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**Sezione di Oftalmologia**  
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# IOL Multifocali di II e III generazione: performance visiva e capacità di lettura.

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**XXXVI Congresso SOSi**

**Acireale, 15/04/2011**

# IOLs PER LA CORREZIONE DELLA PRESBIOPIA

- BIFOCALI

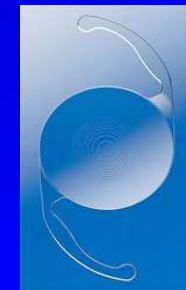
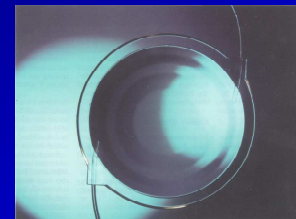


- PSEUDOACCOMODATIVE



- MULTIFOCALI

- REFRATTIVE
- DIFFRATTIVE



# Nostra esperienza

Ophthalmology. 2008 Sep;115(9):1508-16. Epub 2008 Jun 5.

**One-year outcomes with new-generation multifocal intraocular lenses.**

[Cillino S](#), [Casuccio A](#), [Di Pace F](#), [Morreale R](#), [Pillitteri F](#), [Cillino G](#), [Lodato G](#).

PURPOSE: To compare new-generation multifocal intraocular lenses (IOLs) with monofocal IOLs.

DESIGN: Randomized prospective clinical trial.

PARTICIPANTS: Sixty-two consecutive patients with cataract, seen between January of 2005 and January of 2006 at the Department of Ophthalmology of Palermo University Hospital in Italy, were bilaterally implanted with **monofocal (AR 40**, Advanced Medical Optics [AMO], Santa Ana, CA; 15 patients), **multifocal refractive (Array SA40N**, AMO; 16 patients), **multifocal refractive (ReZoom**, AMO; 15 patients), or **multifocal diffractive pupil-independent (Tecnis ZM900**, AMO; 16 patients) IOLs.

INTERVENTION: Bimanual phacoemulsification.

MAIN OUTCOME MEASURES: Primary outcomes were far, near, and intermediate visual acuity of the 4 IOL-implanted groups. Secondary outcomes were defocusing curves, contrast sensitivity, patients' quality of life (7-item visual function questionnaire [VF-7], halos and glare presence, overall satisfaction), and spectacle independence. Snellen visual acuity was measured as uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), uncorrected near visual acuity (UCNVA), best distance corrected near visual acuity (BDCNVA), best corrected near visual acuity (BCNVA), uncorrected intermediate visual acuity (UCIVA), and best distance corrected intermediate visual acuity (BDCIVA).

RESULTS: UCNVA was 20/50 in the monofocal IOL group, compared with 20/32 or better in the multifocal IOL groups ( $P < 0.0005$ ). The monofocal IOL group exhibited a lower BDCNVA than the multifocal IOL groups ( $P < 0.0005$ ). The diffractive multifocal IOL group performed better than either refractive group ( $P = 0.007$ ). UCIVA was significantly different ( $P = 0.001$ ) among the groups: monofocal (AR 40) 20/32; multifocal refractive (Array SA40N) 20/30; multifocal refractive (ReZoom) 20/25; and multifocal diffractive (Tecnis ZM900) 20/30.

**CONCLUSIONS:** Multifocal IOLs provide a greater depth of focus and higher patient satisfaction, and make intermediate and near visual tasks easier than do monofocal lenses. New-generation, diffractive, pupil-independent multifocal IOLs provide better near vision, equivalent intermediate vision, less unwanted photic phenomena, and greater spectacle independence than either monofocal or refractive multifocal IOLs.

# Nostra esperienza

- ✓ **MIOLs vs monofocali**

Performance visiva per vicino e per distanza intermedia notevolmente migliorata

- ✓ **MIOLs diffrattive vs refrattive e monofocali**

< Incidenza diffotopsie

> Indipendenza dagli occhiali

- ✓ **MIOLs vs monofocali**

Significativa riduzione dei costi postoperatori per l'acquisto di occhiali.

# Letteratura

J Cataract Refract Surg. 2008 Jun;34(6):934-41.

**Prospective functional and clinical comparison of bilateral ReZoom and ReSTOR intraocular lenses in patients 70 years or younger.**

[Chang DF](#).

Private Practice, Los Altos, California, USA. dceye@earthlink.net

**CONCLUSIONS:** Both multifocal IOL designs provided excellent UCVA. ReSTOR patients had better clinical and functional vision at near and comparable clinical and functional intermediate performance. Halos were more severe in the ReZoom group. Although the ReSTOR IOL gave higher rates of spectacle freedom, patient satisfaction was high in both groups.

Clin Ophthalmol. 2011 Jan 7;5:45-56.

**Comparison of outcomes with multifocal intraocular lenses: a meta-analysis.**

[Cochener B](#), [Lafuma A](#), [Khoshnood B](#), [Courouve L](#), [Berdeaux G](#).

Centre Hospitalier Universitaire Brest, Brest, France.

## **Abstract**

**PURPOSE:** To compare the clinical outcome of different multifocal intraocular lenses (IOLs) based on information reported in the international literature.

**METHODS:** All comparative clinical trials that involved implanting at least one multifocal IOL in patients with cataract or presbyopia were extracted from the literature. Clinical outcomes included uncorrected near visual acuity, uncorrected distance visual acuity, visual acuity, spectacle independence, and halos. Random effects meta-analyses were conducted to compare outcomes for the different IOL types.

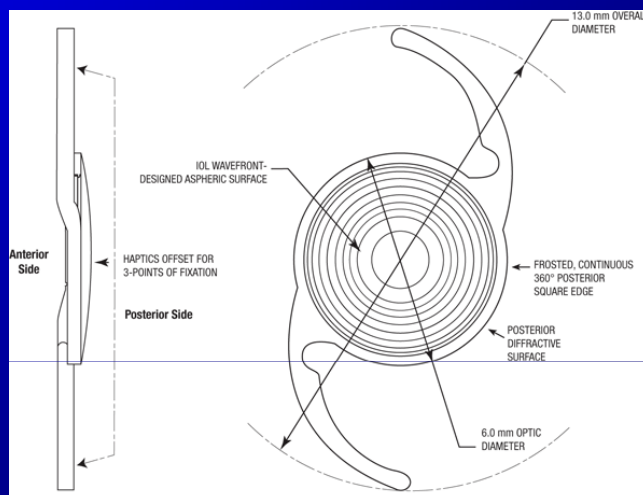
**RESULTS:** Twenty papers were identified describing **11 monofocal IOLs and 35 multifocal IOLs** (19 diffractive, including 12 ReSTOR(®), 14 refractive, and two accommodative) patient cohorts.

**CONCLUSION:** Multifocal IOLs provide better uncorrected near visual acuity than monofocal IOLs, leading to less need for spectacles.

