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ARTICLE

Straylight in posterior polar cataract

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Purpose: To study straylight before and after posterior polar cataract removal.

Setting: Academic Medical Center, Amsterdam, the Netherlands.

Design: Prospective case series.

Methods: Patients diagnosed with posterior polar cataract who agreed to cataract surgery were included in the study. Intraocular straylight was measured before and after surgery with the compensation comparison method using a straylight meter (C-Quant).

Results: Measurements were performed on 8 eyes of 4 patients. The mean preoperative corrected distance visual acuity was relatively good (0.15 logarithm of the minimum angle of resolution [logMAR] ± 0.18 (SD). The mean postoperative CDVA was −0.08 ± 0.09 logMAR ($P < .01$). The mean preoperative straylight was extreme (2.01 ± 0.38 log[s]), 13 times that of a young normal eye; however, it improved postoperatively to 1.04 ± 0.26 log(s) ($P < .01$).

Conclusions: Straylight in eyes with posterior polar cataract patients can be extremely bothersome, while visual acuity is relatively well preserved. Surgery was effective in lowering straylight levels. For these patients, straylight measurements can help objectively measure the quality of vision complaints, and elevated straylight levels can be an indication for surgery independent of visual acuity.

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Posterior polar cataract is an uncommon condition with a relatively high complication rate during cataract surgery. The exact pathophysiology is unknown; however, the process results in dysplastic lens fibers that can adhere to the posterior capsule. Reported posterior capsule rupture rates remain between 6% and 30% despite efforts to improve surgical techniques.[1]

Posterior polar cataracts can remain small and stable in size; therefore, surgery is often postponed until visual function is significantly affected.[2,3] The primary indication for surgical intervention in cataract is poor visual acuity. However, recent articles, such as a review by Kessel et al.,[4] have shown that preoperative visual acuity is a poor predictor of improvement in the subjectively experienced quality of vision after cataract surgery. The review found that visual acuity and subjective quality of vision improve after nearly all cataract operations but that a poor (20/40 or lower) or fair (higher than 20/40) preoperative visual acuity does not predict objective and subjective improvement after surgical intervention. Preoperative acuity measurements are not sufficient to identify which patients can benefit from cataract extraction.

Using only visual acuity as an indication for surgery means that some patients who have straylight-related complaints will be underserved. Straylight is defined as the illumination patients see around bright lights, which can significantly hinder their vision.[5] It is established as the scientific definition for glare by the International Standards Committee, Commission International d'Éclairage.[5] The cause of straylight is light scattering in the eye, which degrades the retinal image. Straylight is an objective component of the quality of vision that is minimally related to visual acuity.[6] The relative independence between acuity and straylight can be understood on physical and methodological grounds.[7] Separate effects on straylight and visual acuity can be seen in cataract as straylight can be increased by cataract with minimal loss of visual acuity.[6,8,9]

Considering the increased risk for capsule rupture during surgery in eyes with posterior polar cataract, the decision to operate must be carefully weighed. For many patients, this decision can be complicated by the presence of subjective visual complaints while visual acuity remains adequate. Straylight as a potential cause of these complaints can remain undiagnosed. The focus on visual acuity is supported by studies showing that eyes with posterior polar

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cataract have surgery at the same visual acuity levels as eyes with other types of cataract.[10,11] However, glare phenomena in eyes with posterior polar cataract are commonly reported.[3,10,12] A posterior cataract type can be a factor in straylight-related problems, as is seen in posterior subcapsular cataract, which is associated with higher straylight levels compared with more anterior acquired cataract types.[9] At present, no data on straylight levels in posterior polar cataract are available.

The aim of this study was to improve the evaluation of the need for cataract surgery in patients with posterior polar cataract. Insight into the straylight and acuity aspects of the quality of vision and their response to cataract surgery would allow the surgeon to better weigh the risk versus the reward in this challenging group. Improved decision-making can prevent a delay in potentially beneficial treatment or disappointing postoperative results.

PATIENTS AND METHODS

Patients with posterior polar cataract having cataract surgery at the Academic Medical Center in Amsterdam, the Netherlands, were included. Ethics committee approval was obtained. None of the patients had relevant ocular disease other than cataract. The indication for surgery in all patients was substantial subjective complaints of visual quality and significantly deteriorated visual function, which included evaluation of visual acuity and straylight levels.

