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Ocular straylight in the normal pseudophakic eye

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Purpose

The purpose of this study was to determine a pseudophakic norm for straylight as a new reference. The proposed model was tested for its applicability in predicting the effect of lens replacement on straylight improvement.

Methods

A retrospective analysis of prospectively collected cross-center data was performed to evaluate changes in intraocular scatter upon crystalline lens replacement. Only studies reporting straylight values obtained with the natural pupil using the C-Quant instrument (Oculus Optikgeräte GmbH, Germany) after uneventful phacoemulsification and following intraocular lens implantation were included[1].

A simple linear regression analysis was used to assess postoperative normal straylight values as a function of age with 95% confidence interval (95% CI). The linearity was assessed using the non-parametric local linear fitting (loess), whereas the normative reference limit was derived with quantile regression (QR). The raw data supplied by either the original authors or by digitization of the published plots was used to determine 95% CI, loess and QR.

The straylight improvement following lens replacement was assessed by evaluation of pre- and postoperative data and defined as preoperative minus postoperative straylight. The age-effect was incorporated to determine a model for straylight improvement. The orthogonal regression analysis was used to calculate the break-even point (BEP).

Results

The pseudophakic norm was based on 13 studies (1533 eyes). It reads:

$$Straylight\ = 0.0044 * Age + 0.89$$

The 95% CI was ± 0.42 log units, derived from 1336 eyes. The new reference as well as the individual postoperative straylight values are presented in Fig. 1.