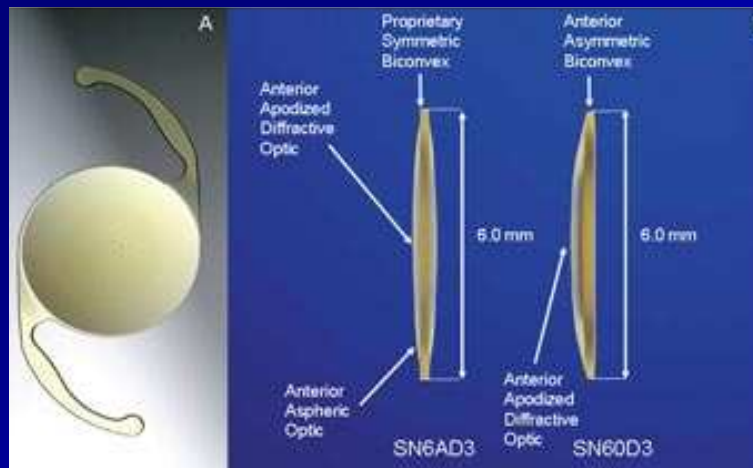
Multifocal IOL design might play a role in postsurgical outcome, because better results were obtained with diffractive lenses. ReSTOR showed better uncorrected near visual acuity, uncorrected distance visual acuity, and higher spectacle independence rates compared with other multifocal IOLs.

# MIOL di nuova generazione

**Tecnis asferica acrilica ZMA00 (+4.00 add)**

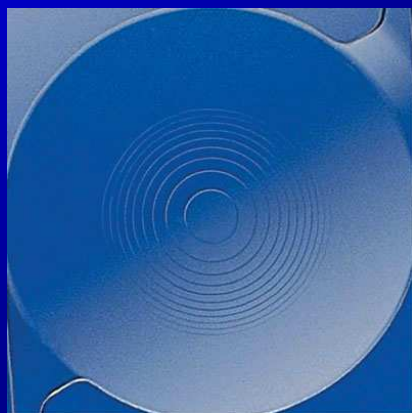


**Restor asferica acrilica SN6AD3 (+4.00 add)**

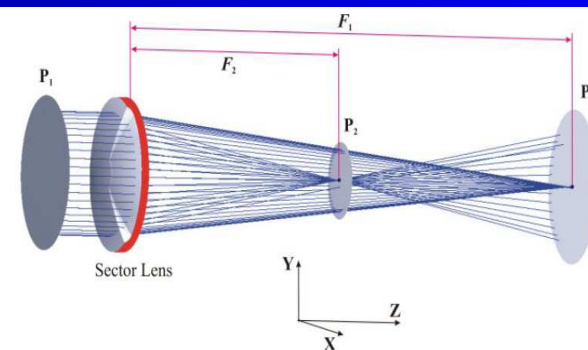
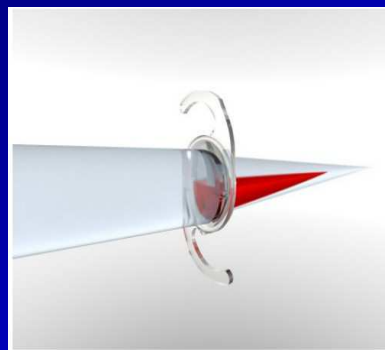
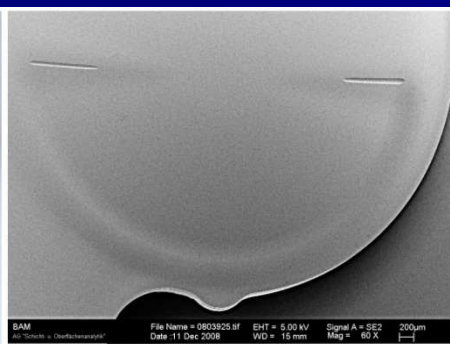


# MIOL di nuova generazione

**Restor IQ asferica acrilica SN6AD1 (+3.00 add)**

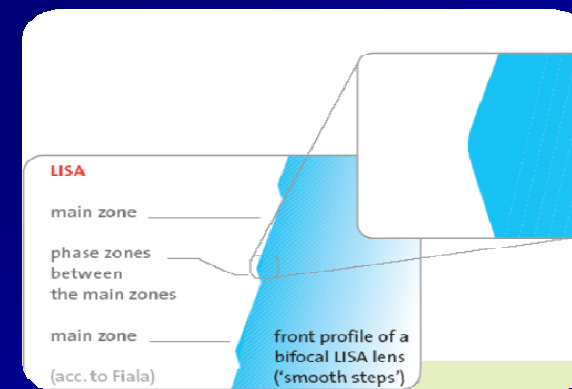
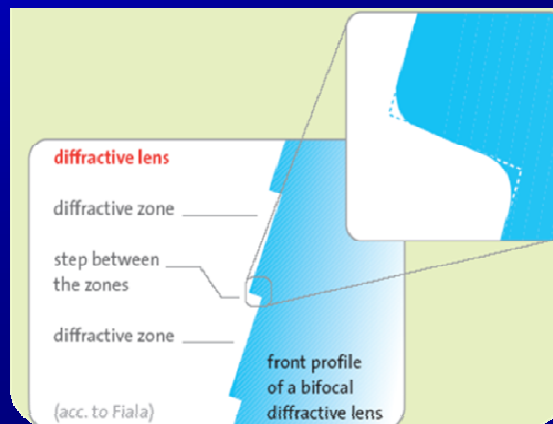


**Mplus LS 312 MF (+3.00 add)**

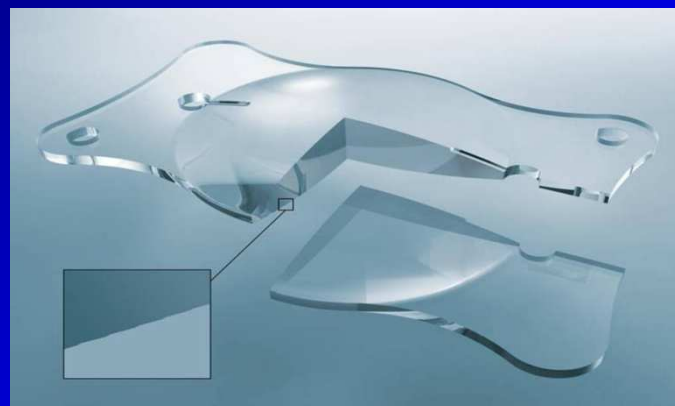
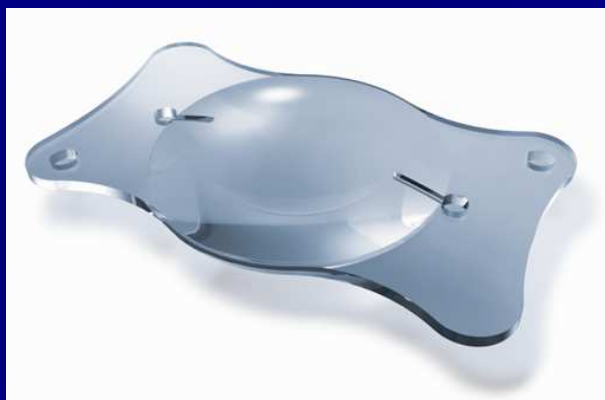


# MIOL di nuova generazione

## AT-LISA acrilica (+3.75 add)



## AT-LISA Toric acrilica (+3.75 add)







# Letteratura

J Cataract Refract Surg. 2010 Nov;36(11):1897-904.

