

Subjective measurement of peripheral refraction.

Authors:

Claudia Colandrea, Maria Pia Bussa, Michela Greco, Marina Serio, Marta Gastaldi, Alessia Chenis, Silvia Di Benedetto, Alessia Bellatorre, Gabriele Civiero.



**UNIVERSITÀ
DI TORINO**

**109° Congresso Nazionale
SIF 2023**



**SOCIETÀ ITALIANA DI FISICA
Italian Physical Society**

**Dipartimento di Fisica
dell'Università di
Salerno (Fisciano)**

Off-axis refraction in scientific literature

The study of peripheral refraction has increased rapidly after the [link](#) between myopia development and peripheral refraction has been developed. [Lundström L. et al., 2011]

2000 -2010: ~50 pub x year

2011 -2018: ~80 pub x year

weak increase in the number of studies

Hot topics

year	PR		Myopia		Dry Eye	
	N pub.	% grow	N pub.	% grow	N pub.	% grow
2022	153	39	2120	26	2129	17
2020	110	38	1686	29	1819	23
2018	80	0	1310	63	1473	80
2011	80		805		820	



Off-axis refraction and myopia



Connection through the years

- **Myopic eyes** are corrected with spherical geometry tend to have relative peripheral hypermetropia. [Jonas, J. B. et al., 2021]
- Although for every diopter of peripheral hyperopic defocus in children, myopia progression only increased by 0.02 D per year. [Mutti DO, Sinnott LT, Reuter KS, et al., 2019]
- Review → Some off-axis **HOAs** seems to influence the refractive state of the eye and their changes during **accommodation** may contribute to the progression of myopia. [Gomes, J.; Sapkota, K.; Franco, S., 2023]

IMI, 2021



Most studies on peripheral refraction are **objective** and **instrumental**

- Wave-front refraction
 - Autorefractometry
 - Retinoscopy
- Reliability of retinoscopy** will be better during on the axis measurement and that the examiner should always perform retinoscopy along the visual axis of the patient with minimal accommodative effort. [Chaurasiya RK., 2022]

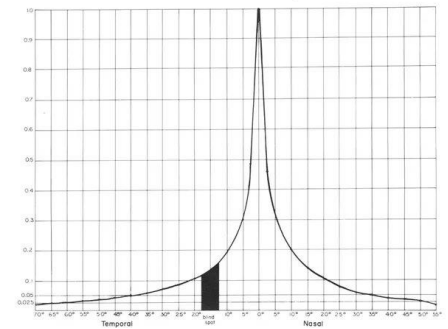
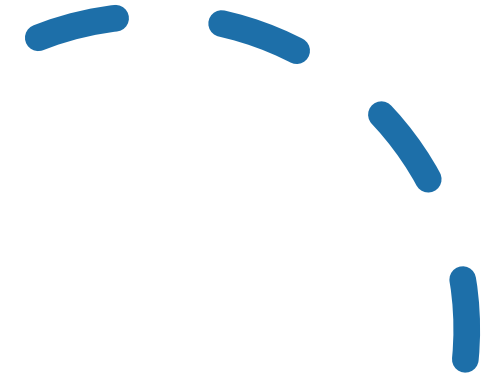
Demir P et al., 2023

Methods

- Preliminary study
- 54 participants
- Age range: 20 to 72 y

- **1) Objective and Subjective Monocular central refraction**

- **2) OFF axis subjective refraction**
 - 4 gaze positions
 - 5,20 m
 - H → 0,6 logMAR
 - 25 cm from lateral fixation points
 - 2,76° from fovea
 - **+0,25 D / -0,25 D Sph.**

