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Myopia correction and management with spectacles

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49th

ECLSO

European Contact Lens and
Ocular Surface Congress

EUROPEAN CONGRESS
ON MYOPIA CONTROL

2 - 3
September
2022

Novotel Tour Eiffel

Paris - France



EUROPEAN CONTACT
LENS SOCIETY OF
OPHTHALMOLOGISTS

Speaker's name :

I do not have any potential conflict of interest

I have the following potential conflicts of interest to report:

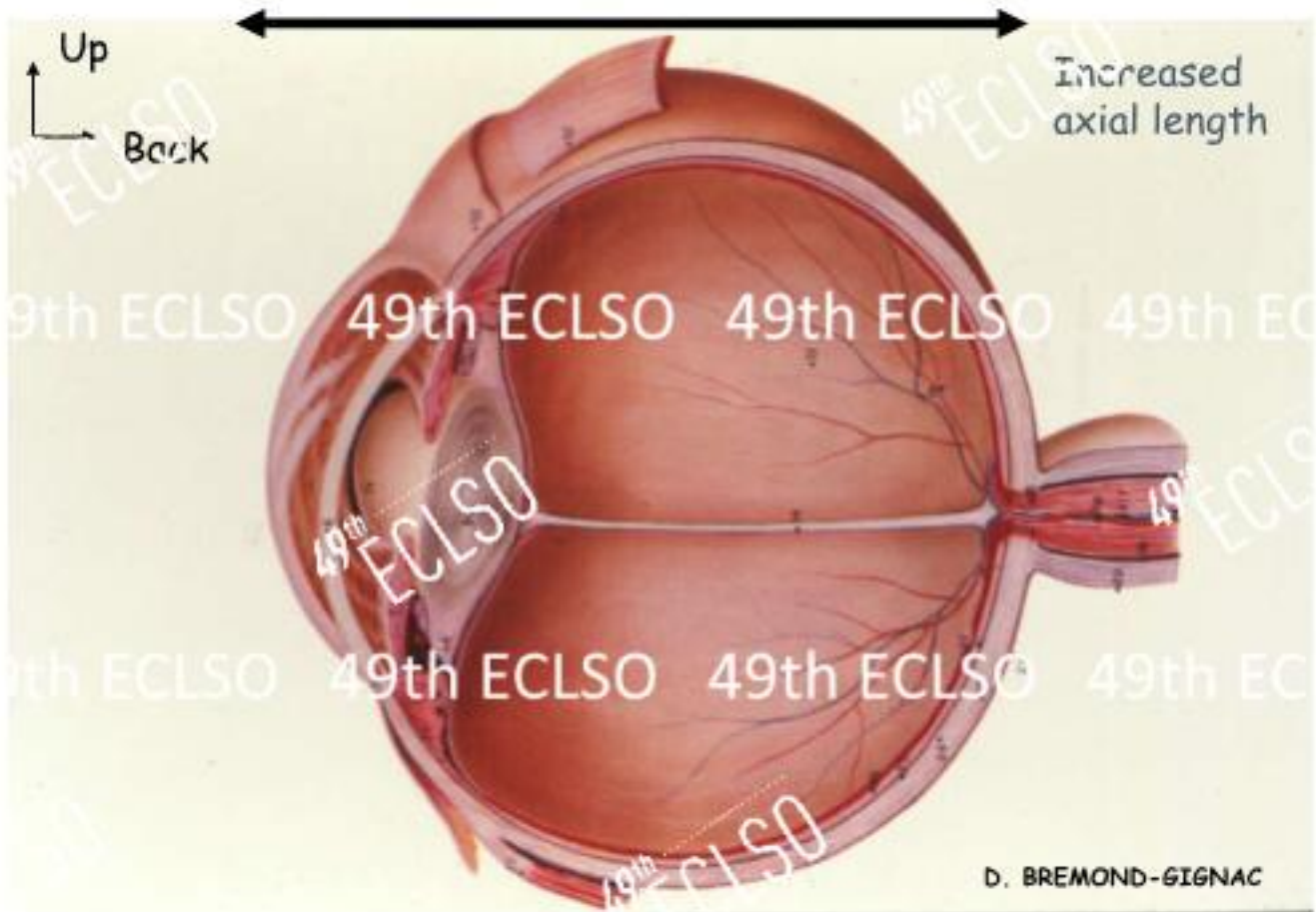
Alcon/Novartis, Bausch, Cooper, Hoya, Krys, Santen, Théa

Children's eye is not a miniature eye:

It grows!



Myopic eye



Concept of myopia blurred vision



Needs to be corrected for visual development!

Children's visual impairment/blindness

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- 👁️ One child becomes blind every minute
- 👁️ 1,8M blind children in the world with prevalence 1,5 for 1000
- 👁️ Definition of blindness in children is less 1/10^{ème} for the best eye in children from 0 to 15 yo
- 👁️ INSERM & ASNAV Studies:
20-25% ocular anomalies in children less than 6 yo

Bremond-Gignac D & al. Visual development in infants: physiological and pathological mechanisms. *Curr Opin Ophthalmol.* 2011



Myopia with visual impairment/blindness

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- 👁️ Myopia : socio-economic burden of myopia is major
- 👁️ Evaluated at 268 Billions /year with blindness risk
- 👁️ Global public health concern

Kempen JH, Mitchell P, Lee KE & al. The prevalence of refractive errors among adults... Arch Ophthalmol. 2004

Holden B, Sankaridurg P, Smith E, Aller T, Jong M, He M. Myopia, an underrated global challenge to vision: where the current data takes us on myopia control. Eye (Lond). 2014

Myopia diagnosis

- 👁️ Diagnosis of myopia has to be done!
- 👁️ Visual screening+++
- 👁️ Differential diagnosis
- 👁️ Optical correction
- 👁️ Myopia Complications
- 👁️ Prevention and myopia control



