Visual performance with an extended depth of focus contact lens for myopia control and corneal topography in assessing lens centration.

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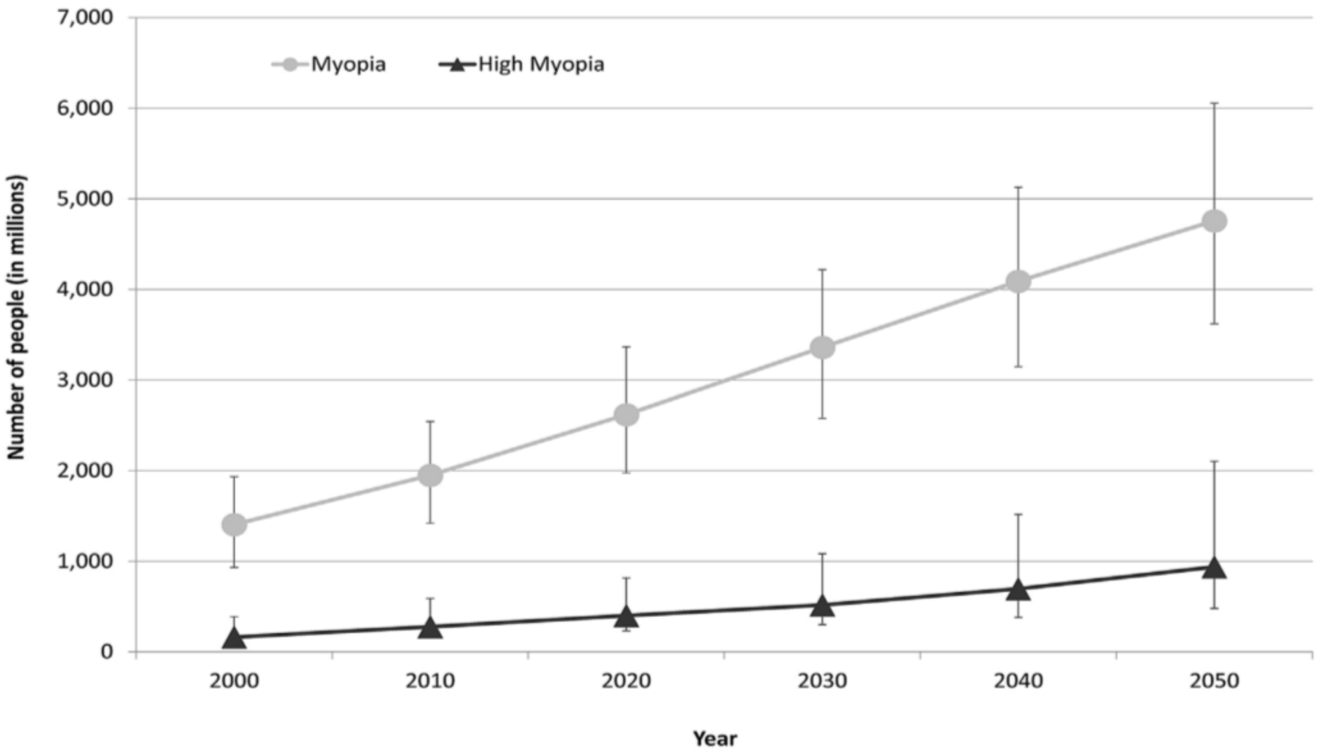
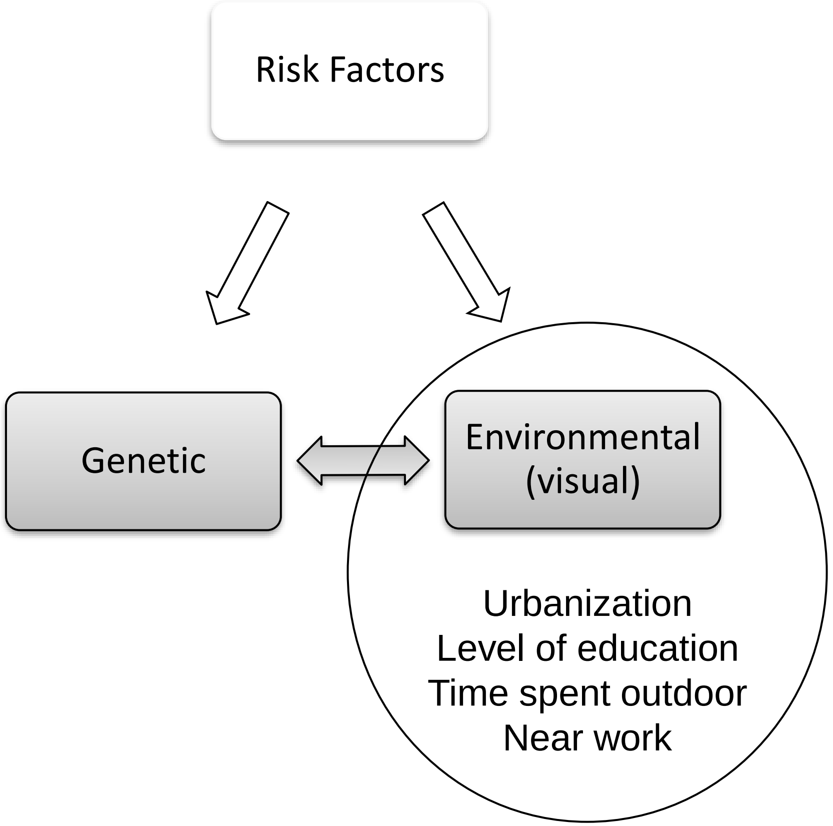
Myopia prevalence and risk factors