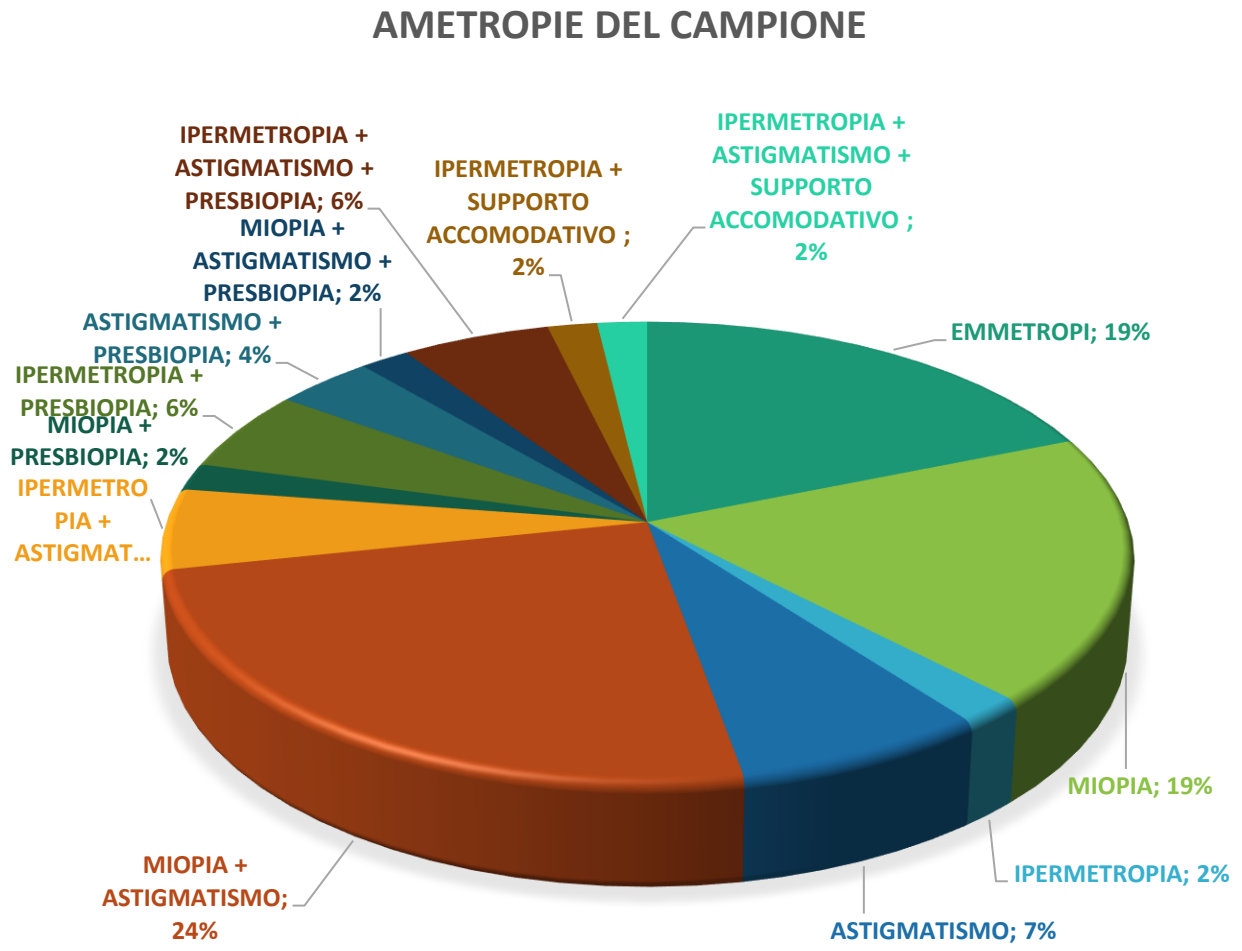
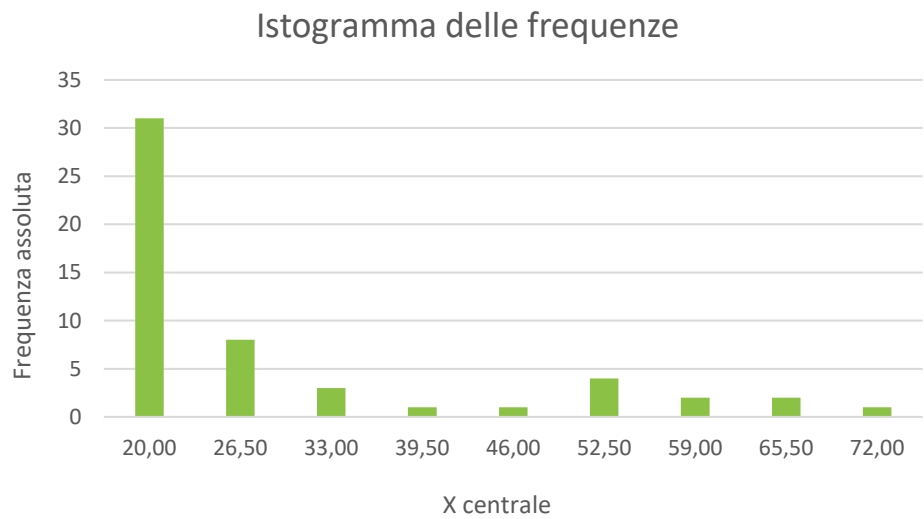


Increase in perceived contrast

Humphriss Immediate
Contrast

Data analysis

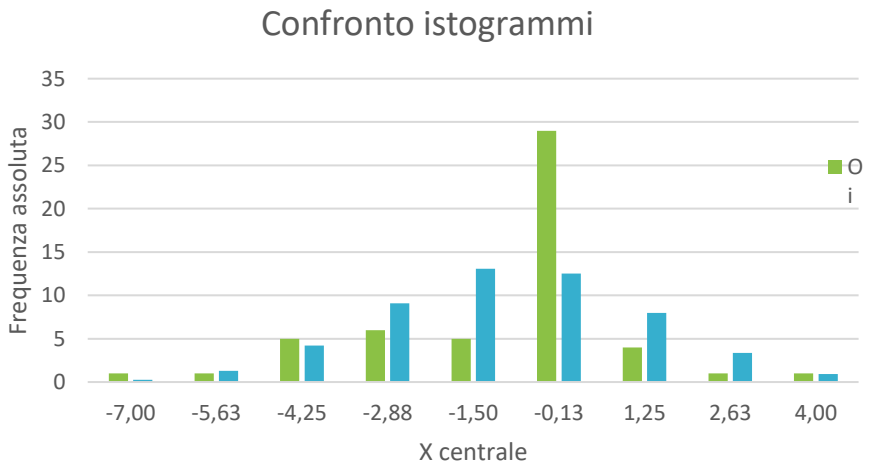
- Distribution of sample ages
- Chart showing ametropias