Very high Myopia of -18D

Recognize myopia initial check-up and correction

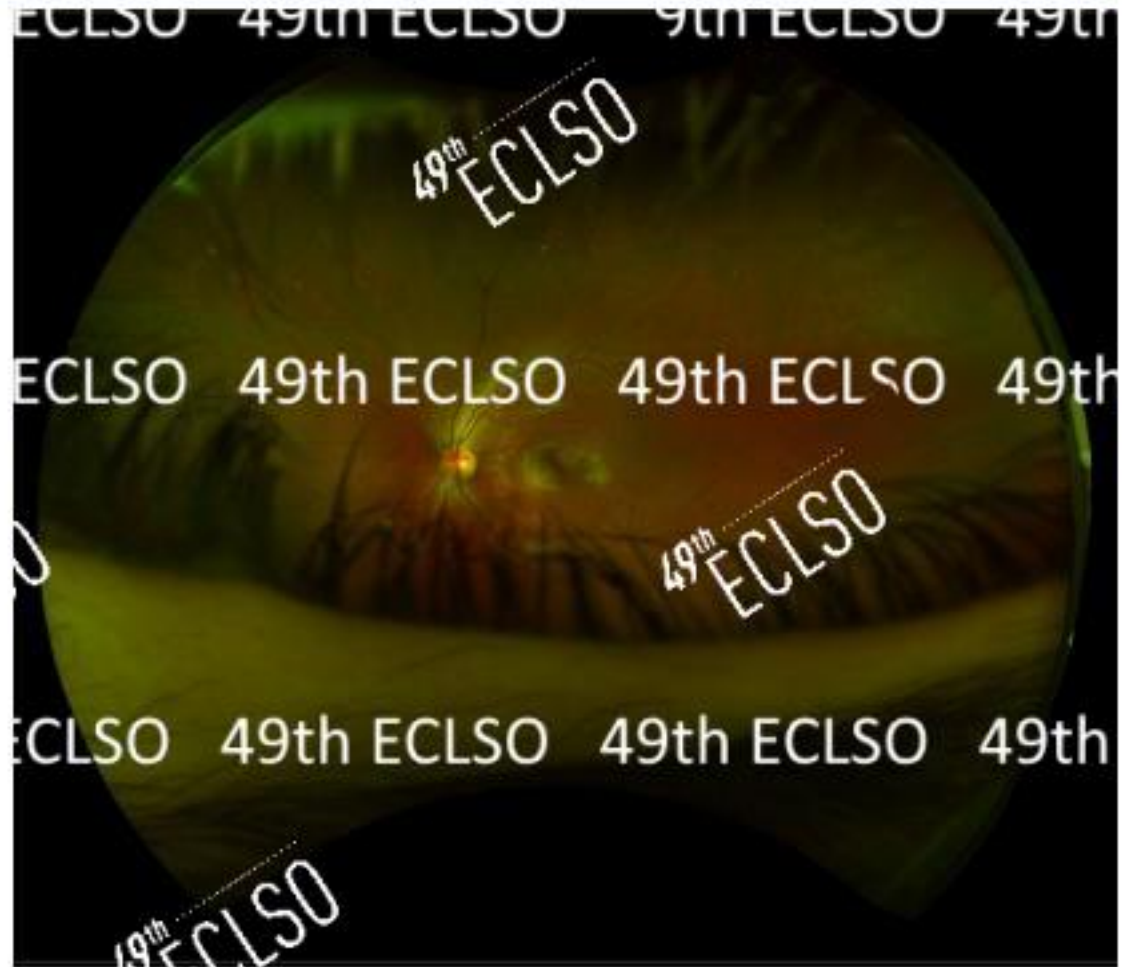
- 👁️ Initial diagnosis of myopia in children
 - 👁️ Refraction $< -0,5D$, Orthoptic check-up
 - 👁️ Increased axial length, Optical measure
 - 👁️ **Cycloplegia mandatory**
 - 👁️ Eliminate juvenile glaucoma
 - 👁️ **Full optical correction is mandatory**



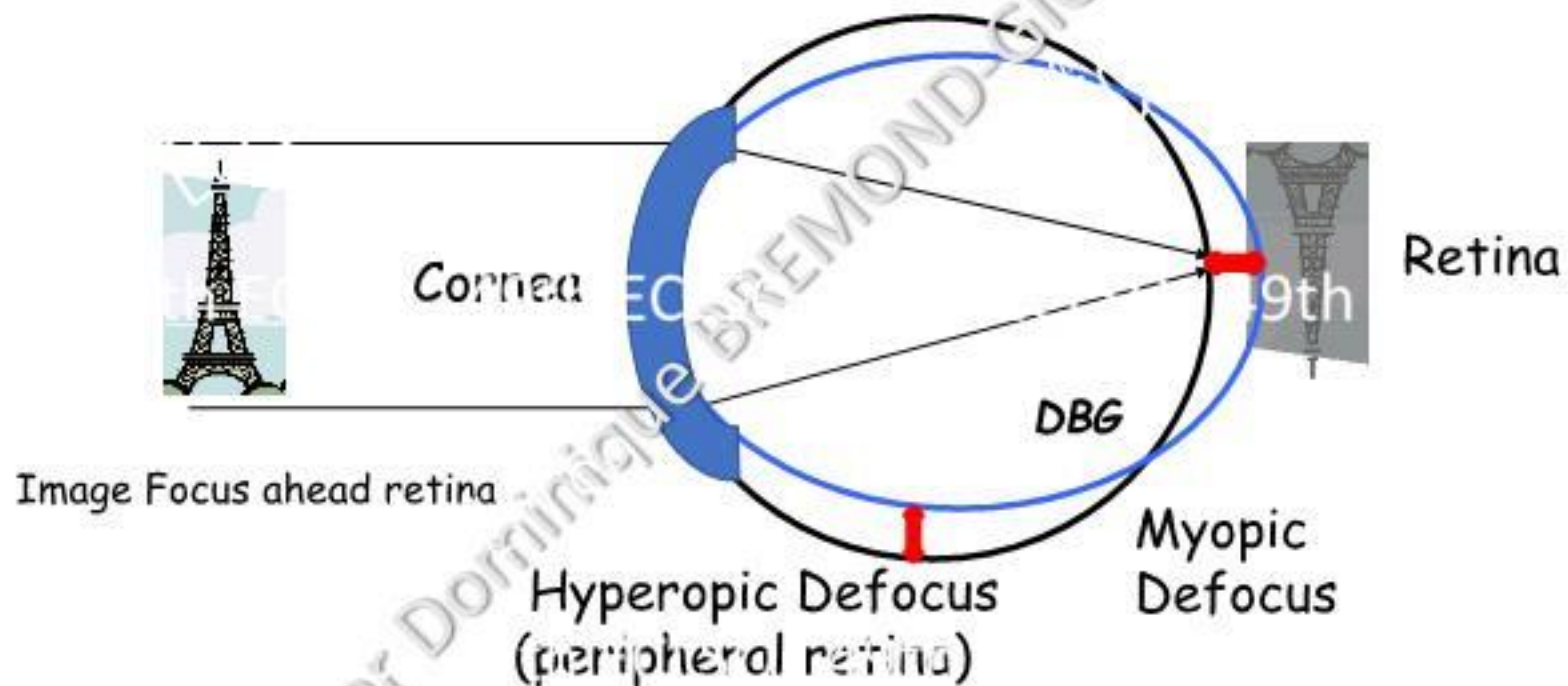
Juvenile glaucoma



Ultra wide field fundus



Physiopathology of myopic eye



Principle of the defocusing lens create a non-hypermetropic defocus on the average peripheral while maintaining an optimal myopic optical correction in the central zone of vision of the lens

Different Defocus spectacle lenses systems

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👁️ **DIMS System MiYOSMART® (HOYA)**