## Visual outcome and patient satisfaction after multifocal intraocular lens implantation: aspheric versus spherical design.

[de Vries NE](#), [Webers CA](#), [Verbakel F](#), [de Brabander J](#), [Berendschot TT](#), [Cheng YY](#), [Doors M](#), [Nuijts RM](#).

Department of Ophthalmology, Maastricht University Medical Center, Maastricht, The Netherlands.

### Abstract

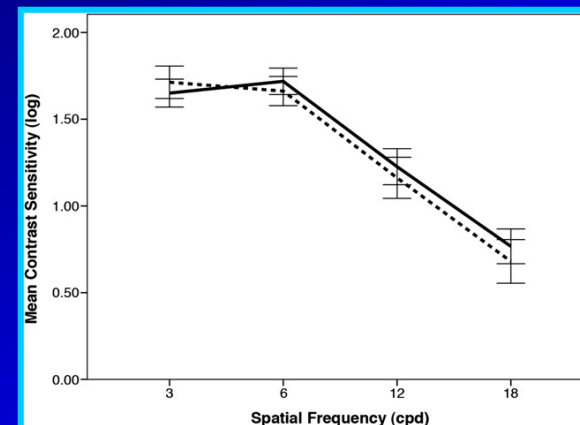
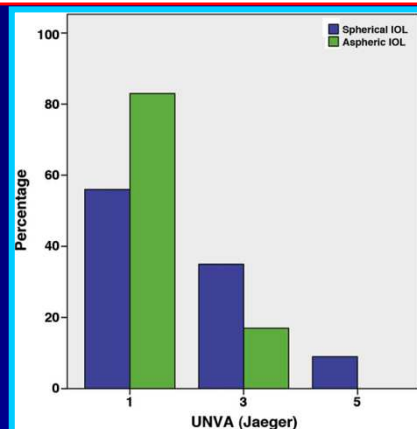
**PURPOSE:** To evaluate visual outcomes and patient satisfaction after implantation of an aspheric apodized diffractive intraocular lens (IOL) or a spherical apodized diffractive IOL in cataract surgery.

**SETTING:** Maastricht University Medical Center, The Netherlands.

**DESIGN:** Nonrandomized clinical trial.

**METHODS:** This prospective nonrandomized study with a 6-month follow-up compared the results of cataract surgery with implantation of an aspheric AcrySof ReSTOR SN6AD3 IOL and a spherical AcrySof ReSTOR SN60D3 IOL. Main outcome measures were uncorrected (UDVA) and corrected (CDVA) distance visual acuities, uncorrected (UNVA) and distance-corrected (DCNVA) near visual acuities, straylight levels, incidence of glare and halos, and contrast sensitivity levels.

**CONCLUSIONS:** Patients with the aspheric multifocal IOL had significantly better near vision than patients with the multifocal spherical IOL. The UDVA, CDVA, intraocular straylight, night-vision symptoms, and contrast sensitivity were similar between the 2 groups.





# Letteratura

J Cataract Refract Surg. 2010 Nov;36(11):1874-9.

**Comparison of reading performance after bilateral implantation of multifocal intraocular lenses with +3.00 or +4.00 diopter addition.**

[Santhiago MR](#), [Netto MV](#), [Espindola RF](#), [Mazurek MG](#), [Gomes Bde A](#), [Parede TR](#), [Harooni H](#), [Kara-Junior N](#).

Cole Eye Institute, Cleveland Clinic Foundation, Cleveland, Ohio, USA. marconysanthiago@hotmail.com

## Abstract

**PURPOSE:** To compare reading ability after cataract surgery and bilateral implantation of multifocal intraocular lenses (IOLs) with a +3.00 diopter (D) addition (add) or a +4.00 D add.

**METHODS:** Patients scheduled for cataract surgery were randomly assigned to bilateral implantation of an aspheric AcrySof ReSTOR multifocal IOL with a +3.00 diopter (D) addition (add) or a +4.00 D add.

**CONCLUSION:** Although the 2 IOL groups had similar performance in reading parameters, patients had to adjust to their best reading distance. The +3.00 D IOL performed better than the +4.00 D IOL at 40 cm.

J Cataract Refract Surg. 2010 Aug;36(8):1316-22.

**Visual outcomes after cataract surgery with implantation of a +3.00 D or +4.00 D aspheric diffractive multifocal intraocular lens: Comparative study.**

[de Vries NE](#), [Webers CA](#), [Montés-Micó R](#), [Ferrer-Blasco T](#), [Nuijts RM](#).

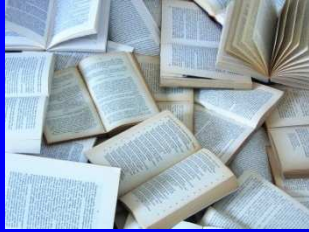
Department of Ophthalmology, Maastricht University Medical Center, Maastricht, The Netherlands.

## Abstract

**PURPOSE:** To compare the visual performance after cataract surgery with implantation of +3.00 diopter (D) or +4.00 D aspheric multifocal intraocular lenses (IOLs).

**METHODS:** This prospective study compared the results of bilateral cataract surgery with implantation of a +3.00 D AcrySof ReSTOR SN6AD1 IOL or a +4.00 D AcrySof ReSTOR SN6AD3 IOL.

**CONCLUSION:** Cataract surgery with the +3.00 D IOL resulted in better intermediate vision than with the +4.00 D model without compromising distance and near visual acuity.



# Letteratura

Acta Ophthalmol. 2010 Aug 17. [Epub ahead of print]

**Comparison of visual performance of silicone and acrylic multifocal IOLs utilizing the same diffractive design.**

[Hütz WW](#), [Jäckel R](#), [Hoffman PC](#).

Augenlinik Bad Hersfeld, Bad Hersfeld, Germany.

## **Abstract**

Abstract. Purpose: To compare the visual outcomes in patients implanted with a diffractive silicone multifocal in one eye and a diffractive acrylic multifocal IOL in their fellow eye. Methods: Forty-two eyes of 21 cataract surgery patients were randomized to undergo implantation with either a silicone diffractive multifocal IOL (Tecnis ZM900, Abbott Medical Optics, Santa Ana, CA, USA) or an acrylic diffractive multifocal IOL (Tecnis ZMA00, AMO). The two IOLs share the same design platform.

Conclusions: Given that the designs of the lenses are identical and that this was a contralateral eye study, it is reasonable to expect that the results between the two eyes and two types of lenses were similar. Both versions of this lens provide excellent visual function.