Visual acuity and straylight measurements were performed preoperatively and at least 2 weeks postoperatively. Straylight was measured using a straylight meter (C-Quant, Oculus Optikgeräte GmbH), which measures ocular straylight using the compensation comparison method.[13] The method has been extensively described and validated.[5,13] In brief, the patient makes a series of forced-choice comparisons of flickering seen in 2 half circles. A flickering ring surrounds the divided circle, producing the perception of flicker in the circle resulting from intraocular light scattering. In 1 randomly selected side of the circle, counterphase flicker is added. This changes the observed flicker strength; if the added flicker equals the straylight strength of the eye, zero flicker results. However, when the compensation flicker is exactly double the straylight value, the flicker appears equal on both sides. The patient responses to a series of short presentations with different compensation levels leads to an estimate of the straylight value of his or her eye; this estimate takes 1.5 minutes. The method also allows one to estimate the precision of the measurement using the estimated standard deviation (SD). In this study, an estimated SD less than 0.12 log was used as the limit value for reliability. Values were expressed as the logarithm of the straylight parameters; that is, as log(s).

Other methods used to estimate scatter and glare include the ocular scatter index and brightness acuity glare testing. The ocular scatter index is not a functional measurement of symptoms and can be affected by artifacts resulting from the use of infrared light and backscatter present in posterior polar cataract.[14] Brightness acuity glare testing is a functional measurement; however, it does not comply with objective quantification of glare according to international standards. For these reasons, the compensation comparison method was used to quantify glare in this study.

Visual acuity was measured using the Early Treatment Diabetic Retinopathy Study chart[15] and was recorded as the logarithm of the minimal angle of resolution (logMAR). This paper reports the corrected distance visual acuity (CDVA).[16]

Cataract surgery was performed by an attending ophthalmologist specialized in anterior segment disease (I.v.d.M.). The surgical technique included of phacoemulsification and hydrodelineation rather than hydrodissection to avoid posterior capsule rupture.

Statistical analysis was performed using the paired *t* test for normally distributed variables (straylight) and the Wilcoxon signed-rank test for non-normally distributed variables (visual acuity). Normality was tested with the Shapiro-Wilk test. The significance level for all tests was 0.05.

RESULTS

In this study, 8 eyes of 4 patients were measured. The mean age of patients was 62 years $\pm$ 4.76 (SD). Table 1 shows the preoperative and postoperative CDVA and straylight results. The mean CDVA was 0.15 $\pm$ 0.18 logMAR preoperatively and -0.08 ± 0.09 logMAR postoperatively; the difference was statistically significant ($P < .01$). The mean straylight was 2.01 $\pm$ 0.38 log(s) preoperatively and 1.04 $\pm$ 0.26 log(s) postoperatively; the difference was statistically significant ($P < .01$). Subjective patient reports of postoperative outcomes were all positive.

Figure 1 shows the preoperative and postoperative straylight in individual eyes compared with reported data on straylight in eyes with a cataract that was not of the posterior polar type. Figure 2 shows the difference between preoperative and postoperative straylight values compared with the change in acuity and with data reported in eyes with a cataract that was not of the posterior polar type.

Posterior capsule rupture occurred in 1 eye (12.5%); surgery could still be completed and the postoperative visual outcomes were comparable to those in the other eyes. No other complications, such as postoperative corneal decompensation, occurred. No eye required posterior capsulorhexis or anterior vitrectomy.

DISCUSSION

In this study, preoperative straylight levels in all eyes with posterior polar cataract were significantly elevated. The amount of straylight was higher than that found in eyes with other types of cataract.[6,9] The reduction in straylight after surgery was significant, with an improvement of 0.97 log units (a factor of 9.4) compared with the improvement in CDVA of 0.24 log units (a factor of 1.7). The improvement in straylight yielded lower postoperative values than seen postoperatively in other types of cataract. However, the age difference between the present study and other studies might have had caused the difference in findings. In pseudophakia, age has an effect on straylight,[17] although the mechanism is unknown. In a study by van der Meulen,[6] the mean age was 72 years, whereas in the present study it was 62 years. In a study by Łabuz et al.,[17] this age difference corresponded to a straylight difference of 0.04 log units. Even if we correct for this, the difference between our results and results in other studies is still significant. Our visual acuity results are comparable to those for other types of cataract and in previous studies of posterior polar cataract.[1–3]

Two patients in our study had a preoperative CDVA of 20/20 in 1 or both eyes, showing that poor visual acuity should not be the sole indication for surgery. Straylight levels in the eyes of these patients were all higher than

Table 1. Visual acuity and straylight results before and after posterior polar cataract surgery.