Technology Defocus Incorporated Multiple Segments



👁️ **HALT System Stellest® (Essilor)**

Technology Highly Aspherical Lenslet Target



👁️ **MyoVision ACE® (Zeiss)**

Technology Defocus system with power gradient



Spectacle lenses MiYOSMART

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👁️ DIMS System

Technology

Defocus Incorporated Multiple Segments

-3,5D de defocus

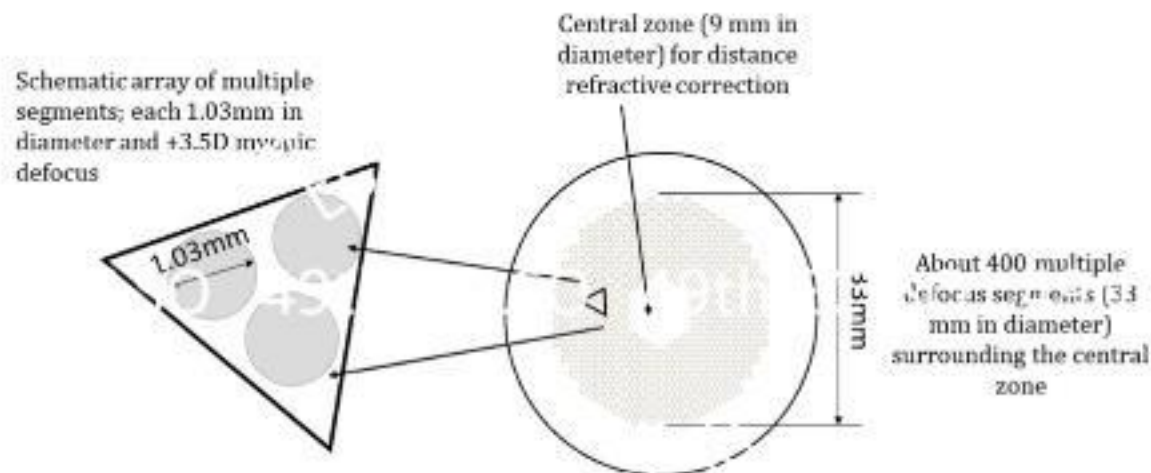
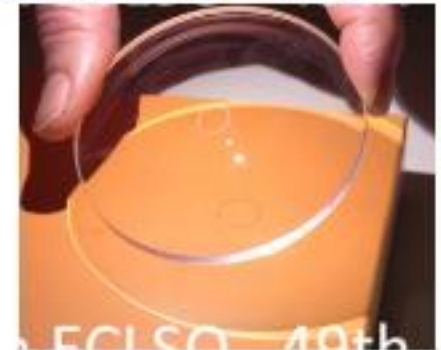


Figure 1 The design of the Defocus Incorporated Multiple Segment (DIMS) spectacle lens.

Defocus spectacle lenses DIMS System

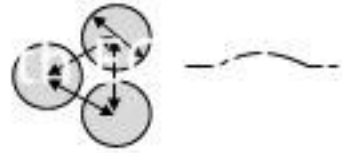
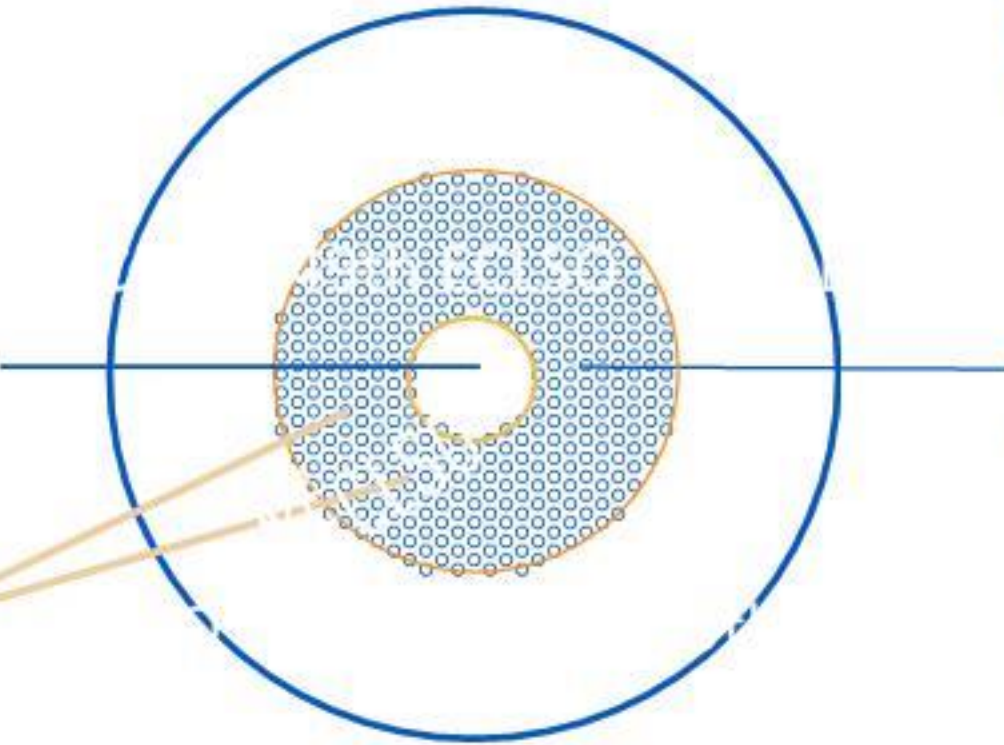
CENTRAL ZONE OF FAR VISION

DIMS spectacle lens has a central part of 9,40 mm without defocus segment.

TREATMENT ZONE

Unique structure of DIMS lens, protected by a licence, allows normal visual perception (i.e. maximal visual acuity) and gestion of myopia at the same time.