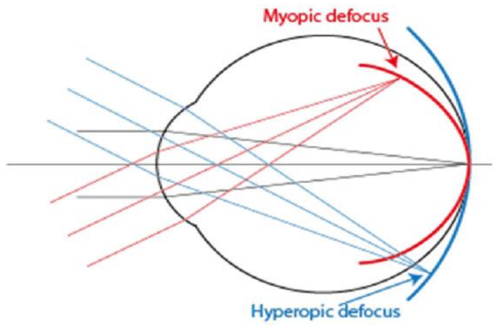
In 2050 myopia will affect about half of the population worldwide with a portion of these people more likely to develop myopic-related ocular conditions.

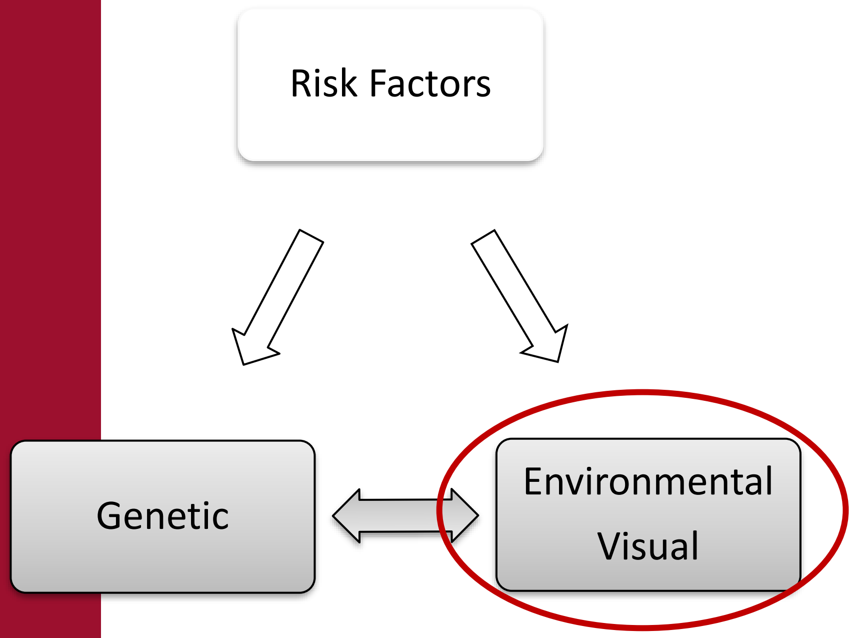


Holden, B. A., Fricke, T. R., Wilson, D. A., Jong, M., Naidoo, K. S., Sankaridurg, P., ... & Resnikoff, S. (2016). Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. *Ophthalmology*, *123*(5), 1036-1042.