# Il nuovo progetto

**Studio della performance visiva e QoL dei pazienti impiantati con IOL multifocali**

Confronto tra MIOL di  
II e III generazione

**Tecnis asferica ZM900 silicone (+4.00 add)**

**Tecnis asferica ZMA00 acrilica (+4.00 add)**

**Restor sferica SN60D3 acrilica (+4.00 add)**

**Restor asferica SN6AD3 acrilica (+4.00 add)**

**IQ Restor asferica SN6AD1 acrilica (+3.00 add)**

**Mplus LS 312 MF (+3.00 add)**

- **Lo studio, della durata di 3 anni (Jul 2008 - Jul 2011), è randomizzato e controllato, in doppio cieco.**
- **20 MIOL (10 pazienti) di ciascun tipo impiantate in 60 pazienti in tutto.**

# Il nuovo progetto

## PARAMETRI QUANTITATIVI:

- ✓ *Acuità visiva mono e binoculare non corretta (UCVA) e corretta (BCVA) per lontano.*
- ✓ *Acuità visiva mono e binoculare non corretta per vicino (UCNVA), corretta per vicino (BCNVA) e per vicino con correzione per lontano (BDCNVA) in condizioni mesopiche e fotopiche.*
- ✓ *Acuità visiva mono e binoculare per la distanza intermedia non corretta (UCIVA) e corretta per lontano (BDCIVA) in condizioni mesopiche e fotopiche.*
- ✓ *Diametro pupillare in condizioni mesopiche e fotopiche*

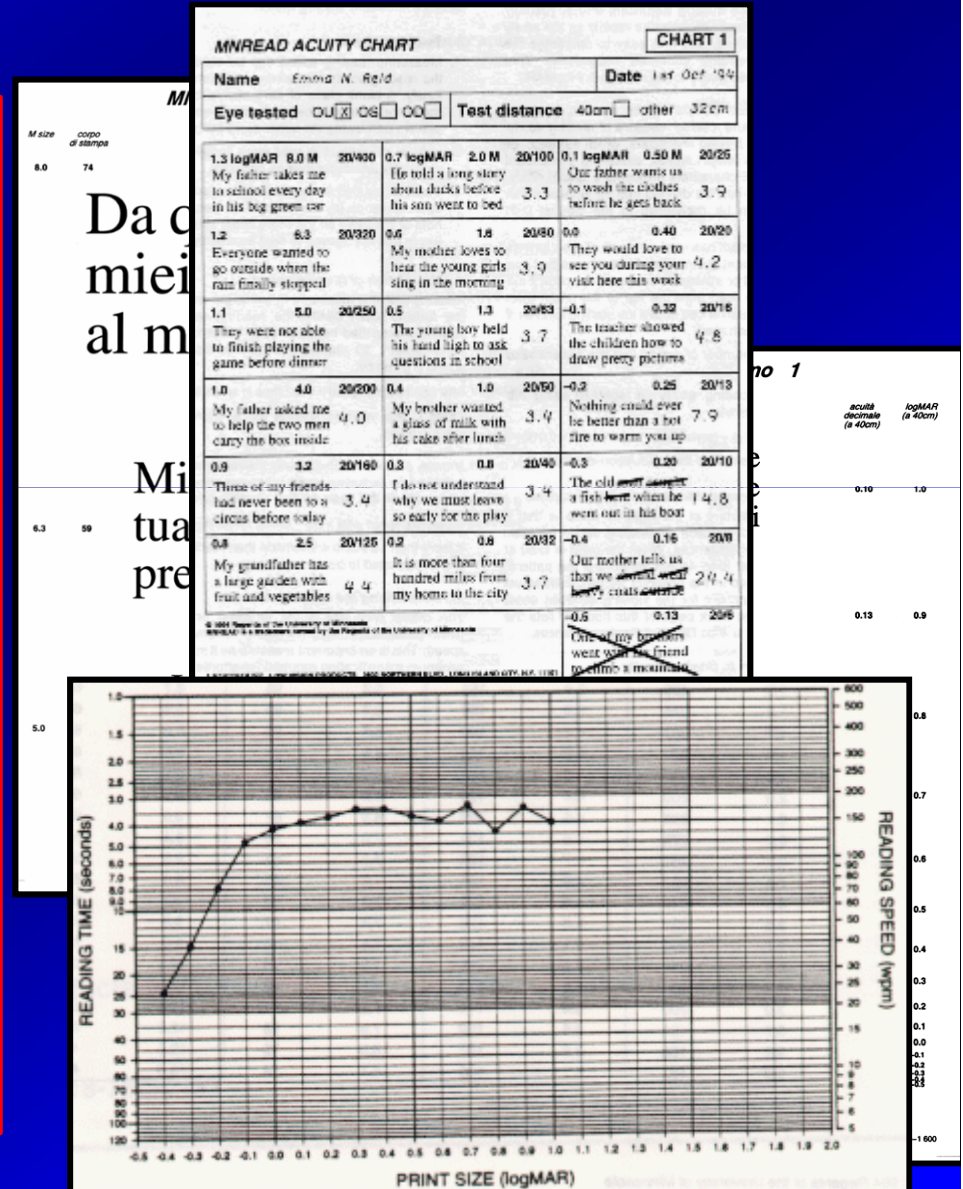
# Il nuovo progetto

## PARAMETRI QUALITATIVI:

- ✓ *Velocità di lettura in condizioni mesopiche e fotopiche: “MNRead Acuity Chart”.*
- ✓ *Lettura a basso contrasto in condizioni mesopiche e fotopiche: “Rex Test”.*
- ✓ *Sensibilità al contrasto in condizioni mesopiche e fotopiche:*  
*“Pelli-Robson Contrast Sensitivity Test”.*
- ✓ *Qualità della vita e soddisfazione personale: “Questionario NEI RQL-42”.*
- ✓ *Comfort visivo soggettivo senza occhiali in alcune mansioni*  
*quotidiane: “Questionario VF-14”.*

# MNREAD EYE CHART

- COMPOSTO DA FRASI CHE SEGUONO UNA PROGRESSIONE LOGARITMICA
- E' POSSIBILE CALCOLARE:
  - **Maximum Reading Speed in Parole/minuto (Words per minute).**
  - **Critical Print Size:** la frase della più piccola dimensione leggibile alla massima velocità di lettura.
  - **Reading Acuity:** la più piccola dimensione del carattere letto senza errori significativi.



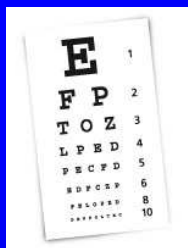
# LOW CONTRAST REX TEST

## (READING EXPLORER TEST)

- CONSISTE IN 2 TAVOLE CON 4 FRASI CASCUNA DI DIMENSIONE COSTANTE.
- IL CONTRASTO DI CIASCUNA FRASE DALL'ALTO AL BASSO DECRESCe CON PROGRESSIONE LOGARITMICA.
- E' POSSIBILE CALCOLARE:
  - **Minimum CS:** la frase con più bassa SC letta senza errori significativi.