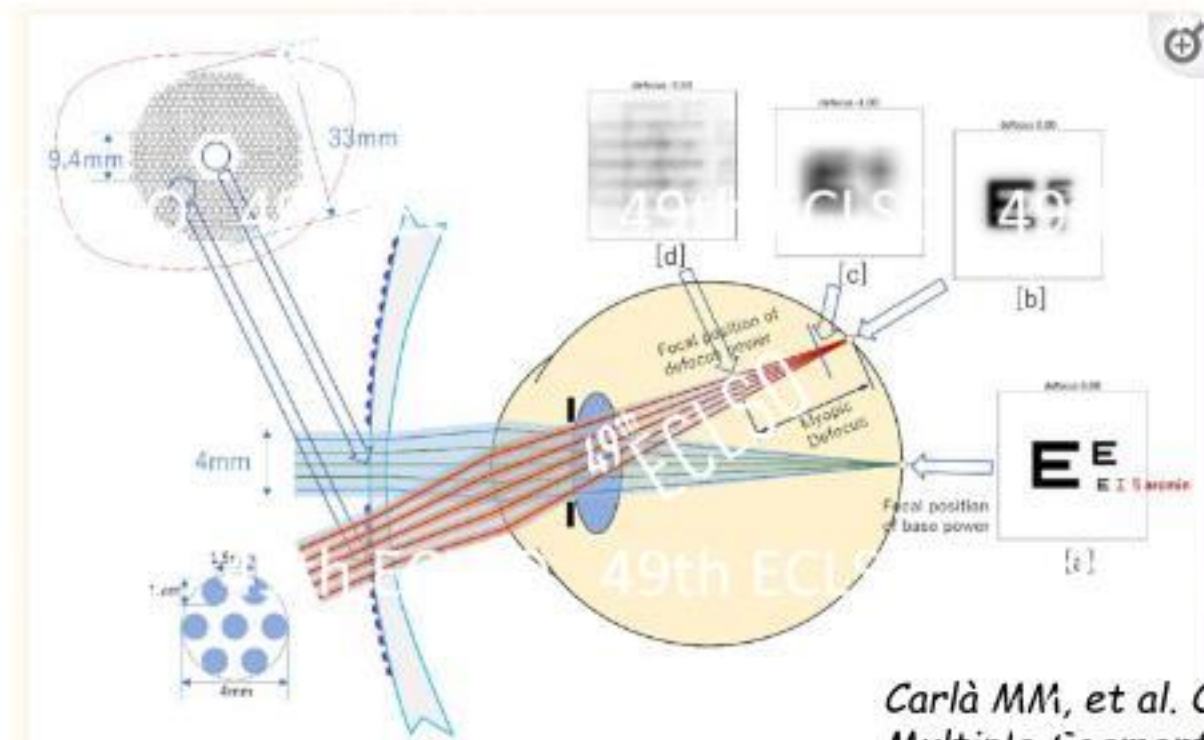
Lens has multiple defocus systems distributed in a honeycomb high density structure with a diameter of 33 mm. Each islet assure a **defocus of 3,5D**.



Defocus spectacle lenses MiYOSMART®

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👁️ DIMS System



Carlà MM, et al. Overview on Defocus Incorporated Multiple Segments Lenses: A Novel Perspective in Myopia Progression Management. *Vision (Basel)*. 2022

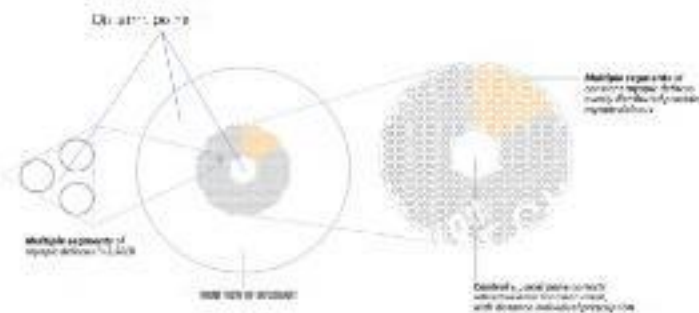
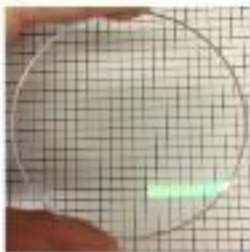
Defocus spectacle lenses

👁️ Defocus

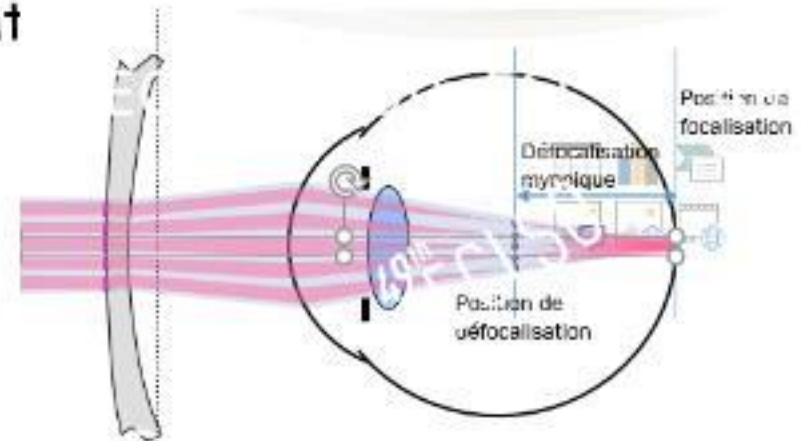
👁️ **MiYOSMART** Hoya

👁️ **D.I.M.S. Technology**

Defocus Incorporated Multiple Segment



Monofocal Zone: 9,5mm



HOYA

1. Lam CS, Tang WC, Lee PH, Zhang HY, Qi H, Hasegawa K, To CH. Myopia control effect of defocus incorporated multiple segments (DIMS) spectacle lens in Chinese children: results of a 3-year follow-up study. *Br J Ophthalmol*. 2021 Mar

Defocus spectacle lenses Stellest®

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👁️ HALT System

Highly Aspherical Lenslet Target

Defocus lens Stellest®

👁️ HALT Defocus

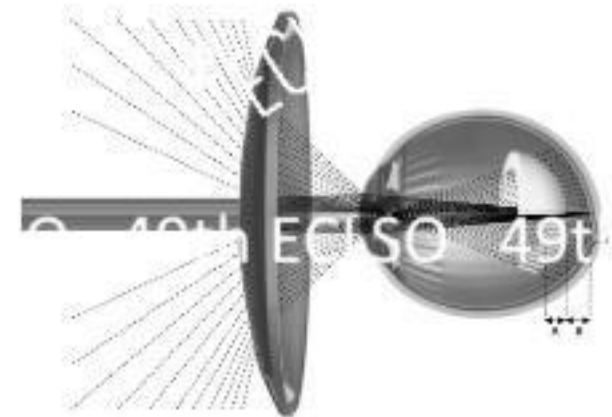
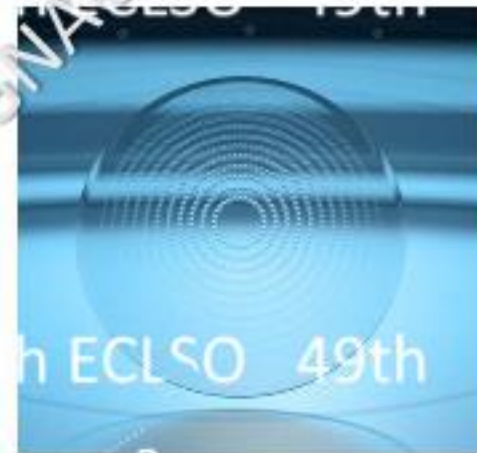
Highly Aspherical Lenslet Target

👁️ STELLEST® Essilor

👁️ Radia! HALT

(Highly Aspherical Lenslet Target)

constellation of aspherical lenslets on 11 rings with
a volume of defocus signal



1. Bao J, Yang A, Huang Y, Li X, Pan Y, Ding C, Lim EW, Zheng J, Spiegel DP, Drobe B, Lu F, Chen H. One-year myopia control efficacy of spectacle lenses with aspherical lenslets. *Br J Ophthalmol*. 2021 Apr