Myopia control strategies





Many strategies have been suggested to prevent myopia onset or reduce the progression

- Pharmacological
- Environmental
- Surgical
- **Optical**

Peripheral defocus

Spectacles

Contact lenses

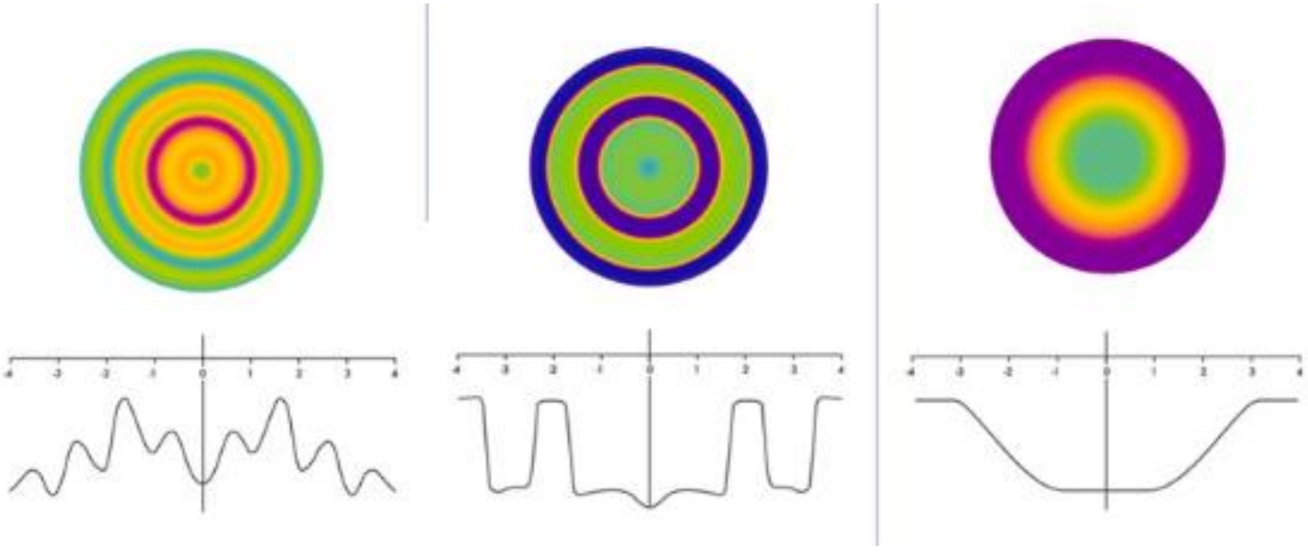
- Ortho-K
- **Multifocal CLs (MCLs)**

Walline, J. J., et al. 2020. Interventions to slow progression of myopia in children. Cochrane Database of Systematic Reviews.

Smith EL, Hung L-F, Huang J. Relative peripheral hyperopic defocus alters centralrefractive development in infant monkeys. Vision Res 2009;49(19):2386–92. https://doi.org/10.1016/j.visres.2009.07.011.

Myopia control - MCLs

Different optical designs of MCLs for myopia control
- extended depth of focus (EDOF)
- bifocal concentric lenses
- peripheral gradient lenses



Potential issues, in visual performance with MCLs

- **reduction in visual acuity** and contrast sensitivity

- presence of ghost images or haloes

EDOF ?

The **centration** of the lens is one **important factor** that can strongly **impact the efficacy** of the correction with MCLs.