0.0 100%	La campagna che si vede dalla mia casa appartiene a suo zio	
0.1 10%	Per tutti questi mesi mia nonna usciva ogni giorno alle t	
0.2 5%	Mi piace andare a casa mia al fiume vedere i pesci ros	
0.3 3.3%	I suoi amici sono a casa e aspettano tanto la sua mam	
0.4 2.5%	La ragazza porta amiche a vedere	
0.5 2.0%	Il suo calzone rosso è molto lungo e si macchia facilmente	
0.6 1.7%	Sono contento per i nuovi giochi che ha portato una mia zia	
0.7 1.5%	Per aver raccolto i fiori ha ricevuto un dono da mia madre	
0.8 1.3%	Mia madre chiede a mio padre di andare a prendere le scarpe	
0.9 1.1%	Gli amici ci dicono che hanno cambiato	









# Risultati preliminari



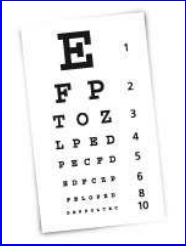
	Restor sferica (SN60D3)	Restor asferica (SN6AD3)	Tecnis silicone (ZM900)	Tecnis acrilica (ZMA00)
<b>UCVA</b>	1.25	1.0	1.05	0.95
<b>BCVA</b>	1.20	1.20	1.26	1.20

*Acuità visiva per lontano (Snellen ratio)*

*Acuità visiva per distanza intermedia (Snellen ratio)*







	Restor sferica (SN60D3)	Restor asferica (SN6AD3)	Tecnis silicone (ZM900)	Tecnis acrilica (ZMA00)
 <b>UCIVA</b>	0.65	0.67	0.54	0.69
 <b>BDCIVA</b>	0.80	0.80	0.48*§	0.52*§
 <b>UCIVA</b>	0.85	0.86	0.85	1.0
 <b>BDCIVA</b>	0.90	1.0	0.86	0.81

\*§ p<0.0005



# Risultati preliminari



	Restor sferica (SN60D3)	Restor asferica (SN6AD3)	Tecnis silicone (ZM900)	Tecnis acrilica (ZMA00)
 UCNVA	3.50	3.50	2.3	3.1
 BDCNVA	3.0	3.0	2.33	2.50
 BCNVA	1.0	1.5	1.44	1.0
 UCNVA	2.0	1.60	1.22	1.90
 BDCNVA	2.0	1.0 §	1.2 §	1.40
 BCNVA	1.0	1.30	1.44	1.30

**Acuità visiva per vicino (Jaeger)**

§ p=0.005

**Pupillometria (mm)**



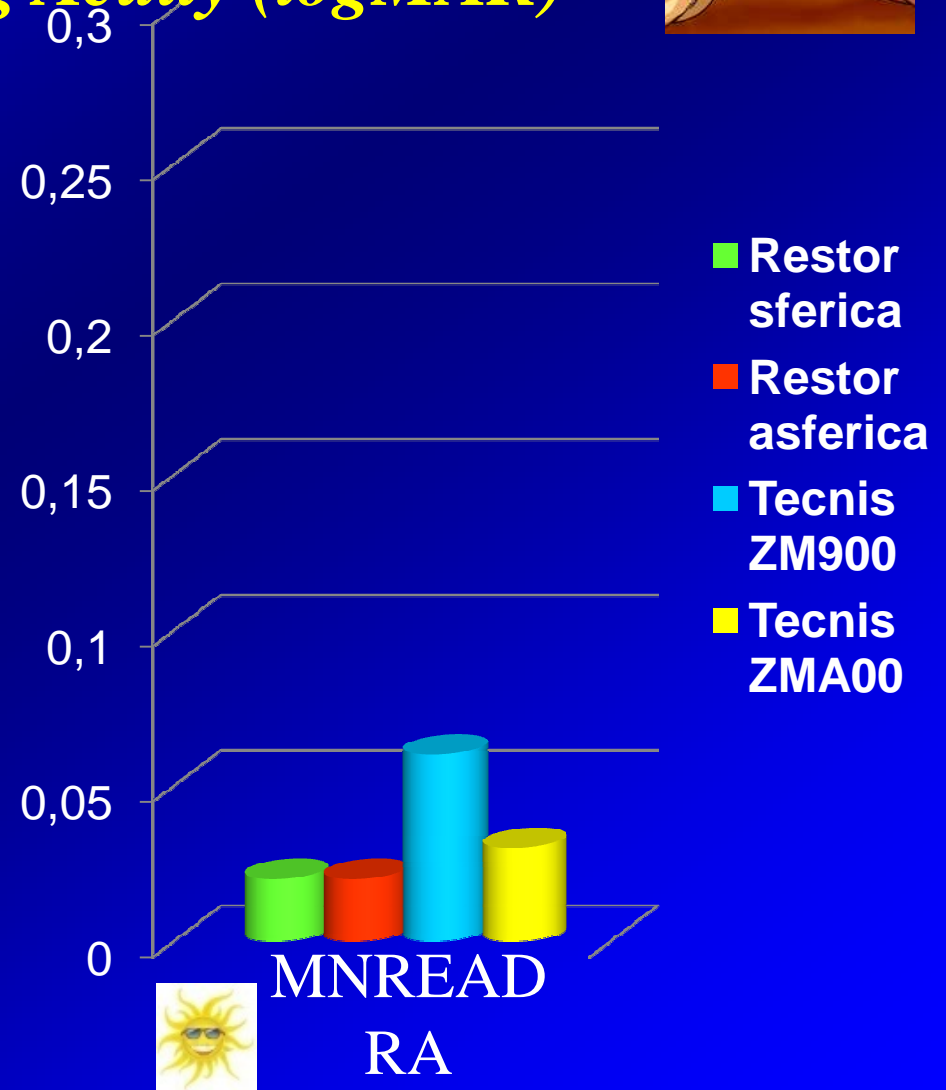
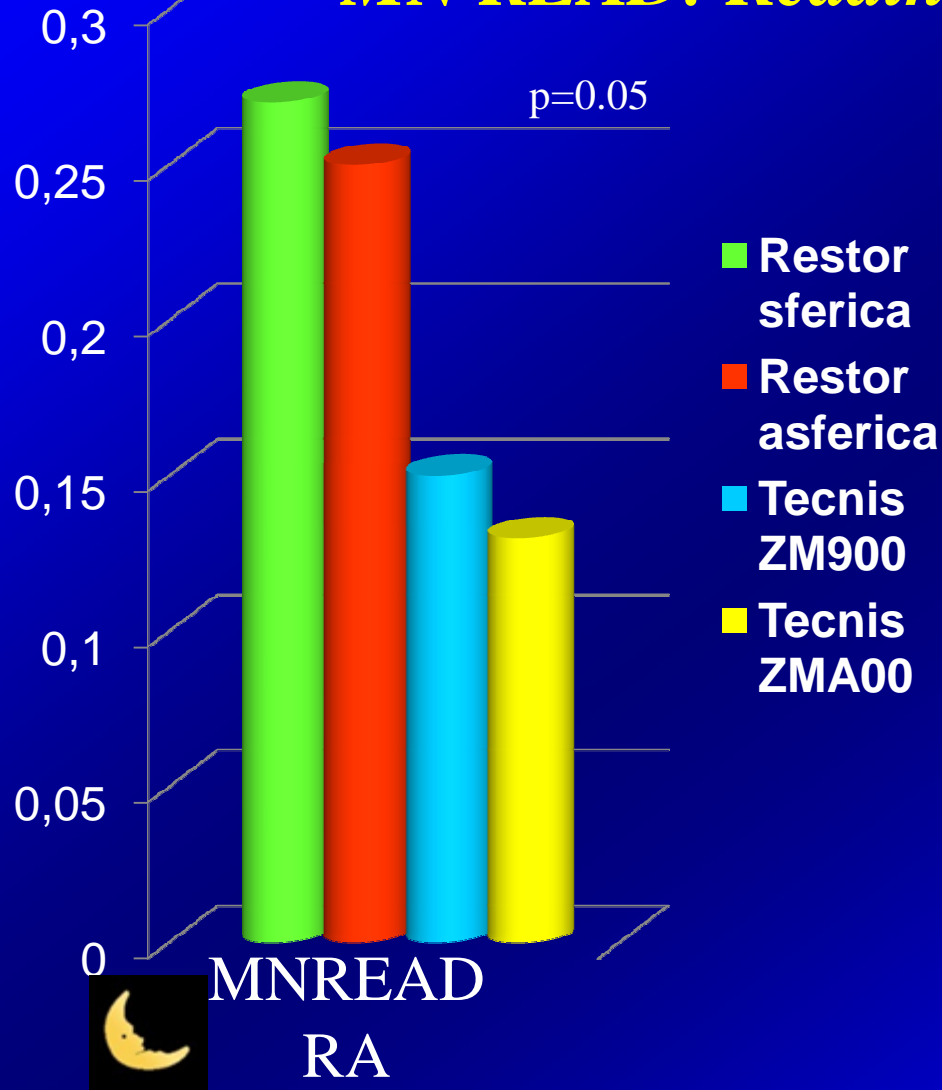
	Restor sferica (SN60D3)	Restor asferica (SN6AD3)	Tecnis silicone (ZM900)	Tecnis acrilica (ZMA00)
 PUPIL OD	4.2	4.2	4.3	4.0
 PUPIL OS	4.4	4.3	4.2	4.0
 PUPIL OD	2.0	2.2	2.08	2.1
 PUPIL OS	2.3	2.1	2.12	2.40