Defocus spectacle lenses MyoVision ACE®

👁 Peripheral Defocus system with power gradient

- 👁 MyoVision ACE® Zeiss
- 👁 12mm monofocal central then defocus by power gradient until 2,5D in periphery
- 👁 Progressive peripheral blur Lenses
- 👁 Allow solar lenses, thinned lenses and high astigmatism

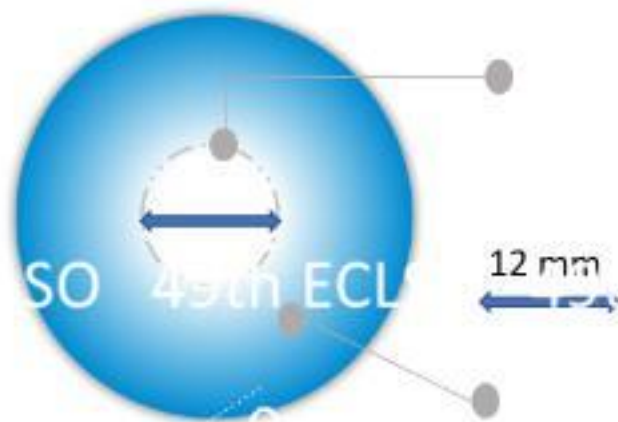
ZEISS MyoVision ➤ ZEISS MyoVision ACE



Defocus spectacle lenses MyoVision ACE®

👁 Defocus

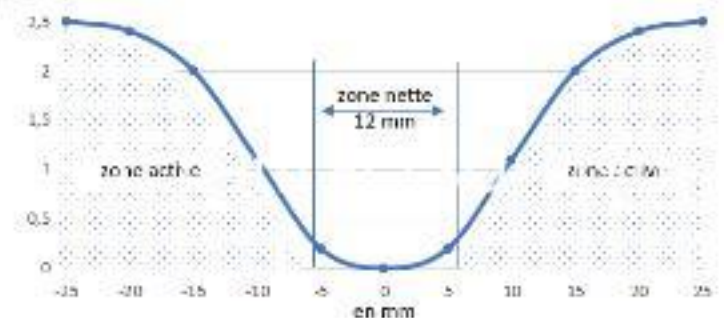
- 👁 Defocus by power gradient until 2,5D in periphery
- 👁 Lenses with progressive peripheral blur



Puissance moyenne sur le verre et indication de centrage (pleine pupille)



Puissance par rapport au point central de référence



Study Defocus spectacle lenses MyoVision ACE®

- 👁️ ACE system, power gradient until 2,5D in periphery
- 👁️ No publication available
- 👁️ Study Ongoing, recruiting

Study Defocus lens Stellest®

👁️ HALT System

Highly Aspherical Lenslet Target

👁️ Defocus

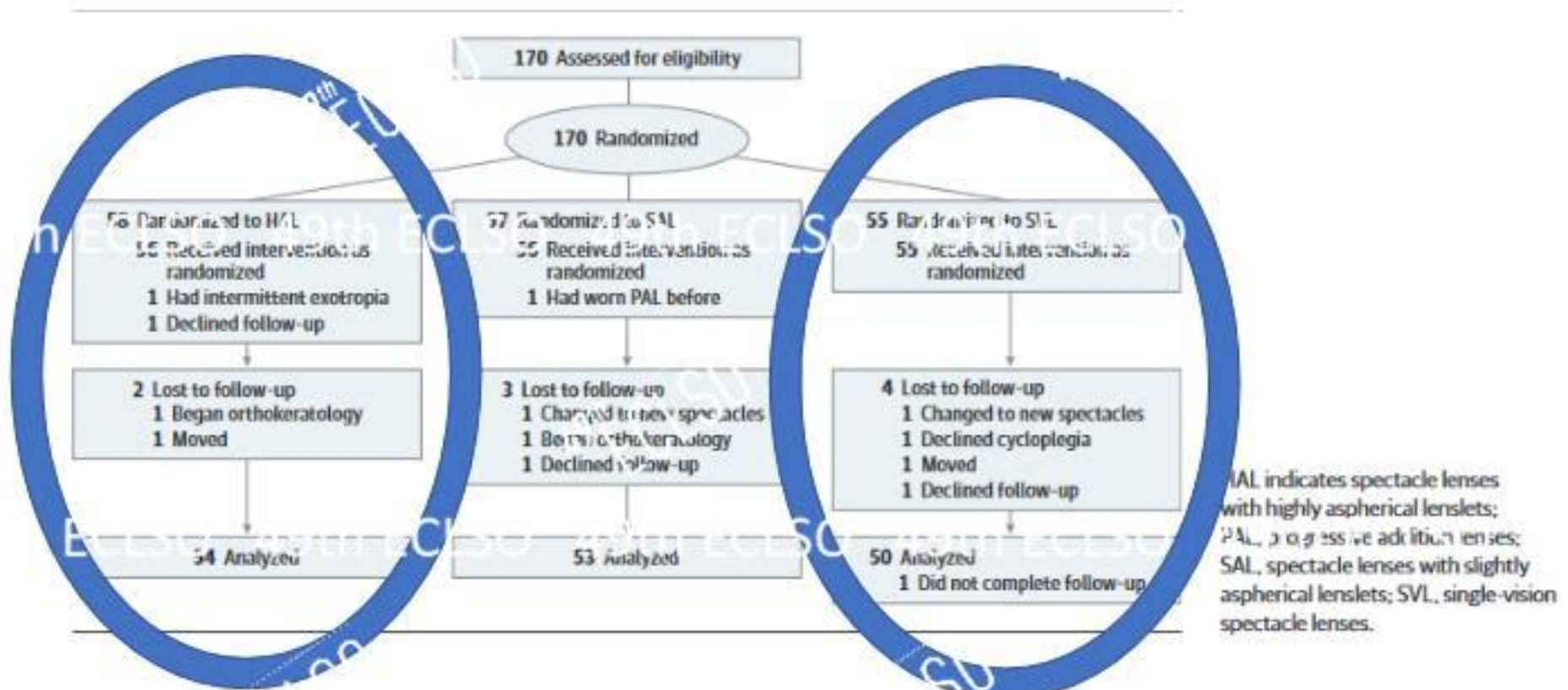
- 👁️ 2 years published
- 👁️ 161 (54 Stellest HALT/53 SAL/50) children
- 👁️ Myopia control 55%/ Ax length 51%



1. Bao J, Yang A, & al. One-year myopia control efficacy of spectacle lenses with aspherical lenslets. *Br J Ophthalmol*. 2021 Apr
2. Bao J, Huang Y, & al. Spectacle Lenses With Aspherical Lenslets for Myopia Control vs Single-Vision Spectacle Lenses: A Randomized Clinical Trial. *JAMA Ophthalmol*. 2022 Mar

