The Effect of Adjustments in Apodization Pattern of Diffractive Multifocal IOLs on Straylight Measurements (disability glare)

Ruth Lapid-Gortzak MD PhD[1,2], Jan Willem van der Linden Bopt. [2], Ivanka van der Meulen MD PhD[1,2], and Tom van den Berg PhD[3]

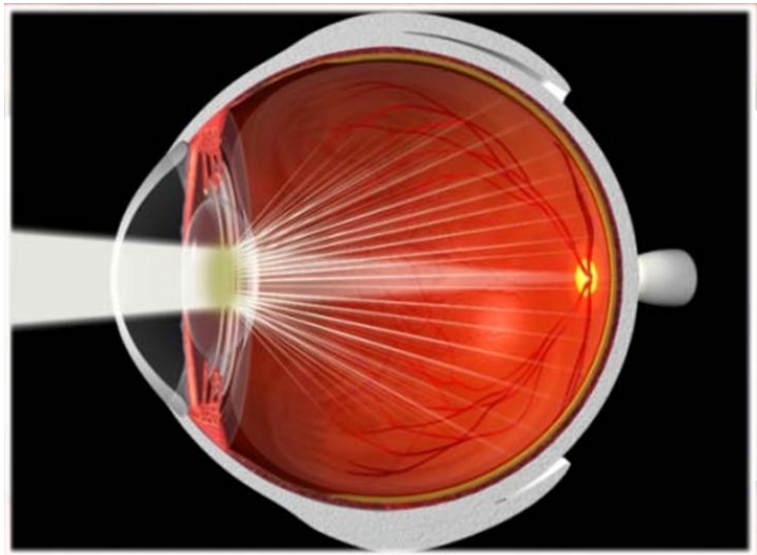
1. AMC, University of Amsterdam, 2. Retina Total Eye Care, Driebergen, 3. NIN, KNAW

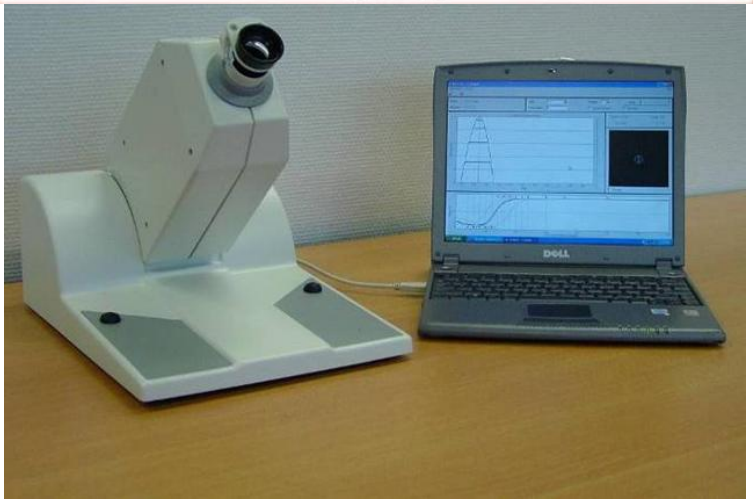
Financial Disclosure:

- Dr. Lapid is a speaker for Alcon, Hanita Lenses, MSD, Oculentis; a clinical investigator for Alcon and Orca; and a consultant for Sanoculis.
- Dr. van den Berg has no proprietary interests, the Royal Dutch Academy of Sciences owns the patent for the C-Quant straylight meter.
- Mr. Van der Linden and Dr. van der Meulen have no interest to disclose.