# Risultati preliminari



## *MN READ: Reading Acuity (logMAR)*

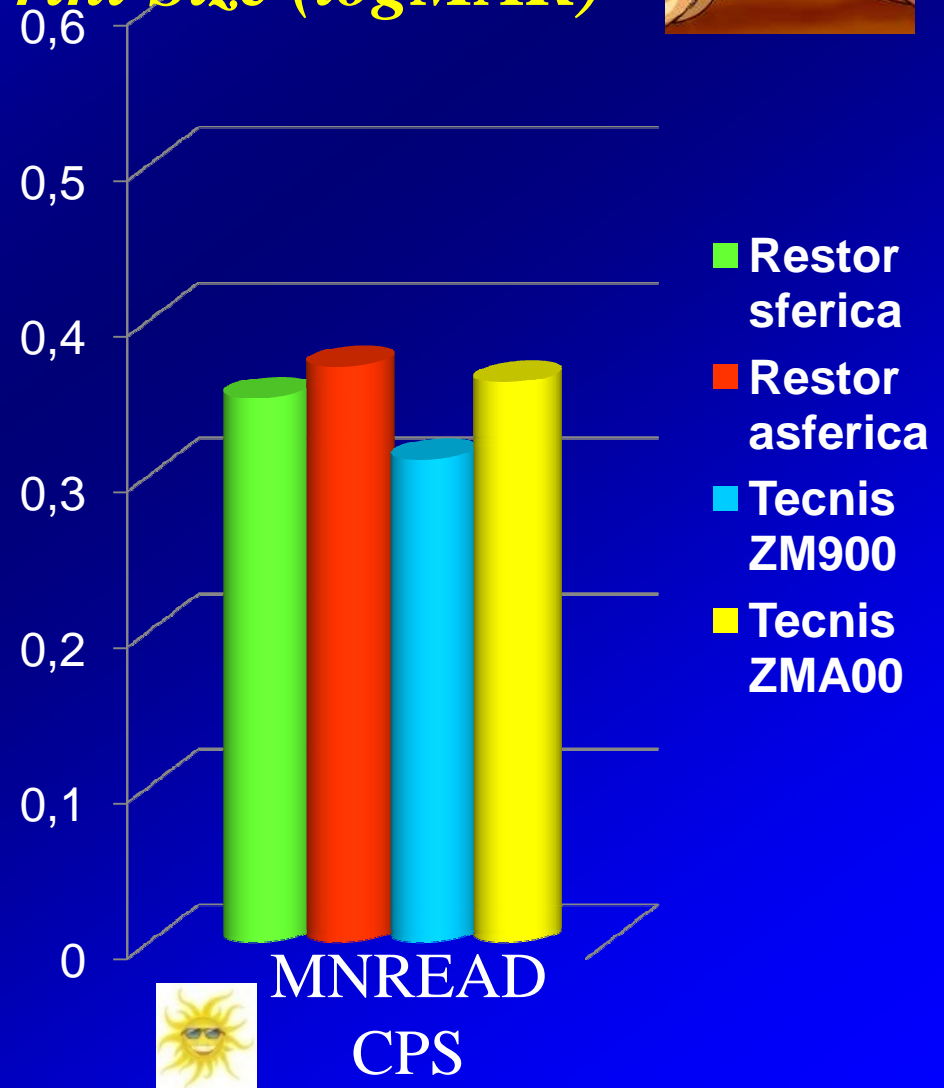
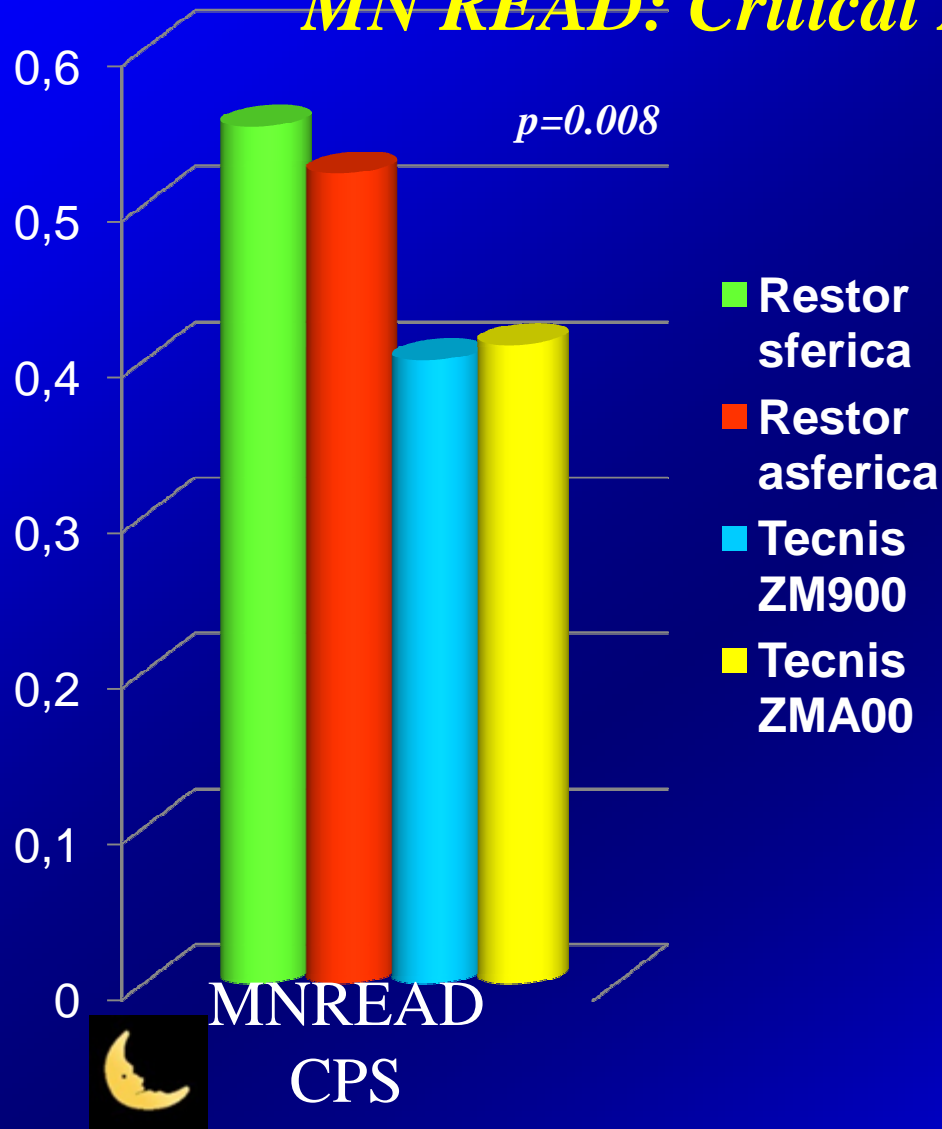




