The Influence of Pupil Size on Myopia Control Effects Using Defocus Incorporated Multiple Segments (DIMS) Spectacle Lenses

Hanyu Zhang [1,2,3], Natalia Vlasak [4], Carly Siu Yin Lam [2,5]

1.School of Medicine, Nankai University, Tianjin, China. 2. Centre for Eye and Vision Research (CEVR), Hong Kong SAR. 3. Eye and Vision Science Research Institute of Nankai University, Tianjin, China. 4. HOYA Vision Care, Research and Development, Amsterdam, The Netherlands 5. Centre for Myopia Research, School of Optometry, The Hong Kong Polytechnic University, Hong Kong SAR

hanyuzhang@nankai.edu.cn; carly.lam@polyu.edu.hk

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Background

- Previous 2-year Randomized Clinical Trial (RCT) study documented that daily wear of the DIMS spectacle lens significantly retarded myopia progression and axial elongation in myopic children.[1] DIMS spectacle lenses provided sustained myopia control without adverse effects over the 6-year study period.[2]
- The DIMS spectacle lens provides simultaneous clear vision with constant myopic defocus during wear, the myopic defocus forms a signal to slow myopia progression.
- A larger pupil diameter theoretically enhances myopia control efficacy by perceiving more myopic defocus in a greater retinal area when using these optical interventions.[3,4]
- The current study aimed to investigate if the baseline pupil size influences the myopia control effects using Defocus Incorporated Multiple Segments (DIMS) spectacle lenses in Hong Kong Chinese children over 6 years.

Methods

- Data from a 6-year clinical study that tested the myopia control effectiveness was reviewed. In the first 2 years, children were allocated randomly to wear either the DIMS spectacle lens (n=79) or Single Vision (SV, n=81) spectacle lens.
- Participants who completed the 2-year RCT were followed for a total of six years. 36 children wore DIMS spectacle lenses for six years. Their pupil size, cycloplegic refractions, axial length were monitored. Pupil size was measured in photopic lighting (135.5lux) using Grand Seiko autorefractor.

Results

- In the first 2 years of study, no statistically significant difference in baseline pupil size was observed in the DIMS (5.68±0.84mm) and SV group (5.64±0.80mm) (p>0.05).
- No statistically significant correlation between baseline pupil size and refraction changes and axial elongation at 12-month and 24-month in the DIMS and SV group (p>0.05) (Figure 1-4).

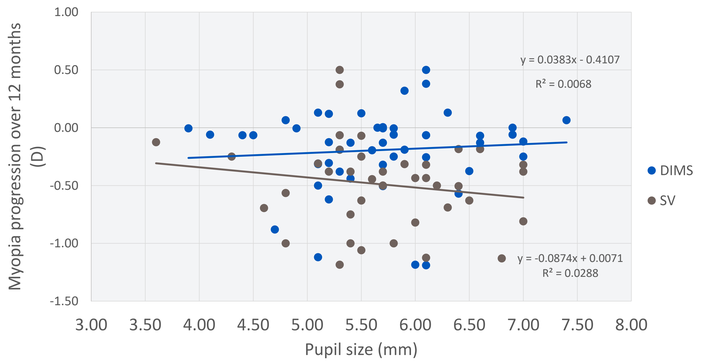

Figure 1. Correlation between baseline pupil size and myopia progression over 12 months.

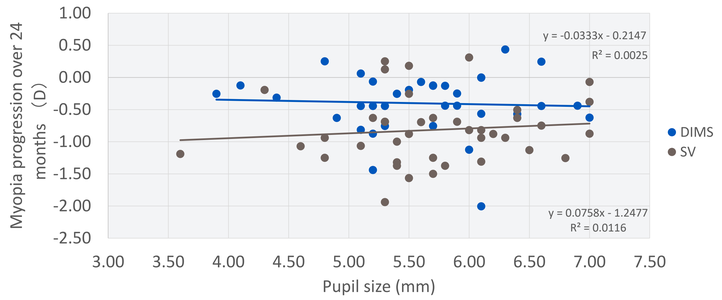

Figure 2. Correlation between baseline pupil size and myopia progression over 24 months.