	CDVA (LogMAR)		Straylight (Log[s])	
Patient, Age, & Eye	Preop	Postop	Preop	Postop
Patient 1/67 y				
Right eye	0.10	0.00	2.05	1.53
Left eye	0.20	0.00	2.02	1.29
Patient 2/57 y				
Right eye	0.00	−0.20	2.06	1.16
Left eye	0.10	−0.10	2.30	0.92
Patient 3/65 y				
Right eye	0.30	0.00	1.49	0.91
Left eye	0.50	0.00	1.49	0.81
Patient 4/59 y				
Right eye	0.00	−0.18	2.62	0.86
Left eye	0.00	−0.18	2.05	0.84

CDVA = corrected distance visual acuity

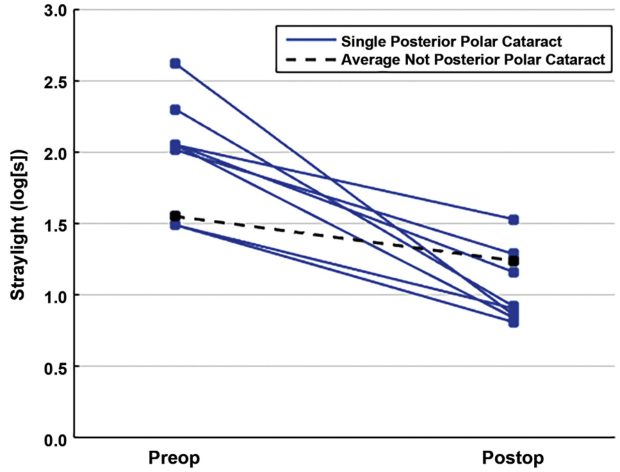

Figure 1. Preoperative and postoperative straylight levels for individual posterior polar cataract patients compared with the average straylight level for cataracts that are not posterior polar as reported by van der Meulen et al.[6]

2.00 log(s); thus, the straylight value was more than 12 times higher than that reported for young normal eyes. These values are significantly higher than the 1.40 log(s) cutoff indicating serious hindering of vision and thus the need for cataract surgery.[5,6] The postoperative straylight level in those 3 eyes was lower than 1.40 log(s). These findings correspond to the low correlation between visual acuity and straylight.[5] One reason for the low correlation between acuity and straylight is that when the opacity covers only part of pupillary opening, a sizeable amount of light entering the eye remains undisturbed.[7] Pupil size might play a considerable role in this group of patients because of the localized nature of the cataract. During straylight measurement, pupil size corresponds to normal photopic conditions.[18] Pupil size has a minor effect on straylight levels in normal eyes,[19] and it would be interesting to establish its effect in relation to the characteristics of a polar cataracts.

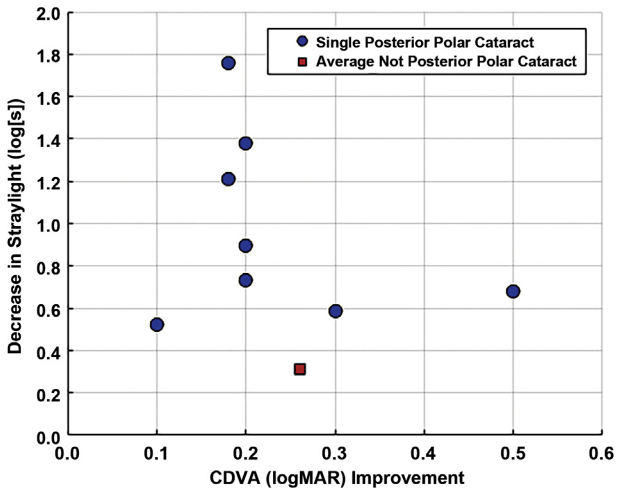

Figure 2. Change in straylight levels and CDVA after cataract surgery. The average data on cataracts that are not posterior polar are from van der Meulen et al.[6] (CDVA = corrected distance visual acuity; logMAR = logarithm of the minimal angle of resolution).

In conclusion, the findings in this study highlight the important role of straylight in decreased quality of vision in eyes with posterior polar cataract. In terms of when to perform surgery, visual complaints in the presence of normal visual acuity should be considered. Increased straylight in the absence of a decrease in visual acuity can be an indication for cataract surgery in these patients. If the surgeon takes all the necessary steps to avoid complications or manages them when they occur, the results can be good even in the event of capsule rupture. All our patients were pleased with surgical outcomes, including those who had a preoperative CDVA of 20/20.

WHAT WAS KNOWN

- Straylight can be elevated in cataract patients.
- Posterior polar cataract results in a significant loss of quality of vision, even when the preoperative visual acuity is good.

WHAT THIS PAPER ADDS

- Posterior polar cataract can cause straylight levels that are higher than with any other cataract type independent of visual acuity deterioration.
- Straylight values decreased after surgery.

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Disclosures: *The Royal Dutch Academy of Arts and Sciences holds a patent for straylight measurement and licenses to Oculus GmbH for the C-Quant instrument, of which Dr. van den Berg is the inventor. Dr. Lapid-Gortzak is a consultant to Alcon Laboratories, Inc., Eye Yon Medical, Hanita Lenses, Thea Pharma GmbH, and Taiho Oncology, Inc. None of the authors has a financial or proprietary interest in any material or method mentioned.*

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