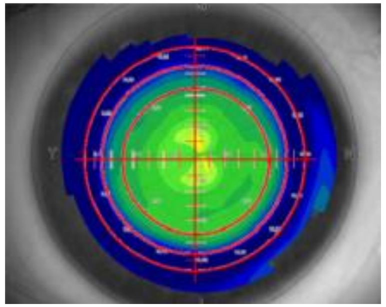
Recently a procedure to evaluate CLs centration through the use of a corneal topography performed over CL has been suggested for scleral lenses and MCLs (not EDOF).

Przekoracka K, Michalak K, Olszewski J, Zeri F, Michalski A, Paluch J, et al. Contrast sensitivity and visual acuity in subjects wearing multifocal contact lenses with high additions designed for myopia progression control. Contact Lens Anterior Eye 2020;43(1):33–9. https://doi.org/10.1016/j.clae.2019.12.002.

Vincent SJ, Collins MJ. A topographical method to quantify scleral contact lens decentration. Contact Lens Anterior Eye 2019;42(4):462–6. https://doi.org/ 10.1016/j.clae.2019.04.005.

Zeri F, Di Vizio A, Guida M, Rotondi A, Tavazzi S, Naroo SA. Accuracy, inter-observer and intra-observer reliability in topography assessment of multifocal contact lens centration. Contact Lens Anterior Eye 2020;43(5):448–57. https://doi. org/10.1016/j.clae.2020.02.008.

Purpose



Evaluate accuracy and repeatability of the centration assessment of EDOF CLs using corneal topography*

Compare the visual performance of EDOF with a control single vision CL

Purpose

*Giulia Carlotta Rizzo, *Contact Lens and Anterior Eye*, https://doi.org/10.1016/j.clae.2021.101533

Method

Material and Sample

Commercial name	Xtensa	Mylo
Manufactor	Mark'ennovy (Spain)	Mark'ennovy (Spain)
Material	Filcon IV	Filcon V3
$\%H_2O$	55%	75%
Design	Aspheric	EDOF
Base Curve [mm]	8.70	7.10 – 9.80 (steps 0.30)
Diameter [mm]	14.40	13.50 – 15.50 (steps 0.50)

	Whole sample (n=33)
Gender	
Men / Women	8 (24.2 %) / 25 (75.8%)
Age (years)	
Mean ± SD (min;max)	22.7 ± 2.0 (18.6; 27.9)
spherical equivalent (D) right eye	
Mean ± SD (min;max)	-2.92 ± 2.02 (-9.63; -0.50)
spherical equivalent (D) left eye	
Mean ± SD (min;max)	-2.95 ± 2.03 (-9.88; -0.25)

1 Examiner (preliminary examination, data collection)

2 Observers (naïve vs more then 20 years of experience)

Method

Vision Chart LCD (CSO; Florence; Italy)

CL evaluation with slit lamp (SL)
Gold standard

SL elite HR (CSO; Florence; Italy)

Topography over EDOF CL

Osiris-T (CSO; Florence; Italy)

For each EDOF CL, a topography over the CL and a slit lamp (SL) digital picture were taken.

Performance

Monocular scotopic visual acuity (VA), with both lenses, was evaluated at high (HC – 96.5%) and low contrast (LC - 12.5%)

Scoring letter by letter

Zeri F, Di Vizio A, Guida M, Rotondi A, Tavazzi S, Naroo SA. Accuracy, inter-observer and intra-observer reliability in topography assessment of multifocal contact lens centration. Contact Lens Anterior Eye 2020;43(5):448–57. https://doi.org/10.1016/j.clae.2020.02.008.