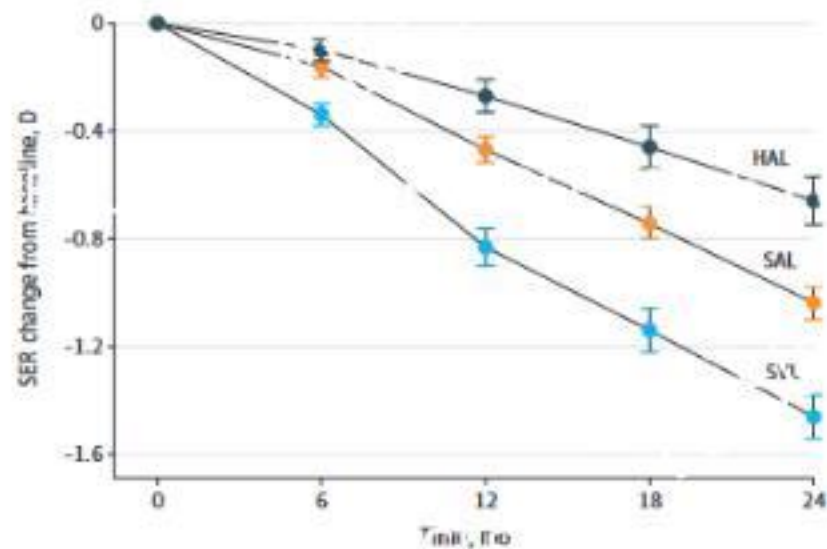
Study Defocus spectacles lenses Stellest®

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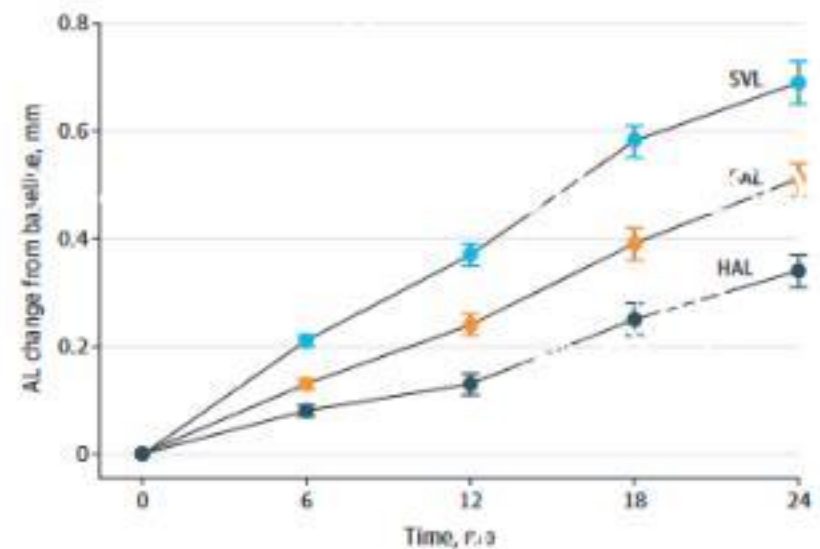


Study Defocus spectacles lenses Stellest®

A Change in unadjusted SER



B Change in unadjusted AL



Error bars represent standard errors of the mean. HAL indicates spectacle lenses with highly aspherical lenslets; SAL, spectacle lenses with slightly aspherical lenslets; SVL, single-vision spectacle lenses.

Study Defocus lenses Stellest®

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Table 2. Comparisons of Myopia Progression and Axial Elongation Between Full- and Part-time Wearers

Clinical value	Mean (SE)		
	HAL ^a	SAL ^a	SVL ^a
Change in SER, D			
Full-time wearers	-0.48 (0.10)	-0.95 (0.08)	-1.44 (0.10)
Part-time wearers	-0.92 (0.13)	-1.15 (0.10)	-1.50 (0.15)
P value	.01	.11	.77
Change in AL, mm			
Full-time wearers	0.28 (0.04)	0.46 (0.04)	0.69 (0.04)
Part-time wearers	0.43 (0.06)	0.57 (0.04)	0.70 (0.07)
P value	.03	.10	.92

Abbreviations: AL, axial length; HAL, spectacle lenses with highly aspherical lenslets; SAL, spectacle lenses with slightly aspherical lenslets; SER, spherical equivalent refraction; SVL, single-vision spectacle lenses.

^a Full-time wearers wore lenses at least 12 hours per day, and part-time wearers wore lenses at least 6 hours per day. In the HAL group, there were 32 full-time wearers and 22 part-time wearers. In the SAL group, there were 30 full-time wearers and 23 part-time wearers. In the SVL group, there were 34 full-time wearers and 16 part-time wearers.

Study Defocus lenses MiYOSMART®

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👁 System DIMS

👁 Technology

Defocus Incorporated Multiple Segments

Study Defocus lens MiYOSMART®

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👁️ Asian children followed on 2 years

MiYOSMART® Hoya

👁️ 183 children (93/90)

👁️ Control myopia on 2 years

👁️ Control myopia of 59 %

(mean)

👁️ Eye axial Length of 60%

(en moyenne)

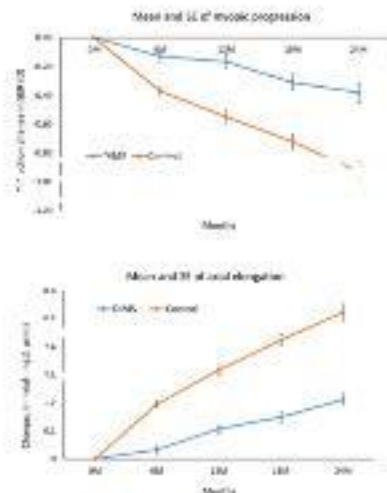


Figure 1. Mean and SE of myopia progression and axial elongation over 24 months for DIMS and Control groups.