Introduction:

- Multifocal intraocular lenses are designed to effectively restore visual acuity for distance and near.
- Different optical designs of multifocal IOL may affect side effects experienced by the patient.
- Some of these side effects are possibly related to glare disability, which is straylight.
- The effect of multifocality on straylight is not yet clear.
- Straylight is caused by scattering of light in the optically imperfect components of the eye. This light does not come to a focus on the retina and causes veiling of sight, glare, and loss of contrast.
- Straylight is measured with the C-Quant Straylight meter (Oculus, Germany)






Effects of
Straylight:
loss
of contrast
&
Blinding
@
night
Lapid-Gortzak *et al*

Background

Author	Journal	Conclusion
Dick *et al*	1999 Ophthalmology	No difference between MFIOL and monoIOL
De Vries *et al*	2008 JCRS	SN6AD3 higher log(s) 0.078
Ehmer *et al*	2011 Ophthalmologe	higher straylight with MFIOL
Hoffmann *et al*	2009 JRS	No difference
Cervino *et al*	2008 JCRS	No difference
De Vries *et al*	2010 JCRS	Addition type +3 +4 no difference
Schrecker *et al*	2012 JCRS	No difference diffractive versus sectorial addition

MFIOL = multifocal IOL, monoIOL = monofocal IOL

Purpose

- To investigate the behavior in straylight in 2 types of apodized diffractive multifocal IOLs (SN6AD1, Alcon, USA, versus Seelens MF and BunnyLens MF, Hanita Lenses, Israel). Hanita claims in adjustments to the apodization surface to reduce side effects such as halos.

Methods:

- Prospective interventional case cohort
- Tenets of Declaration of Helsinki adhered to
- Standard phacoemulsification surgery – implantation with the MFIOL that the patient opted for.
- Inclusion: uneventful phacoemulsification.
- Exclusion: other types of lenses, incomplete data-set, other ocular findings that may influence straylight measurements, such as corneal problems, or vitreous turbidity, PCO etc.
- Outcome measures: UDVA, CDVA, Straylight (log (s)), refraction, pre- and post-operatively.

Methods: MF IOLs compared:

SeeLens MF

(Hanita Lenses, Israel)
hydrophilic

multifocal apodized diffractive IOL

11 rings on the surface,

6mm optic & 13mm haptic diameter.

SN6AD1

(“ReSTOR”, Alcon, USA)
hydrophobic

multifocal apodized diffractive IOL

9 rings on the surface

6mm optic & 13mm haptic diameter.

Results CVDA and refraction:

	SeeLens MF	SN6AD1
N	84	79
pre-op CDVA (logMAR +/- SD, range)	0.04± 0.08 (0.3 to -0.1)	0.06 ± 0.10 (0.4 to -0.1)
post-op CDVA (logMAR+/-SD, range)	-0.03 ± 0.06 (0.2 to -0.16)	-0.02 ± 0.08 (0.4 to -0.2)
preopRefraction SE +/- SD (range)	+1.30 D± 2.05 (-6.625 to +5.75)	+0.48 ± 2.65 (-10.75 to +6.00)
postopRefraction SE +/- SD (range	0.01 ± 0.43 (-1.375 to 1.25)	0.06 ± 0.35 (-0.75 to 0.875)