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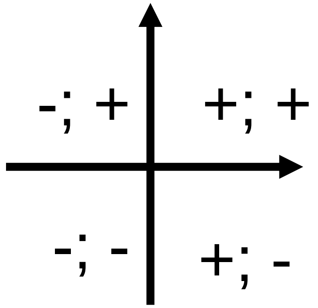
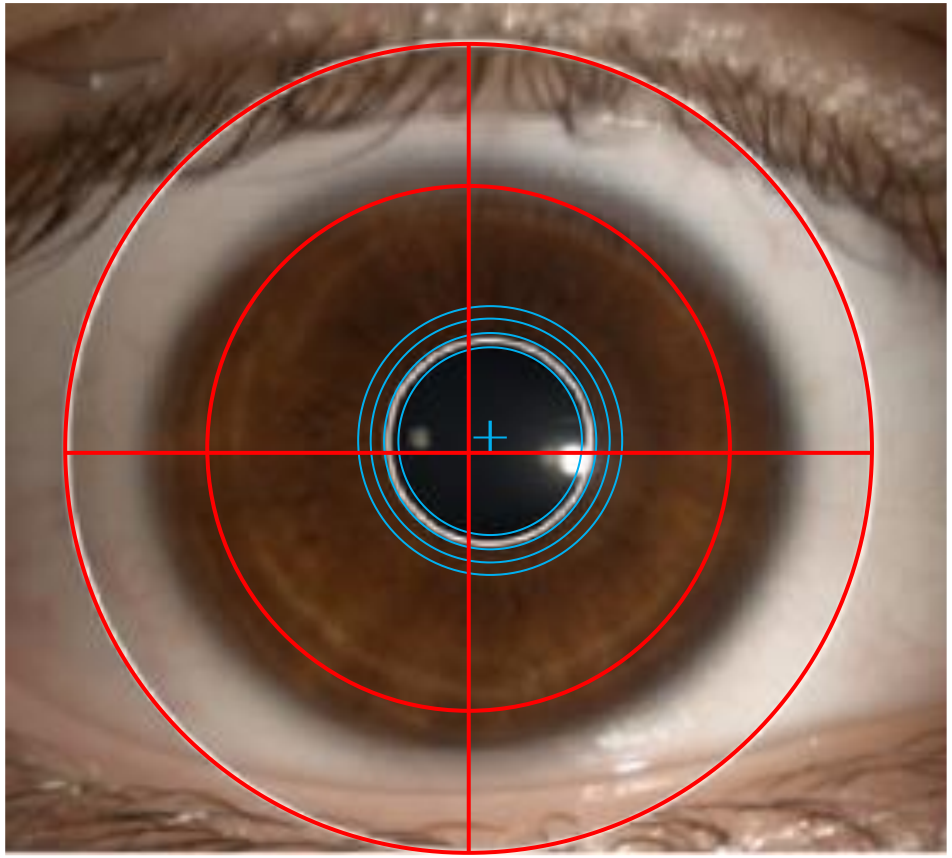
Method

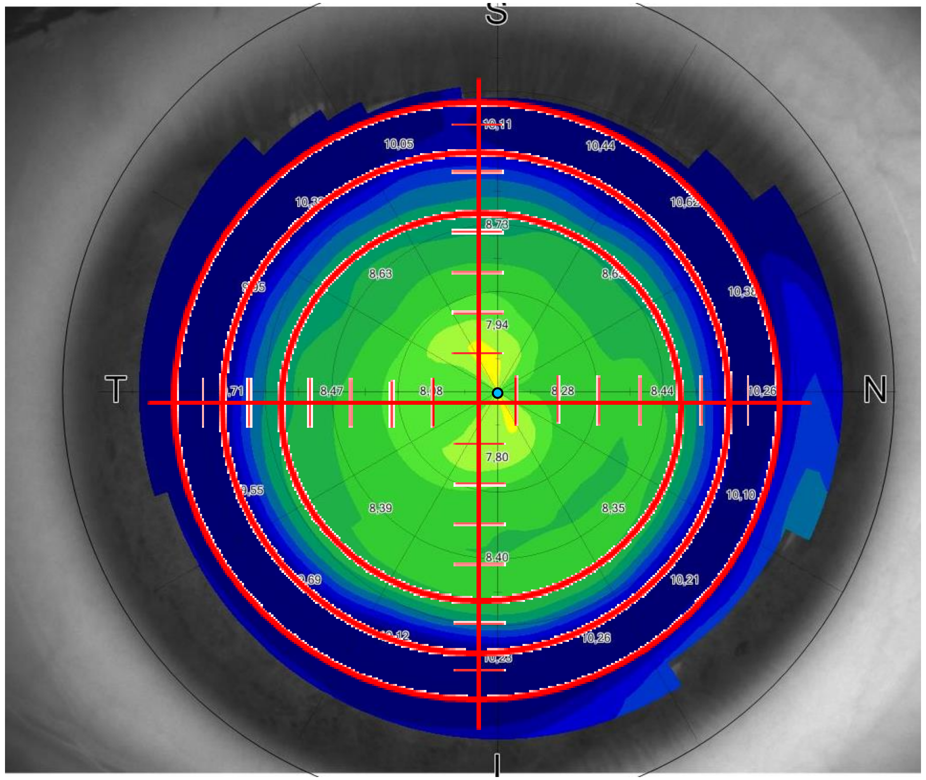
EDOF CL centration respect to pupil centre …





