAL lenses slow myopia in Vietnamese children with myopia. Importantly, when children switched from HAL to single vision spectacle lenses, progression was similar to that observed with use of single vision spectacles and indicates no rebound of myopia progression. Compliance was high with no differences compared to single vision lenses.

c. Link to article:

https://www.ajo.com/article/S0002-9394(22)00418-4/fulltext

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10 Effect of spectacle lenses with aspherical lenslets on choroidal thickness in myopic children: a 2-year randomized clinical trial

a. **Citation:** Huang Y, Li X, Wu J, Huo J, Zhou F, Zhang J, Yang A, Spiegel DP, Chen H, Bao J. Effect of spectacle lenses with aspherical lenslets on choroidal thickness in myopic children: a 2-year randomized clinical trial. *British Journal of Ophthalmology*. 2022 Sep 27. DOI: 10.1136/bjo-2022-321815

b. **Summary:** The objective of the study was to examine the long-term influence of spectacle lenses with highly aspherical lenslets (HAL) and slightly aspherical lenslets (SAL) on macular choroidal thickness (ChT) in myopic children. The two-year randomized clinical trial was conducted at the Eye Hospital of Wenzhou Medical University in Wenzhou, China. The study showed that over two years, wearing spectacle lenses with aspherical lenslets reduced or eliminated the thinning of the ChT, compared with the use of single vision lenses, with HAL having a better effect by preserving the initial ChT and even increasing it.

c. **Link to article:**

https://bjo.bmj.com/content/early/2022/09/27/bjo-2022-321815

11 Visual acuity, near phoria and accommodation in myopic children using spectacle lenses with aspherical lenslets: results from a randomized clinical trial

a. **Citation:** Huang Y, Li X, Wang C, Zhou F, Yang A, Chen H, Bao J. Visual acuity, near phoria and accommodation in myopic children using spectacle lenses with aspherical lenslets: Results from a randomized clinical trial. *Eye and Vision*. 2022;9(1):33. DOI: https://doi.org/10.1186/s40662-022-00304-3

b. **Summary:** The objective of this study was to examine the short- and long-term effects of myopia control spectacle lenses with highly aspherical lenslets (HAL) and slightly aspherical lenslets (SAL) on visual function and visual quality. The study utilized data from a prospective, randomized, controlled, and double-blinded study where 170 myopic children aged 8–13 years were randomly assigned to the HAL, SAL, or single-vision spectacle lenses (SVL) groups. The study concluded that both HAL and SAL do not have a significant influence on accommodation and phoria, but had larger accommodative micro-fluctuations (AMFs) compared to SVL. After a year of use, visual acuity with HAL and SAL recovered to be at the same level as SVL.

c. **Link to article:**

https://eandv.biomedcentral.com/articles/10.1186/s40662-022-00304-3

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12 Spectacle lenses with aspherical lenslets for myopia control vs single-vision spectacle lenses: a randomized clinical trial

a. **Citation:** Bao J, Huang Y, Li X, Yang A, Zhou F, Wu J, Wang C, Li Y, Lim EW, Spiegel DP, Drobe B, Chen, H. Spectacle lenses with aspherical lenslets for myopia control vs single-vision spectacle lenses: a randomized clinical trial. *JAMA ophthalmology*. 2022;140(5):472-8. DOI:10.1001/jamaophthalmol.2022.0401

b. **Summary:** The objective of this randomized clinical trial was to evaluate whether spectacle lenses with higher lenslet asphericity have a higher myopia control efficacy during the course of two years. The clinical trial was conducted between July 2018 and October 2020 at the Eye Hospital of Wenzhou Medical University in Wenzhou, China. In this study, both spectacle lenses with highly aspherical lenslets (HAL) and spectacle lenses with slightly aspherical lenslets (SAL) effectively slowed myopia progression and axial elongation throughout two years, compared with single vision spectacle lenses (SVL). Higher lenslet asphericity led to higher myopia control efficacy, therefore HAL lenses were significantly more effective at slowing down myopia progression than SAL lenses and SVL. The study also demonstrated that the wearing time considerably influenced the treatment outcome, with longer wearing hours resulting in better myopia control efficacy for HAL.

c. **Link to article:**

https://jamanetwork.com/journals/jamaophthalmology/fullarticle/2790589

13 One-year myopia control efficacy of spectacle lenses with aspherical lenslets

a. **Citation:** Bao J, Yang A, Huang Y, Li X, Pan Y, Ding C, Lim EW, Zheng J, Spiegel DP, Drobe B, Lu F. One-year myopia control efficacy of spectacle lenses with aspherical lenslets. *British Journal of Ophthalmology*. 2022;106(8):1171-6. DOI: https://doi.org/10.1136/bjophthalmol-2020-318367

b. **Summary:** This paper evaluates the one-year efficacy of two myopia control spectacle lenses with lenslets of different asphericity: spectacle lenses with highly aspherical lenslets (HAL) and spectacle lenses with slightly aspherical lenslets (SAL). Spectacle lenses with aspherical lenslets—both HAL and SAL—effectively slowed myopia progression and axial elongation compared with single vision spectacle lenses. Higher lenslet asphericity led to higher myopia control efficacy, so HAL lenses were more effective at slowing down myopia progression than SAL lenses. This demonstrated that HAL is a good solution for children, to help slow down their myopia progression and reduce related risks later in life.