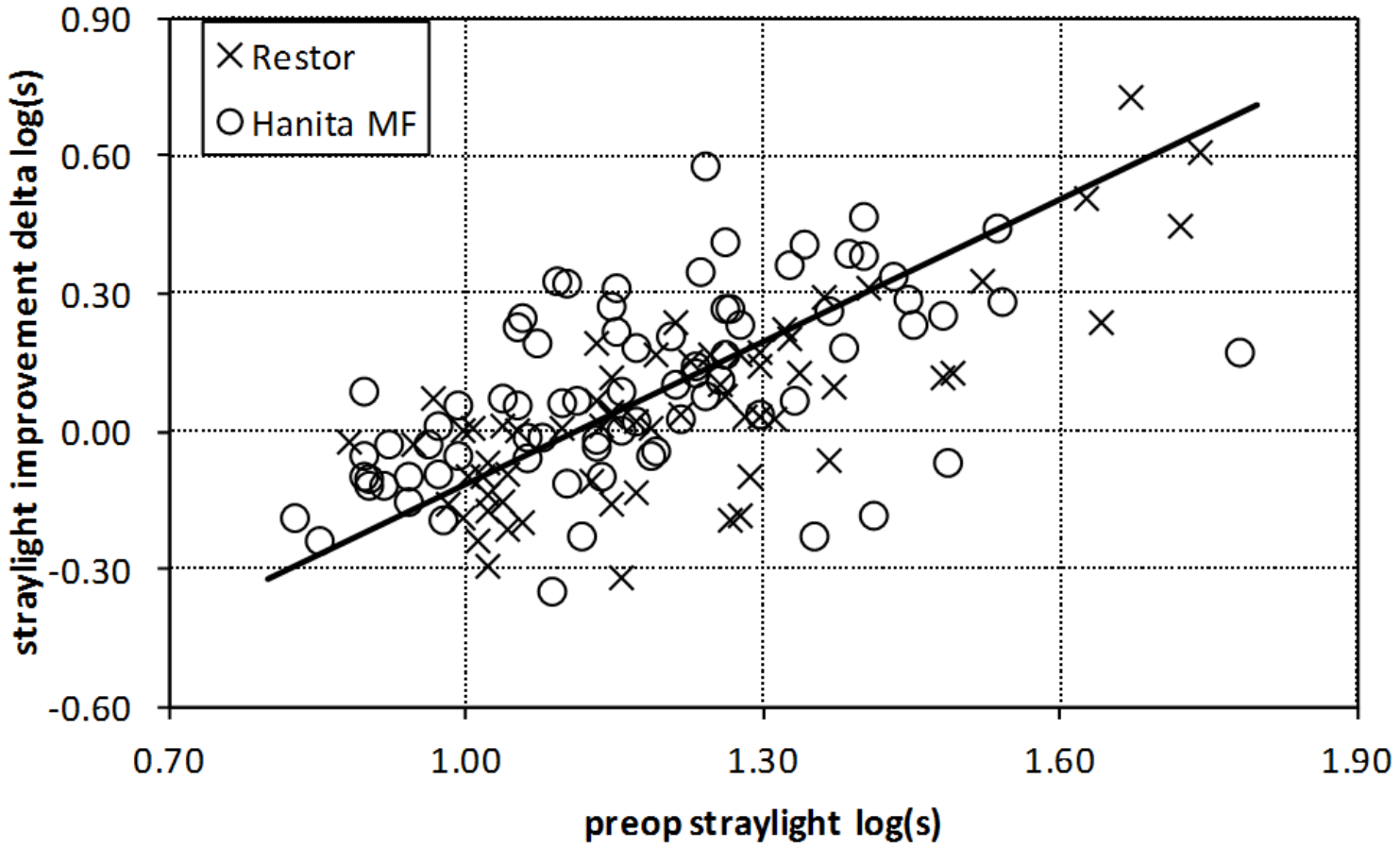
Results straylight

	Pre-op log(s)	Post op log(s)	Improvement
SN6AD1	1.20 ± 0.20	1.16 ± 0.14	0.05± 0.20
SeeLens/BunnyLens	1.17 ± 0.19	1.08 ± 0.19	0.10 ± 0.20