Clinical science

Defocus Incorporated Multiple Segments (DIMS) spectacle lenses slow myopia progression: a 2-year randomised clinical trial

Carly Siu Yin Lam,¹ Wing Chan Tang,¹ Dennis Yan-yin Tse,¹ Roger Pak Kin Lee,¹ Rachel Ka Man Chan,¹ Keigo Hasegawa,² Hai Qi,² Takashi Hatanaka,² Chi Ho To¹

Abstract
Aim To determine if Defocus Incorporated Multiple Segments (DIMS) spectacle lenses slow childhood myopia progression.
Methods A 2-year double-masked randomised controlled trial with a 12-month follow-up period. 183 children, aged 6–12 years, were randomly assigned to wear DIMS (n=93) or single vision (SV) spectacle lenses (n=90). DIMS lens incorporated multiple segments with optical defocus of +1.50 D. Axial elongation and myopia progression were measured at 6-month intervals.
Results 180 children completed the study, 92 in the DIMS group and 88 in the SV group. Myopia progression over 2 years was -0.15 ± 0.11 D in the DIMS group and $+0.15 \pm 0.11$ D in the SV group. Mean axial elongation was 0.55 ± 0.11 mm in the DIMS group and 0.25 ± 0.11 mm in the SV group. Myopia progression was 52% slower in the DIMS group compared with those in the SV group (mean difference -0.44 ± 0.09 D, 95% CI -0.72 to -0.17 , $p < 0.0001$). Likewise, children in the DIMS group had less axial elongation by 62% than those in the SV group (mean difference 0.30 ± 0.04 mm, 95% CI 0.22 to 0.37 , $p < 0.0001$). 21.1% children who wore DIMS lenses had no myopia progression over 2 years, but only 3.9% for those who wore SV lenses.
Conclusions Our study shows that DIMS spectacle lenses slow myopia progression and axial elongation in children. Our study demonstrated that DIMS lenses slow myopia progression and axial elongation in children.

Several clinical interventions are currently used for slowing the progression of myopia.^{1,2} A meta-analysis in efficacy comparison of different interventions for myopia control reported that myopia control treatment is relatively more effective than eye drops (such as 0.01% atropine or 0.05% atropine).³ Light therapy (such as orthokeratology) is also effective, but the associated side effects, such as photophobia and blurry vision, are not well tolerated. Lower dose (0.01%–0.1%)^{4,5} atropine eye drops similar treatment effects with less side effects, which are reasonably preventable as possible, making spectacles the most ideal alternative option.
 A meta-analysis have provided solid evidence that atropine eye drops (AED) inhibit eye growth, reduce myopic defocus progression, eye growth,⁶ and reduce myopia.⁷ The previous meta-analysis⁸ and clinical studies^{9,10} have demonstrated that myopia eye growth could be inhibited or arrested by applying AED using dual-point or individual lenses. Indeed, AED is likely to be the key mechanism that underlies a number of current myopia control strategies, such as orthokeratology¹¹ and multifocal soft contact lenses.^{12,13}
 Several years ago, we designed a concentric dual-point soft contact lens called ‘Defocus Incorporated Multiple Segments’ (DIMS) lens for myopia control. Our study has built on the evidence that atropine eye drops slow myopia progression and axial elongation in children. Our study demonstrated that DIMS lenses slow myopia progression and axial elongation in children.

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 Mar;104(3):363–368.

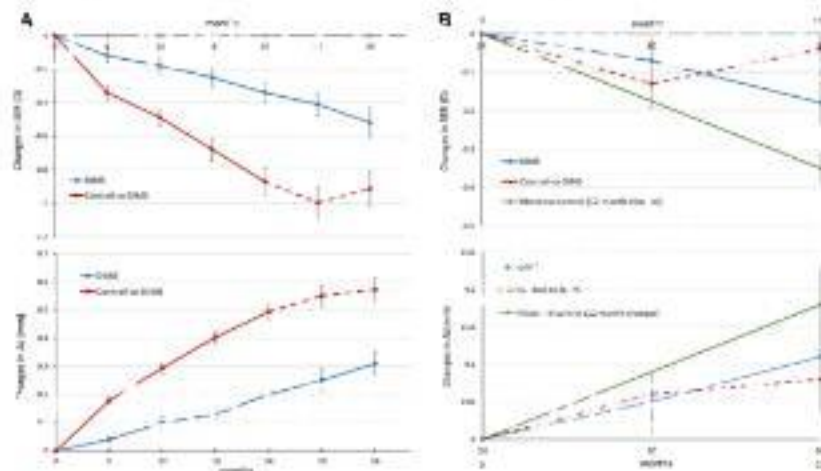
Study Defocus lens MiYOSMART®

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👁️ Asian study on 3 years

👁️ 128 patients

👁️ Myopia control on 3 years



Myopia control effect of defocus incorporated multiple segments (DIMS) spectacle lens in Chinese children: results of a 3-year follow-up study

Carly SY Lam^{1,2}, Wang Chun Tang¹, Paul H Lee^{1,2}, Han Yu Zhang^{1,2}, Hua Qi¹, Kojiro Hasegawa^{1,2}, Chi Ho To^{1,2}

ABSTRACT

AIM: To determine myopia progression in Chinese children wearing DIMS lenses, the use of defocus incorporated multiple segments (DIMS) lenses for myopia control in Chinese children was evaluated using a 3-year follow-up study.

Methods: 128 children (aged 6-12 years) were recruited to the DIMS trial. DIMS lenses were compared to conventional DIMS lenses (DMS group), and 0 diopter lenses were used as control (DMS group). Children were followed up for 36 months. Myopia control was assessed as the change in spherical equivalent (SE) over the 36-month period.

Results: The 3-year SE change was significantly smaller in the DIMS group (-0.45 D) compared to the DMS group (-0.85 D) and the control group (-1.05 D). The DIMS group showed a significantly smaller SE change compared to the DMS group and the control group.

Conclusion: DIMS lenses showed a significantly smaller SE change compared to the DMS group and the control group over 36 months.

Lam CS, Tang WC, Lee PH, Zhang HY, Qi H, Hasegawa K, To CH. Myopia control effect of defocus incorporated multiple segments (DIMS) spectacle lens in Chinese children: results of a 3-year follow-up study. *Br J Ophthalmol*. 2021 Mar

Study Defocus lens MiYOSMART®

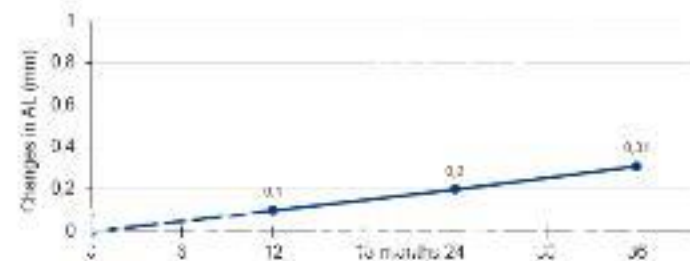
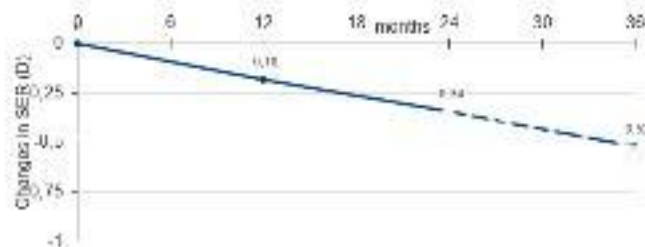
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👁 Asian study on 3 years