c. **Link to article:**

https://bjo.bmj.com/content/early/2021/04/01/bjophthalmol-2020-318367

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14 The impact of spectacle lenses for myopia control on visual functions

a. **Citation:** Gao, Y, Lim, EW, Yang, A, Drobe, B, Bullimore, MA. The impact of spectacle lenses for myopia control on visual functions. *Ophthalmic and Physiological Optics*. 2021;41:1320–1331. https://doi.org/10.1111/opo.12878

b. **Summary:** This research paper evaluated the impact of two new myopia control spectacle lens designs: spectacle lenses with Highly Aspherical Lenslets (HAL) and Slightly Aspherical Lenslets (SAL), on different visual functions. The study concluded that high contrast visual acuity and all the peripheral measures of vision were not affected by both the lens designs when compared to single vision lenses, however there was a slight reduction in low contrast visual acuity through the periphery. In addition, the study also concluded that the lens designs were safe to use for myopia control, as they did not impact tested central and peripheral visual functions.

c. **Link to article:**

https://onlinelibrary.wiley.com/doi/10.1111/opo.12878

15 Influence of lenslet configuration on short-term visual performance in myopia control spectacle lenses

a. **Citation:** Li X, Ding C, Li Y, Lim EW, Gao Y, Fermigier B, Yang A, Chen H and Bao J. Influence of Lenslet Configuration on Short-Term Visual Performance in Myopia Control Spectacle Lenses. *Frontiers in Neuroscience*. 2021;15:667329. DOI: 10.3389/fnins.2021.667329

b. **Summary:** The objective of this study was to assess the optical quality and visual performance of three different lenslet configurations on myopia control spectacle lenses – lenses with concentric rings of contiguous highly aspherical lenslets (HAL), lenses with concentric rings of slightly aspherical lenslets (SAL), and lenses with honeycomb configuration of spherical lenslets (HC). The study concluded that HAL and SAL had a substantially lower negative impact on visual acuity and contrast sensitivity, and there was no significant effect on short-term visual performance by looking through the lenslet structure of myopia control spectacle lenses.

c. **Link to article:**

https://www.frontiersin.org/articles/10.3389/fnins.2021.667329/full

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INDEPENDENT RESEARCH

01 Spectacle Lenses With Highly Aspherical Lenslets for Slowing Axial Elongation and Refractive Change in Low-Hyperopic Chinese Children: A Randomized Controlled Trial

a. **Citation:** Zhang Z, Zeng L, Gu D, Wang B, Kang P, Watt K, Zhou J, Zhou X, Chen Z, Yang D, Chen C. Spectacle Lenses With Highly Aspherical Lenslets for Slowing Axial Elongation and Refractive Change in Low-Hyperopic Chinese Children: A Randomized Controlled Trial. American Journal of Ophthalmology. 2025 Jan 1;269:60-8.

b. **Summary:** This randomized controlled trial investigated the effects of spectacle lenses with highly aspherical lenslets (HAL) on refractive and axial length (AL) changes in Chinese children with low hyperopia. A total of 108 children aged 6 to 9.9 years were assigned to either the HAL group or a single vision lens (SVL) group. After one year, both groups showed similar changes in spherical equivalent refractive error, but the HAL group who wore their lenses for over 30 hours per week exhibited significantly less AL elongation, compared to the SVL group. The study concluded that HAL spectacle lenses significantly slowed down AL elongation in low hyperopic children wearing them over 30 hours per week, showing a dose-response relationship where longer wear times correlated with less AL change.

c. **Link to article:**

https://pubmed.ncbi.nlm.nih.gov/39197509/

02 Comparing the effects of highly aspherical lenslets versus defocus incorporated multiple segment spectacle lenses on myopia control

a. **Citation:** Guo H, Li X, Zhang X, Wang H, Li J. Comparing the effects of highly aspherical lenslets versus defocus incorporated multiple segment spectacle lenses on myopia control. Scientific Reports. 2023;13(1):3048. DOI: https://doi.org/10.1038/s41598-023-30157-2

b. **Summary:** This independent real-world study was carried out in China to compare the effect of spectacle lenses with highly aspherical lenslets (HAL) versus defocus incorporated multiple segments (DIMS) on myopia progression in 1 year. The study was a retrospective analysis of data from children who were prescribed HAL or DIMS lenses in Guangzhou Aier Eye Hospital, China. Results of the independent study determined HAL users had 0.29D less myopia progression and 0.11mm less axial length elongation than DIMS users after 1 year. The study concludes that Chinese children wearing spectacle lenses designed with HAL had less myopia progression and axial elongation than those wearing spectacle lenses designed with DIMS.

c. **Link to article:**

https://www.nature.com/articles/s41598-023-30157-2

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