Comparison of the Effectiveness of Defocus Spectacle Lenses in Slowing Myopia Progression: A Retrospective Cohort Study

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Introduction

- **Background**

The defocus spectacle lenses most commonly used for myopia control:
Defocus Incorporated Multiple Segments (DIMS)
Highly Aspherical Lenslets (HAL)
Peripheral Defocus (PD)
Asymmetric Peripheral Defocus (APD)

- **Research gap**

Uncertainty regarding their relative effectiveness in slowing myopia progression in clinical settings.

- **Objective**

To compare their effectiveness in patients with myopia.

Methods

- We included myopia patients with treatment records for DIMS, HAL, PD, APD, or single-vision (SV) spectacle lenses from Tianjin Eye Hospital, China.
- Changes in spherical equivalent refraction (SER) and axial length (AL) from baseline to 12-month follow-up were adopted to assess the myopia progression.
- Overlap weighting using propensity scores was applied to adjust for potential confounders.
- Confounding variables with insufficient balance were included in the outcome model for additional adjustment.
- Paired comparisons of the five types of spectacle lenses were performed.

Results

- **Baseline demographics and characteristics of patients with myopia before and after overlap weighting**

Population

633 patients

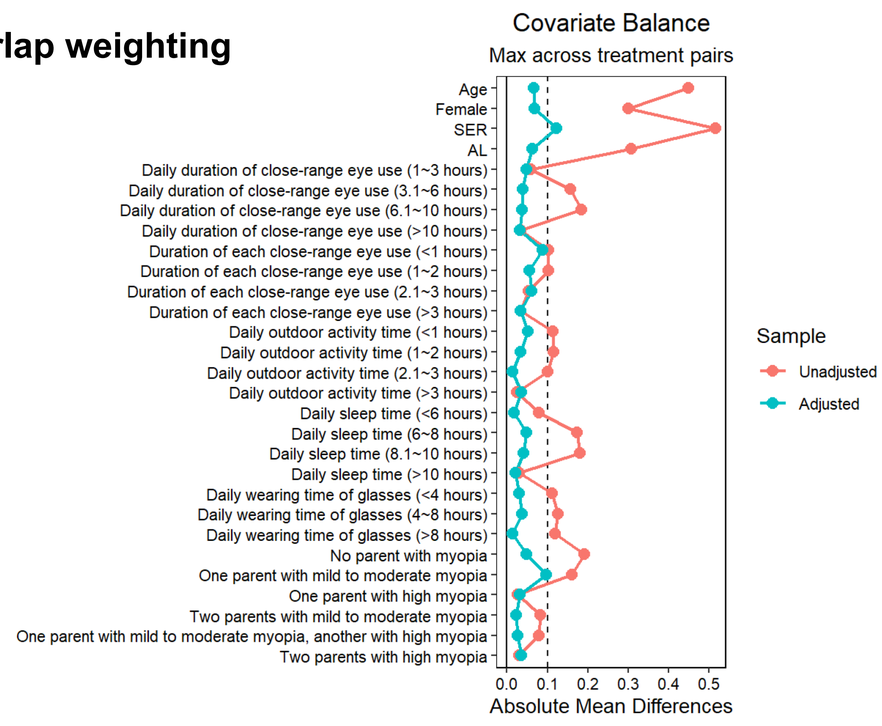
213 with DIMS, 78 with HAL, 102 with PD, 169 with APD, 71 with SV

Female 48.03%

Mean age 11.32 years

Overlap weighting

After overlap weighting, baseline characteristics were well-balanced with maximum pairwise standardized mean difference < 0.1 except for SER.