For the SL images, a software was used to assess the position of the lens

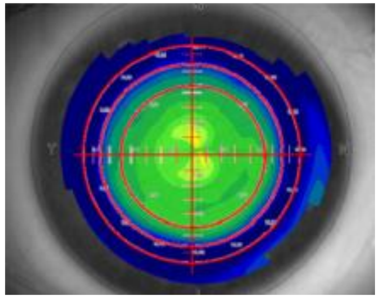
For the topography acquisitions, the position was detected using a qualitative procedure, by two observers and repeated after 15 days.



Results

CL centration

- Accuracy
- Inter-observer repeatability
- Intar-observer repeatability

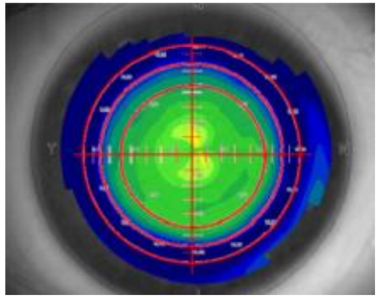


Visual performance

- HCVA
- LCVA

Results

Assesment of CL centration - Accuracy



EDOF CL centre coordinates (*x, y*) respected to pupil centre according the 2 different procedures used to assess CL centration

Right Eye

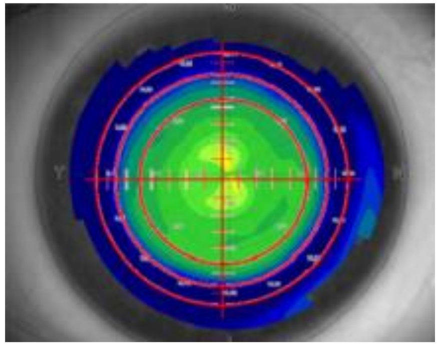
	SL assessment		T assessment		Paired comparison (*t*-test)	
Coordinate	*x*	*y*	*x*	*y*	*x*	*y*
Mean ± SD (mm) (Range: min/max)	−0.27 ± 0.19 (0.09/ −0.64)	−0.12 ± 0.31 (0.44/ −0.98)	−0.12 ± 0.19 (0.29/ −0.49)	−0.19 ± 0.16 (0.11/ −0.52)	**t = −3.61 p < 0.01**	t = −1.39 p = 0.17

Left Eye

	SL assessment		T assessment		Paired comparison (*t*-test)	
Coordinate	*x*	*y*	*x*	*y*	*x*	*y*
Mean ± SD (mm) (Range: min/max)	0.22 ± 0.23 (0.64/ −0.20)	−0.17 ± 0.34 (0.43/ −0.95)	0.25 ± 0.18 (0.77/ −0.05)	−0.21 ± 0.18 (0.14/ −0.68)	t = −0.65 p = 0.52	t = −0.72 p = 0.48

T assessment values represent the average of the measurements achieved by the two observers