Shapiro-Wilk χ^2 test → NOT NORMAL → preliminary data set with 30 students

Data analysis

- Spherical equivalent distribution for central refraction



Shapiro-Wilk
 Calculated W: 0,915673
 Critical W: 0,9562 Calc < Critical W
 Pval < 0,05 → **NOT NORMAL**

How strongly the categories are associated?

PR (- or +)

Rx cat.

Myopia nasal

Myopia + Ast

nasal, temporal, inf, sup

	N			

	nasale -0,25	tempiale -0,25	inferiore -0,25	superiore -0,25	totale
miope	9	9	8	9	35
miope + astigmatico	13	7	8	11	39
totale	22	16	16	20	74

In conclusione

Cramer's V

MYOPIA / + LENS	0.11	→	weakly associated
MYOPIA / - LENS	0.20	→	
HYPEROPIA / + LENS	0.58	→	moderate
HYPEROPIA / - LENS	0,20	→	

[ES>0.6 → strong association]

Index
bias

+

unreliable correlations
between qualitative
amount

Categoria Ipermetropi e
categoria preferenza lente
positiva → maggior
dipendenza.

- Pre pilota per
 - Valutazione della risposta periferica
 - Applicabilità clinica
- Necessario campione distribuito per fasce d'età e per condizione refrattiva.

Grazie a tutti per
l'attenzione!

E per il supporto ed il lavoro
svolto insieme ringrazio:

Maria Pia Bussa, Michela
Greco, Marina Serio, Marta
Gastaldi, Alessia Chenis,
Silvia Di Benedetto, Alessia
Bellatorre, Gabriele Civiero.



SOCIETÀ ITALIANA DI FISICA
Italian Physical Society



UNIVERSITÀ
DI TORINO



Bibliography

- Lundström, L.; Rosén, R.; Baskaran, K.; Jaeken, B.; Gustafsson, J.; Artal, P.; Unsbo, P. Symmetries in peripheral ocular aberrations. *J. Mod. Opt.* **2011**, *58*, 1690–1695.
- Jonas JB, Ang M, Cho P, et al. IMI Prevention of Myopia and Its Progression. *Invest Ophthalmol Vis Sci.* 2021;62(5):6.
- Mutti DO, Sinnott LT, Reuter KS, et al... Peripheral refraction and eye lengths in myopic children in the Bifocal Lenses In Nearsighted Kids (BLINK) Study. *Transl Vis Sci Technol.* 2019; 8: 17.
- Gomes, J.; Sapkota, K.; Franco, S. Central and Peripheral Ocular High-Order Aberrations and Their Relationship with Accommodation and Refractive Error: A Review. *Vision* **2023**, *7*, 19.
- Romashchenko, D.; Papadogiannis, P.; Unsbo, P.; Lundström, L. Simultaneous measurements of foveal and peripheral aberrations with accommodation in myopic and emmetropic eyes. *Biomed. Opt. Express* **2021**, *12*, 7422.
- Chaurasiya RK. Refractive changes during off-the-axis retinoscopy in myopia. *Indian J Ophthalmol.* 2022;70(3):779-781.
- Demir P, Macedo AF, Chakraborty R, Baskaran K. Comparison of an open view autorefractor with an open view aberrometer in determining peripheral refraction in children. *J Optom.* 2023;16(1):20-29.
- Tay E, Mengher L, Lin XY, Ferguson V. The impact of off the visual axis retinoscopy on objective central refractive measurement in adult clinical practice: a prospective, randomized clinical study. *Eye (Lond).* 2011;25(7):888-892.
- Zhu X, Wang D, Li N, Zhao F. Effects of Customized Progressive Addition Lenses vs. Single Vision Lenses on Myopia Progression in Children with Esophoria: A Randomized Clinical Trial. *J Ophthalmol.* 2022;2022:9972761. Published 2022 Feb 27.
- Charman WN, Radhakrishnan H. Peripheral refraction and the development of refractive error: a review. *Ophthalmic Physiol Opt.* 2010;30(4):321-338.
- Moore KE, Berntsen DA. Central and peripheral autorefraction repeatability in normal eyes. *Optom Vis Sci.* 2014;91(9):1106-1112.