# Risultati preliminari



## *MN READ: Critical Print Size (logMAR)*

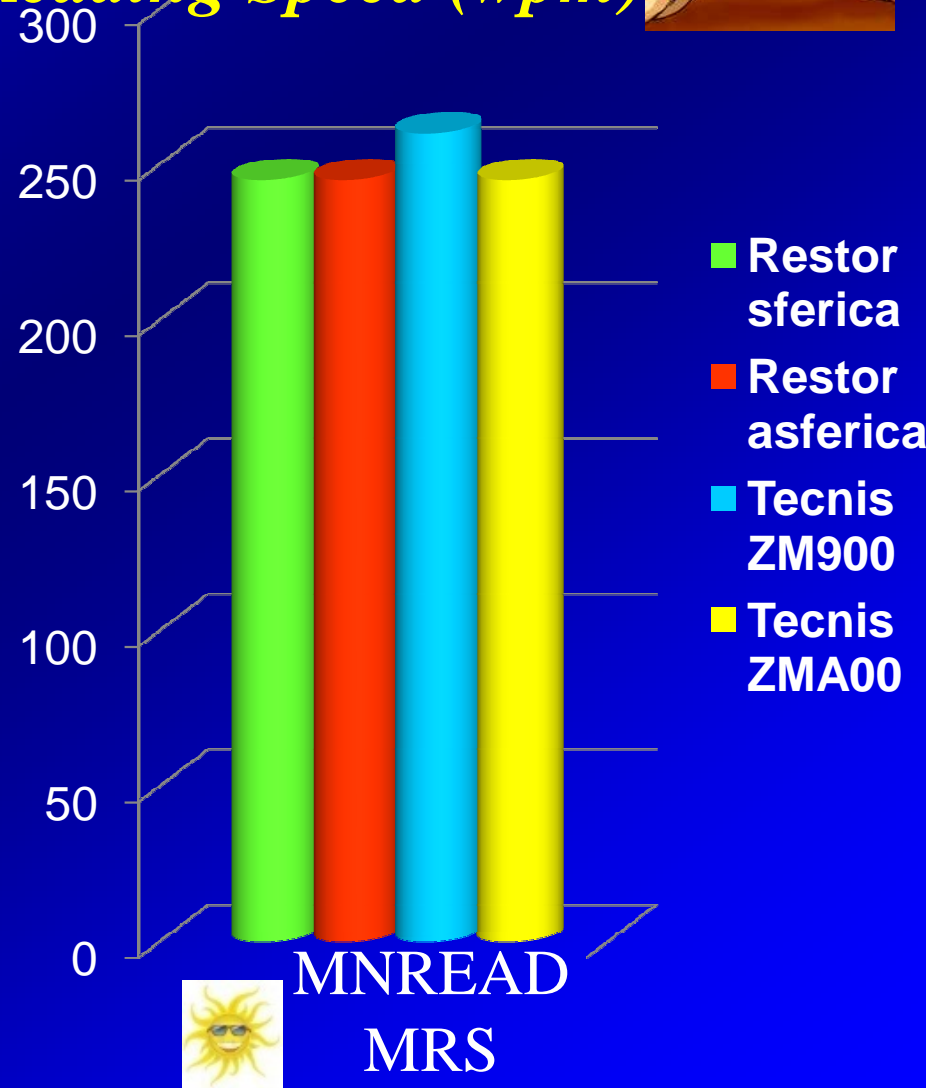
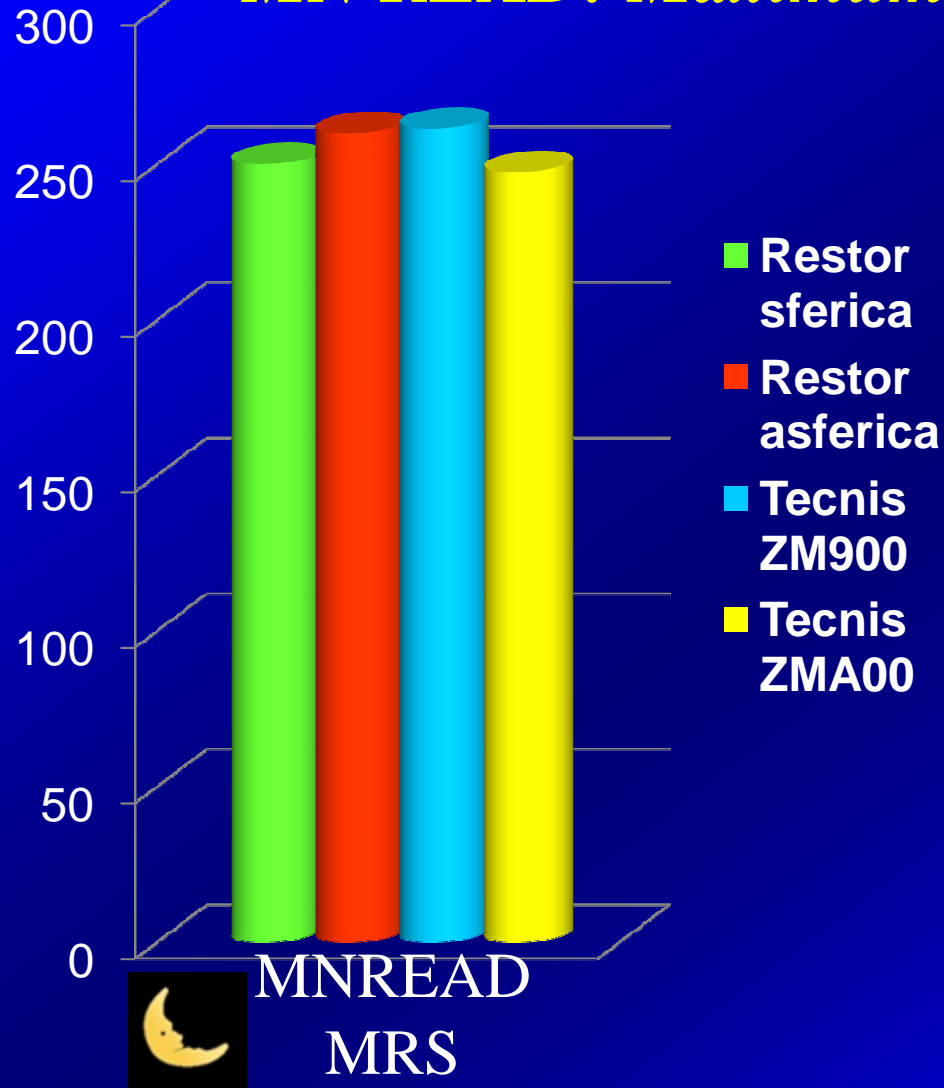