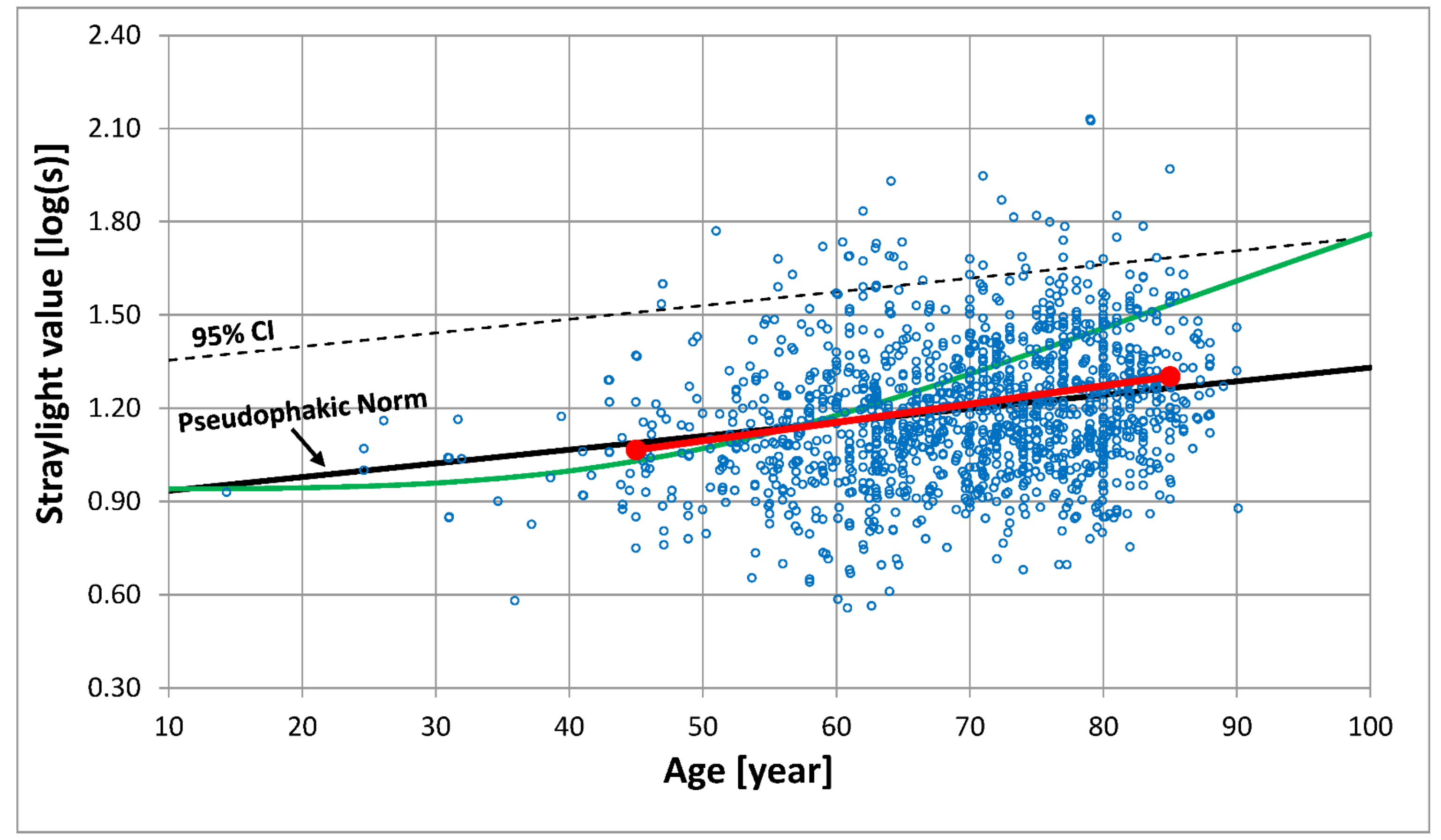

Figure 1. Intraocular scatter as a function of age in pseudophakic eyes (the circles) with the new pseudophakic norm (the solid black line). The green line shows the norm for the phakic eye[2]. The solid red line is the break-even point age dependency.

The loess fit showed linear trend with the same slope as the new pseudophakic reference (Fig. 2A). The normative limits were derived for the 90th, 95th and 98th percentile (Fig. 2B)

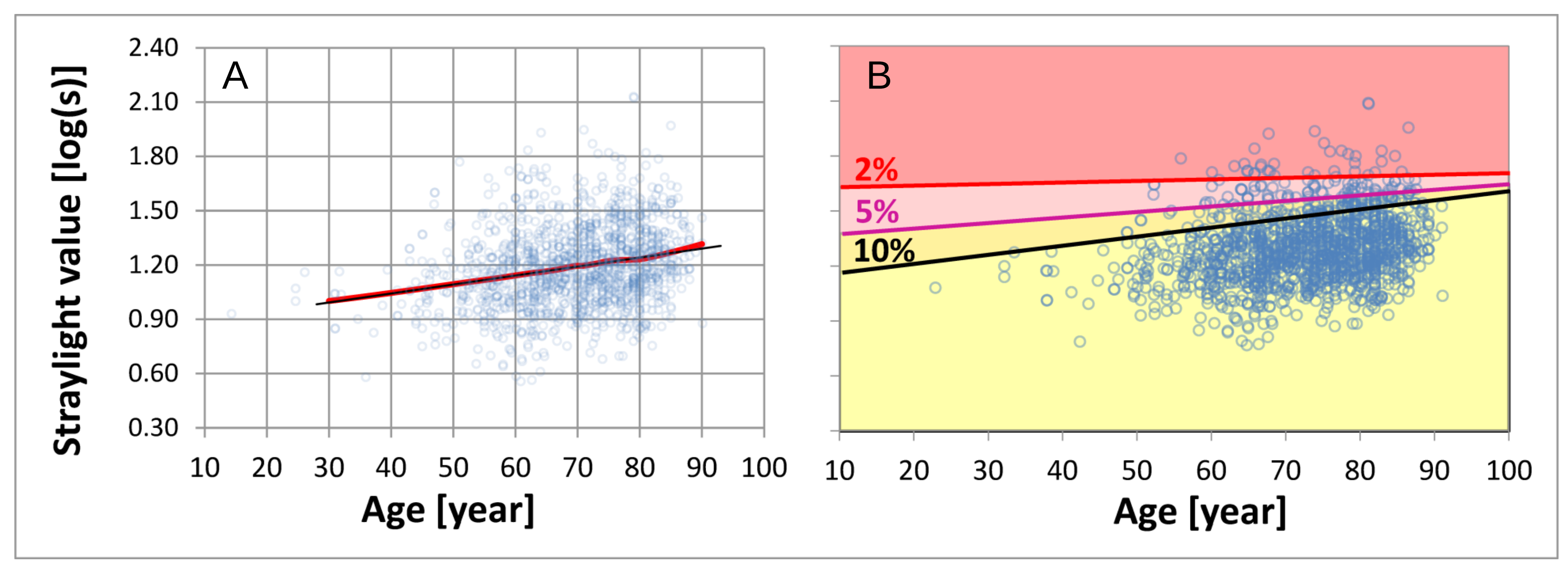

Figure 2. Evaluation of the pseudophakic norm. A) Test for linearity using the loess fit (the red line). B) The quantile regression lines.

A clear correlation (R^2=0.59, $p<0.05$) was observed between preoperative straylight and its improvement yielding the relationship:

$$Straylight\ Imp. = 1.04 * Preop.straylight - 0.006 * Age - 0.84$$

The BEP increase with subject age is shown in Tab. 1 as well as in Fig. 1 (the red line) and in Fig. 3.