CONCLUSION

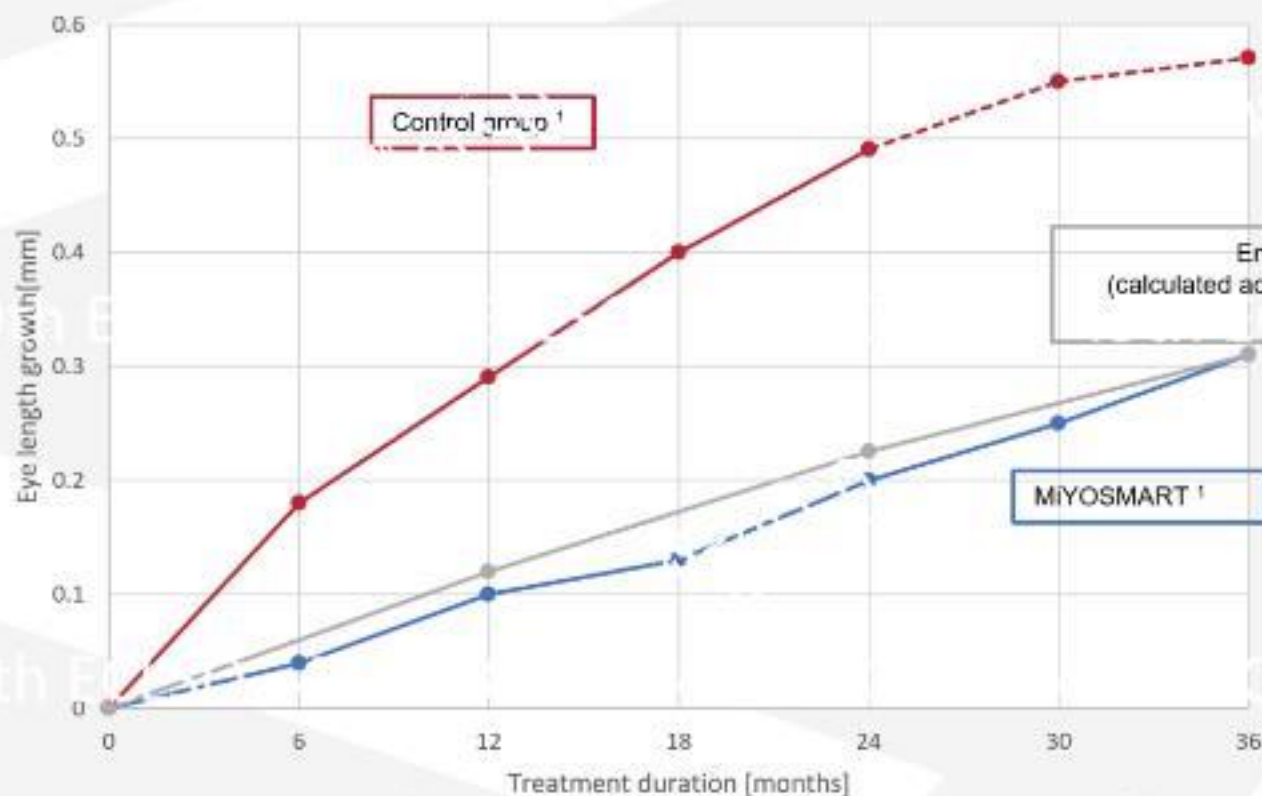
Myopia control by defocus spectacle lenses MiYOSMART stable on 3 years and :

- Annual Progression dioptrique (SER):
 - 1st year -0.18D
 - 2nd year -0.16D
 - 3rd year -0.18D
- Annual Progression AL (AL)
 - 1st year 0.1 mm
 - 2nd year 0.1 mm
 - 3rd year 0.11 mm



Lam CS, Tang WC, Lee PH, Zhang HY, Qi H, Hasegawa K, To CH. Myopia control effect of defocus incorporated multiple segments (DIMS) spectacle lens in Chinese children: results of a 3-year follow-up study. *Br J Ophthalmol*. 2021 Mars

Increased Axial Length DIMS on 3 years



Longitudinal analysis of axial length growth in a German cohort of healthy children and adolescents

Carolin Truckenbrod¹, Christof Meigen¹, Manuel Biedt¹, Mandy Vogel¹, Pablo Sans Diaz^{2,3}, Siegfried Wahl^{2,4}, Anne Jarkutat¹ and Wolfram Koozekan^{1,5,6}

¹ Data on file; 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 myopic progression for a 2-year randomised clinical trial.

British Journal of Ophthalmology. Published Online First: 29 May 2019. doi:10.1136/bjophthalmol-2018-313739

Different groups & number of subjects³



	GROUP 1 (n=36)	GROUP 2 (n=14)	GROUP 3 (n=22)	GROUP 4 (n=18)	p - value
Age at enrolment (\pm s.d.)	9.75 \pm 1.42	10.21 \pm 1.53	10.50 \pm 1.41	10.33 \pm 1.71	0.265
Gender, % (no.)					
Male	47% (17)	79% (11)	45% (10)	50% (9)	
Female	53% (19)	21% (3)	55% (12)	50% (9)	0.195

Defocus lenses

Type of defocus lens	Optical Company	Defocus system	Monofocus central Zone	Power of defocus	Clinical studies
MIYOSMART	HOYA OPTICS	D.I.M.S (Defocus Incorporated Multiple Segments) (400 microlens)	9,40mm	3,5D	YES
STELLEST	ESSILOR LUXOTTICA	HALT (Highly Aspherical Lenslet Target) 1021 microienselets	9mm		YES
MyoVision ACE	ZEISS	Defocus with power gradient	12mm	2,5D	ONGOING

Defocus lenses

Type of defocus lens	Defocus system	Clinical studies published	Nb patients treated included/ control	Nb patients/ Nb control	Conclusion
MIYOSMART	D.I.M.S (Defocus Incorporated Multiple Segments) (200 microlens)	6 years study 2 and 3 years studies Myopia control 55% myopia diopters 60% Axial Length 6 years study	183 children (93 Miyosmart/ 90)	3 years studies 120 (65 / 55) 6 ans years Prog 0,92D AL 0,60mm	6 years study Control 59% in D 60% in AL
STELLEST	HALT (Highly Aspherical Lenslet Target) 1021 microlenslets	2 years study Myopia control 55% myopia diopters 51% axial length	161/106 children (54 Stellest/ 55/52) children	2 years studies 106 children (54 Stellest/ 52)	2 years study 55% in D 51% in AL
MyoVision ACE	Defocus with power gradient	Studies ongoing No publication	Recruiting	Ongoing	No results available



Take home messages



👁️ Environmental Measures

👁️ Different treatments by defocus systems: all different

- 👁️ Defocus lenses MiYOSMART® (6 years study, 2014)
- 👁️ Defocus lenses STELLEST® (2 ans years study, 2018)
- 👁️ Defocus lenses Myovision ACE® (Ongoing study)

👁️ Defocus lenses we need to consider

- Published clinical studies, double mask, with proved efficacy
- Long studies to evaluate long efficacy and rebound





Necker Ophthalmology Team



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