- **Multigroup comparisons of PD，DIMS，HALT，APD，SV on outcomes**

	Unweighted						Weighted					
Variables	PD	DIMS	APD	HALT	SV	*P* value	PD	DIMS	APD	HALT	SV	*P* value
Changes of SER mean (SD)	-0.67 (0.42)	-0.43 (0.37)	-0.59 (0.40)	-0.32 (0.43)	-0.76 (0.48)	< 0.001	-0.64 (0.41)	-0.40 (0.35)	-0.60 (0.41)	-0.28 (0.40)	-0.68 (0.45)	< 0.001
Changes of AL mean (SD)	0.31 (0.19)	0.22 (0.25)	0.31 (0.23)	0.16 (0.20)	0.35 (0.20)	< 0.001	0.33 (0.19)	0.20 (0.27)	0.31 (0.21)	0.12 (0.18)	0.34 (0.18)	< 0.001

- **Paired comparisons of PD，DIMS，HALT，APD，SV on outcomes**

Change in SER from baseline to follow-up

	Unweighted			Weighted			Doubly robust with the unbalanced covariate		
	Estimate mean difference	Standard Error	Adjusted P value	Estimate mean difference	Standard Error	Adjusted P value	Estimate mean difference	Standard Error	Adjusted P value
PD vs SV	0.09	0.06	1	0.04	0.07	1	0.04	0.07	1
DIMS vs SV	0.33	0.06	< 0.001	0.28	0.07	< 0.001	0.28	0.06	< 0.001
APD vs SV	0.17	0.06	0.19	0.08	0.07	1	0.08	0.07	1
HALT vs SV	0.44	0.07	< 0.001	0.41	0.08	< 0.001	0.40	0.08	< 0.001
DIMS vs PD	0.23	0.05	< 0.001	0.24	0.05	< 0.001	0.24	0.05	< 0.001
APD vs PD	0.08	0.05	1	0.04	0.06	1	0.04	0.06	1
HALT vs PD	0.35	0.06	< 0.001	0.37	0.07	< 0.001	0.37	0.07	< 0.001
APD vs DIMS	-0.16	0.04	< 0.001	-0.20	0.04	< 0.001	-0.20	0.04	< 0.001
HALT vs DIMS	0.12	0.05	0.04	0.13	0.06	0.07	0.13	0.06	0.19
HALT vs APD	0.27	0.06	< 0.001	0.33	0.06	< 0.001	0.33	0.06	< 0.001

Change in AL from baseline to follow-up

	Unweighted			Weighted			Doubly robust with the unbalanced covariate		
	Estimate mean difference	Standard Error	Adjusted P value	Estimate mean difference	Standard Error	Adjusted P value	Estimate mean difference	Standard Error	Adjusted P value
PD vs SV	-0.04	0.03	1	-0.01	0.03	1	-0.01	0.03	1
DIMS vs SV	-0.13	0.03	< 0.001	-0.14	0.03	< 0.001	-0.14	0.03	< 0.001
APD vs SV	-0.04	0.03	1	-0.03	0.03	1	-0.03	0.03	1
HALT vs SV	-0.19	0.04	< 0.001	-0.22	0.03	< 0.001	-0.22	0.03	< 0.001
DIMS vs PD	-0.09	0.03	0.002	-0.12	0.03	< 0.001	-0.12	0.03	< 0.001
APD vs PD	0.00	0.03	1	-0.02	0.03	1	-0.02	0.03	1
HALT vs PD	-0.16	0.03	< 0.001	-0.20	0.03	< 0.001	-0.20	0.03	< 0.001
APD vs DIMS	0.08	0.02	< 0.001	0.10	0.03	< 0.001	0.10	0.03	0.001
HALT vs DIMS	-0.07	0.03	0.11	-0.08	0.03	0.05	-0.08	0.03	0.08
HALT vs APD	-0.15	0.03	< 0.001	-0.18	0.03	< 0.001	-0.18	0.03	< 0.001

Conclusions

In this study, DIMS and HAL spectacle lenses were more effective in slowing myopia progression compared with SV, PD, and APD spectacle lenses.

The findings may inform decisions for defocus spectacle lenses selection for myopia control.