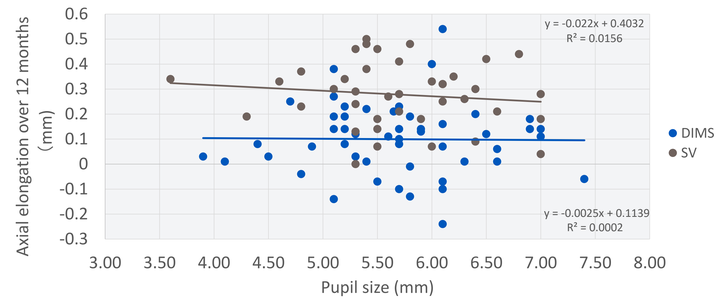

Figure 3. Correlation between baseline pupil size and axial elongation over 12 months.

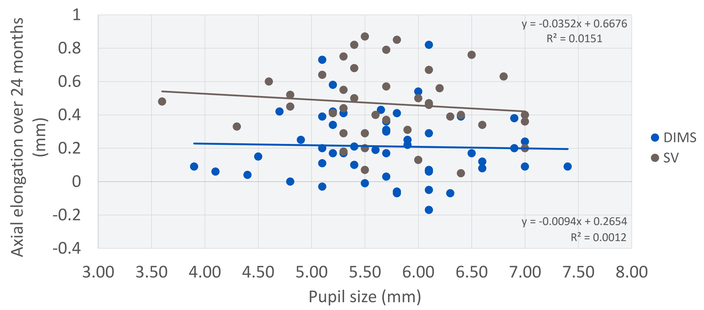

Figure 4. Correlation between baseline pupil size and axial elongation over 24 months.

- For children who wore DIMS spectacle lenses over 6 years, no statistically significant correlation was observed between baseline pupil size with either myopia progression and axial elongation (p>0.05).
- The average percentage at positions within the lens can be considered as the segment area percentage within a large area. This is calculated as the percentage of blue area over the triangle area, 42.76% in this case (Figure 5)

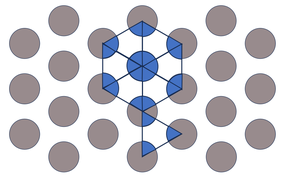

Figure 5. The average percentage at positions within the lens.

- The percentage of segments area for different pupil sizes was similar (Table1, Figure 6).

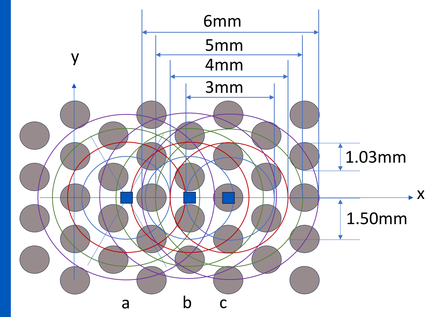

Figure 6. the percentage of segments area under 3mm, 4mm, 5mm,and 6mm pupil size.

Table 1. The percentage of segments area under 3mm, 4mm, 5mm and 6mm pupil size.

Pupil size	a	b	c
3mm	42.42%	40.67%	44.57%
4mm	41.56%	42.05%	46.28%
5mm	44.12%	44.62%	38.92%
6mm	41.42%	41.71%	45.69%

Conclusions

- Myopic children using DIMS spectacle lenses showed similar myopia control effects irrespective of the pupil sizes. These findings agree with a previous study using multifocal contact lenses. [5]
- This could be attributed to the design of the DIMS spectacle lens in which the area of distance correction and myopic defocus have a constant ratio close to 50:50 resulting in similar amount of myopic defocus in all directions of gaze regardless of pupil size.

References

1. Lam CSY, Tang WC, Tse DY, Lee RPK, Chun RKM, Hasegawa K, Qi H, Hatanaka T, To CH. Defocus Incorporated Multiple Segments (DIMS) spectacle lenses slow myopia progression: a 2-year randomised clinical trial. Br J Ophthalmol, 2020
2. Lam CSY, Tang WC, Zhang HY, et al. Long-term myopia control effect and safety in children wearing DIMS spectacle lenses for 6 years. Scientific reports, 2023
3. Chen Z, Niu L, Xue F, et al. Impact of pupil diameter on axial growth in orthokeratology. Optom Vis Sci, 2012
4. Tan Q, Ng AL, Cheng GP, Woo VC, Cho P. Combined 0.01% atropine with orthokeratology in childhood myopia control (AOK) study: a 2-year randomized clinical trial. Cont Lens Anterior Eye. 2023
5. Berntsen D A, Ticak A, Sinnott L T, et al. Peripheral defocus, pupil size, and axial eye growth in children wearing soft multifocal contact lenses in the BLINK study. Invest Ophth Vis Sci, 2023

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