Assesment of CL centration – Repeatability



Inter-observer repeatability

Topographical assessment	Right eye		Left eye	
	x	*y*	*x*	*y*
Observer 1	−0.11 ± 0.22 mm	−0.16 ± 0.18 mm	0.22 ± 0.18 mm	−0.16 ± 0.20 mm
Observer 2	−0.14 ± 0.19 mm	−0.22 ± 0.16 mm	0.28 ± 0.23 mm	−0.26 ± 0.22 mm
Paired comparison (*t*-test)	t = 1.02; p = 0.31	**t = 2.83; p < 0.01**	t = -1.73; p = 0.09	**t = 2.68; p < 0.01**

Observer 1 - with less clinical experience

Observer 2 - with longer clinical experience

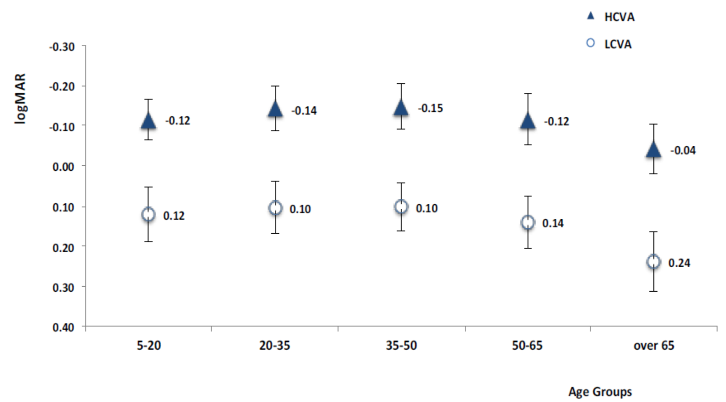
Intra-observer repeatability T0 – T15

	Topographical assessment			
	Right eye		Left eye	
	x	*y*	*x*	*y*
Observer 1	0.58 (0.29–0.77)	0.75 (0.55–0.87)	0.65 (0.38–0.81)	0.81 (0.64–0.90)
Observer 2	0.84 (0.70–0.92)	0.89 (0.79–0.95)	0.88 (0.77–0.94)	0.96 (0.92–0.98)

Test-retest intraclass correlation coefficients (ICC) (single measures, with 95% CI) for the two observers

Results

Visual Acuity – EDOF vs SV CL



Right Eye

	High Contrast			Low Contrast		
	EDOF CL	SV CL	Wilcoxon signed-rank test	EDOF CL	SV CL	Wilcoxon signed-rank test
Mean ± SD (logMAR)						
Range (min; max)						

Left Eye

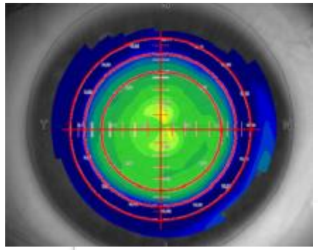
	High Contrast			Low Contrast		
	EDOF CL	SV CL	Wilcoxon signed-rank test	EDOF CL	SV CL	Wilcoxon signed-rank test
Mean ± SD (logMAR)	-0.06 ± 0.09	-0.14 ± 0.07	**p<0.05**	0.23 ± 0.11	0.11 ± 0.10	**p<0.05**
Range (min; max)	(-0.18; 0.18)	(-0.28; 0,06)		(0.06; 0.50)	(-0.06; 0.38)	

SV CL: Single Vision Contact Lens; LCVA: Low Contrast Visual Acuity; HCVA: High Contrast Visual Acuity.

0,02 logMAR = 1 letter

LogMAR (Minimum Angle of Resolution)	Decimal Notation (Visus)
−0.30	2.00
−0.12	1.33
0.00	**1.00**
0.10	0.80
0.18	0.67
0.30	0.50
0.40	0.40
0.48	0.33
0.60	0.25
0.70	0.20
0.78	0.17
0.88	0.13
1.00	0.10
1.30	0.05

Conclusions



Centration of the EDOF CL can be accurately detected by a corneal topography performed over CL.

Intra- and inter-observer reliability of the measurement were good; however, a certain potential effect of observer experience in the field could affect the level of repeatability of the technique.

VA with EDOF CLs was significantly lower compared to single vision CL expecially at LC

… next step …

Evaluate the impact of EDOF CL decentration on VA

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Thank you for your attention!