# Risultati preliminari

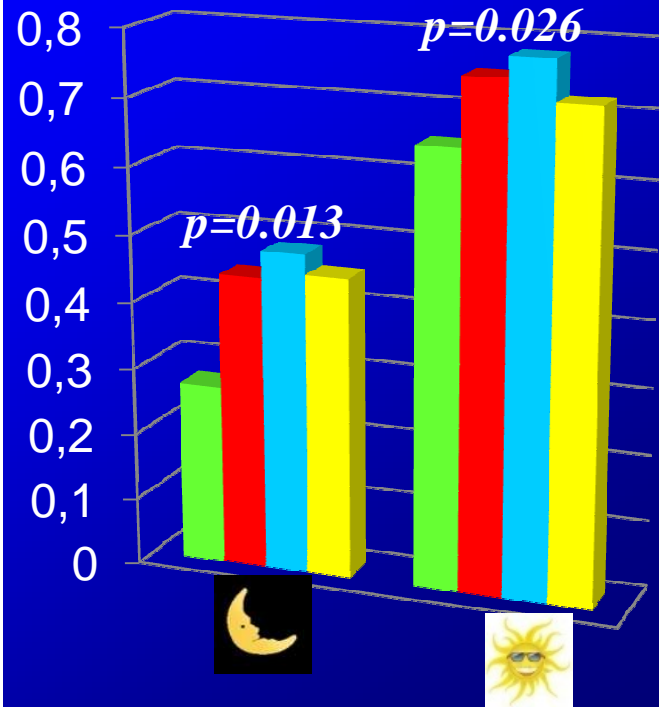


*MN READ: Maximum Reading Speed (wpm)*





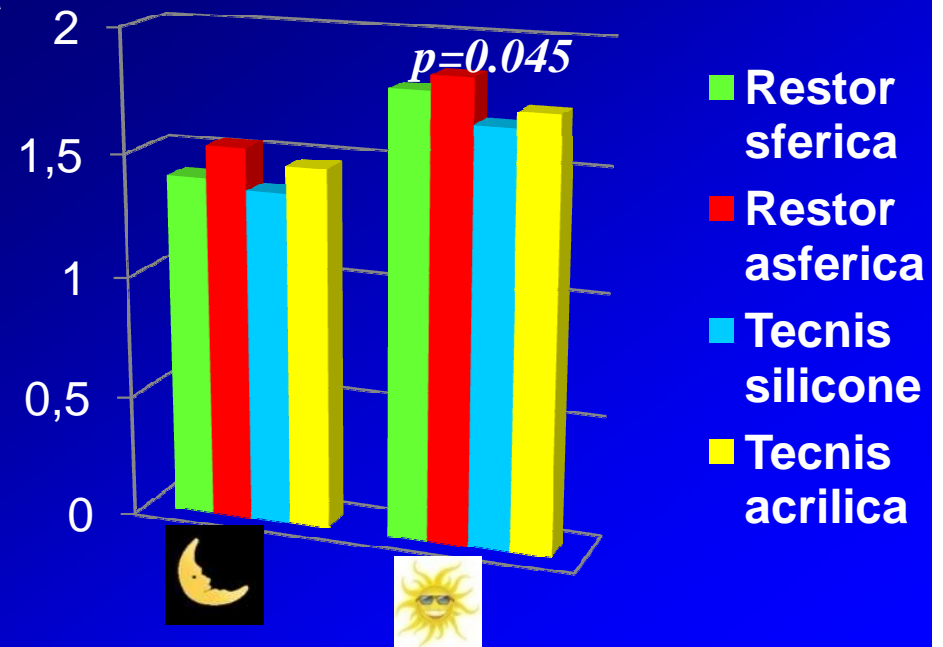
# Risultati preliminari



*Low Contrast Rex Test:  
lettura a basso contrasto  
(logCS)*

- Restor sferica
- Restor asferica
- Tecnis silicone
- Tecnis acrilica

*Pelli Robson:  
sensibilità al contrasto  
(logCS)*



- Restor sferica
- Restor asferica
- Tecnis silicone
- Tecnis acrilica

# Conclusioni

✓ MIOL confermano ottimi risultati in termini di acuità visiva a tutte le distanze.

✓ MIOL specialmente di III generazione sembrano garantire elevati livelli di:

- performance visiva in differenti condizioni di luce
- velocità di lettura
- sensibilità al contrasto.



✓ Restor di III generazione Vs Restor di II generazione:

Migliore sensibilità al contrasto e lettura a basso contrasto in mesopico.

✓ Tecnis di III generazione Vs Tecnis di II generazione:

Equivalenti in termini di acuità e performance visiva.



✓ Tecnis Vs Restor:

Trend verso la migliore acuità visiva per vicino.

Trend verso la peggiore acuità visiva per distanza intermedia mesopica.

Miglior performance nella lettura di caratteri piccoli ad alta velocità in mesopico.

Trend verso la migliore acuità di lettura in mesopico.



*Grazie per  
l'attenzione*