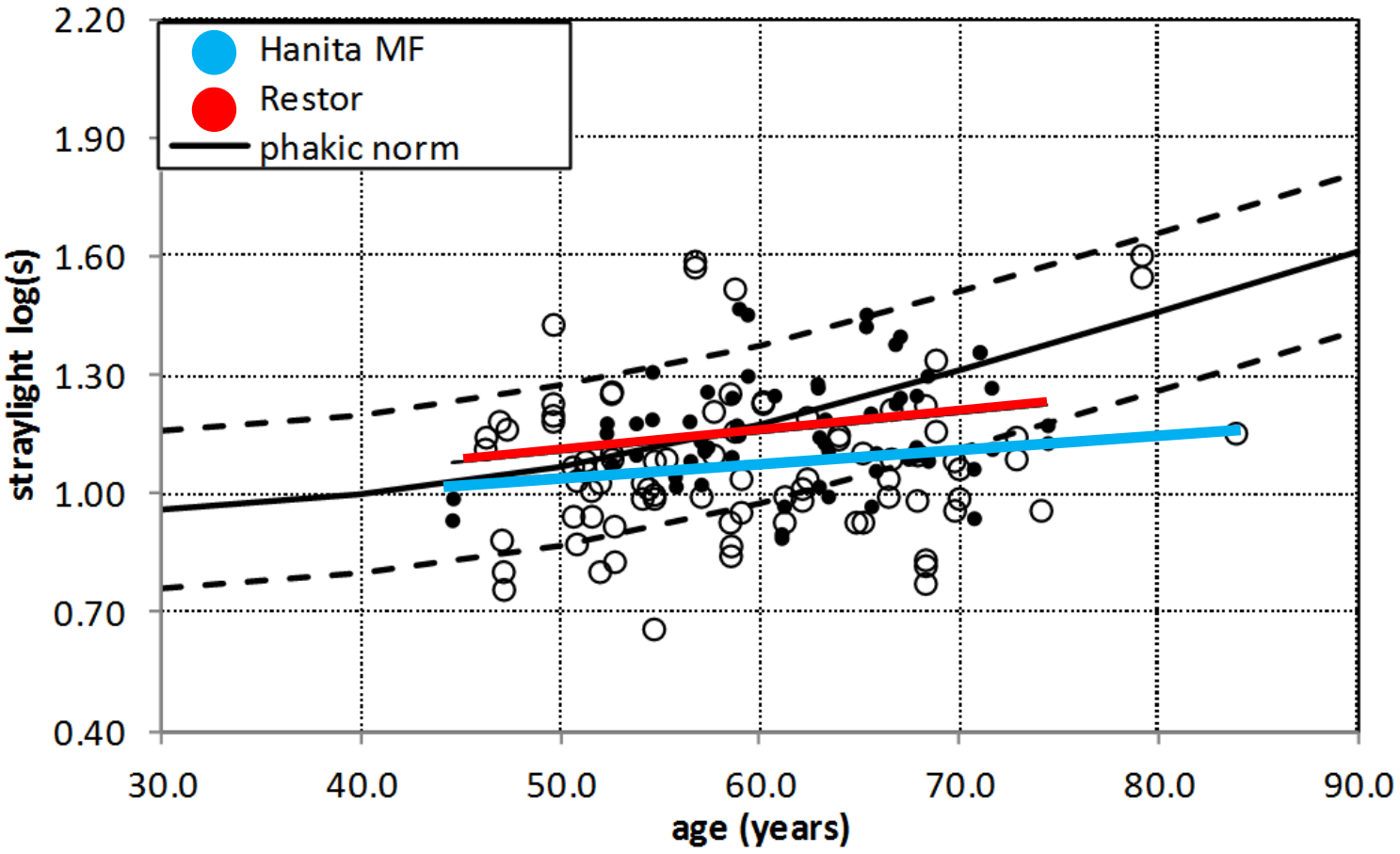
- 0.084 log(s) between SeeLens/BunnyLens vs SN6AD1.
- Age adjusted difference: 0.0707 log(s) in favor of SeeLens/BunnyLens $p<0.0056$ (double sided t-test)

- Reasons?
  1. Adjusted apodization pattern
  2. Hydrophilic material versus hydrophobic material

Results: straylight improvement upon surgery



Results: Post-op Straylight values compared to the phakic norm



Conclusion:

- Post-operatively the hydrophilic lens with adjusted apodization (SeeLens, Hanita) resulted on average in 0.0707 log (s) less straylight ($p<0.0056$). Clinically, a mean difference of 0.1 log(s) is comparable to 1 line on the visual acuity chart.
- IOLs (SeeLens, Hanita & ReSTOR, Alcon) perform equally in terms of postoperative CDVA and spherical equivalent refraction.
- These lenses differ in: material – hydrophilic versus hydrophobic, in UV filters – violet filter versus blue-blocking filters, and in the pattern of apodization.
- More study is needed to completely understand the cause of the difference and its clinical impact.