Age	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
BEP	1.06	1.13	1.18	1.26	1.29
R^2	0.81	0.64	0.56	0.58	0.42
p	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Table 1. The break-even point (BEP) dependency on age.

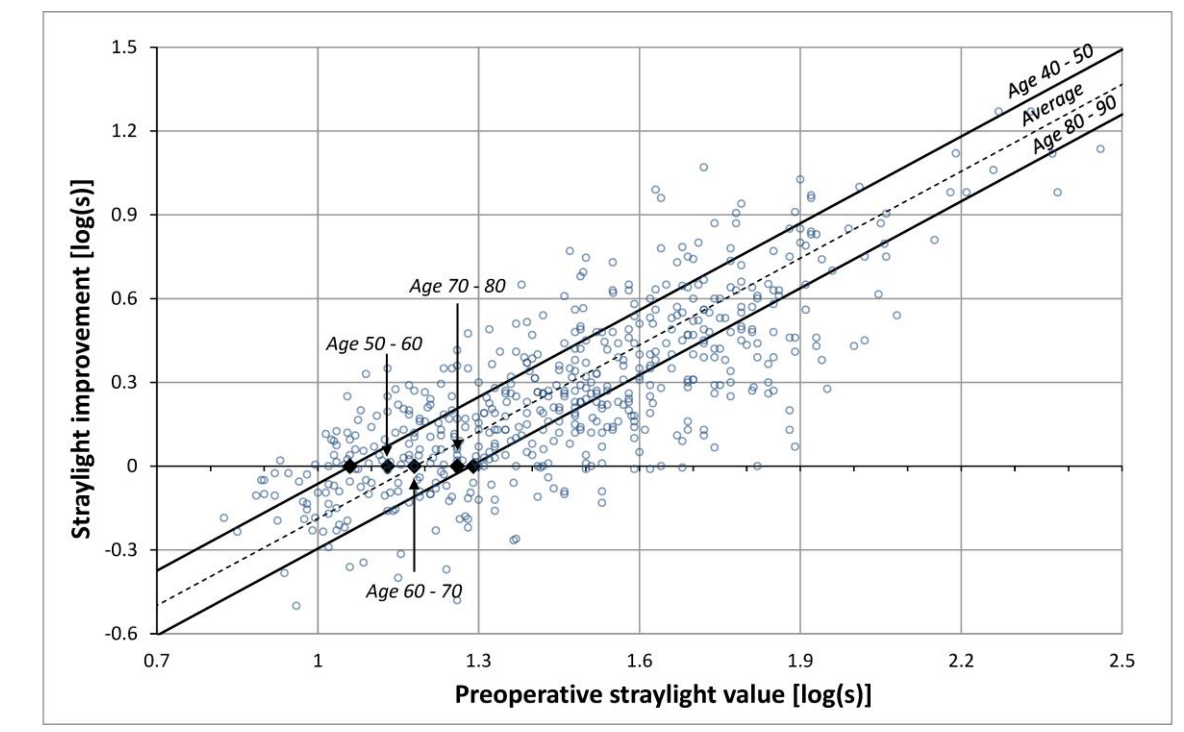

Figure 3. Improvement of straylight upon crystalline lens exchange. The solid lines indicate the age effect. The diamonds represent the break-even points.

Conclusion

We developed a normative model for straylight in the pseudophakic eye that is considerably different from the previously published norm for the phakic eye[2]. The loess fit shows that the straylight-age dependency in pseudophakia is not logarithmic as for the phakic eyes, but linear (Fig. 1).

The relationship between preoperative straylight value and its improvement after intraocular lens implantation was different for the various age groups. The BEP values are very close to the reference line showing its clear age-dependency (Fig. 1).

The proposed normative model can be considered as a predictive feature to improve the decision-making process before crystalline lens exchange and serve as a reference criterion for postoperative straylight.

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MARIE CURIE ACTIONS

Disclosures

The Netherlands Academy of Arts and Sciences owns a patent on straylight measurement, with Van den Berg as inventor, and licenses that to Oculus for the C-Quant instrument. The authors have no proprietary or commercial interest in any materials discussed in this study.

References

1. Łabuz et al. Ocular straylight in the normal pseudophakic eye. J Cataract Refract Surg (in press)
2. Van den Berg et al. Straylight effects with aging and lens extraction. Am J Ophthalmol 2007; 144:358-363