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Impact of First Eye versus Second Eye Cataract Surgery on Visual Function and Quality of Life

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Purpose: To compare the impact of first eye versus second eye cataract surgery on visual function and quality of life.

Design: Cohort study.

Participants: A total of 328 patients undergoing separate first eye and second eye phacoemulsification cataract surgeries at 5 veterans affairs centers in the United States. Patients with previous ocular surgery, postoperative endophthalmitis, postoperative retinal detachment, reoperation within 30 days, dementia, anxiety disorder, hearing difficulty, or history of drug abuse were excluded.

Methods: Patients received complete preoperative and postoperative ophthalmic examinations for first eye and second eye cataract surgeries. Best-corrected visual acuity (BCVA) was measured 30 to 90 days preoperatively and postoperatively. Patients completed the National Eye Institute Visual Functioning Questionnaire (NEI-VFQ) 30 to 90 days preoperatively and postoperatively. The NEI-VFQ scores were calculated using a traditional subscale scoring algorithm and a Rasch-refined approach producing visual function and socioemotional subscale scores.

Main Outcome Measures: Postoperative NEI-VFQ scores and improvement in NEI-VFQ scores comparing first eye versus second eye cataract surgery.

Results: Mean age was 70.4 years (±9.6 standard deviation [SD]). Compared with second eyes, first eyes had worse mean preoperative BCVA (0.55 vs. 0.36 logarithm of the minimum angle of resolution (logMAR), $P < 0.001$), greater mean BCVA improvement after surgery (−0.50 vs. −0.32 logMAR, $P < 0.001$), and slightly worse postoperative BCVA (0.06 vs. 0.03 logMAR, $P = 0.039$). Compared with first eye surgery, second eye surgery resulted in higher postoperative NEI-VFQ scores for nearly all traditional subscales ($P < 0.001$), visual function subscale (−3.85 vs. −2.91 logits, $P < 0.001$), and socioemotional subscale (−2.63 vs. −2.10 logits, $P < 0.001$). First eye surgery improved visual function scores more than second eye surgery (−2.99 vs. −2.67 logits, $P = 0.021$), but both first and second eye surgeries resulted in similar improvements in socioemotional scores (−1.62 vs. −1.51 logits, $P = 0.255$).

Conclusions: Second eye cataract surgery improves visual function and quality of life well beyond levels achieved after first eye cataract surgery alone. For certain socioemotional aspects of quality of life, second eye cataract surgery results in comparable improvement to first eye cataract surgery. *Ophthalmology 2017;■:1–8* © *2017 by the American Academy of Ophthalmology*

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Cataract surgery is the most commonly performed surgical procedure in the world, with an estimated 1.7 million operations performed annually in the United States alone.[1] With the aging of the global population, the number of patients with operable cataract is expected to increase further in coming years. Cataract surgery rates have increased worldwide in recent decades and will continue to increase for the foreseeable future.[2,3] Cataract surgery performed in the second eye is common in developed countries, with further increases expected in the future.[4] Prior studies have demonstrated that first eye cataract surgery benefits patients through meaningful gains in day-to-day visual function,[5–10] improvement in social and emotional aspects of life,[5,10] and a reduction in risk of mechanical falls,[11,12] hip fractures,[13] and other adverse events. Although second eye cataract surgery has been linked to gains in several objective metrics, such as visual acuity,[5–10,14–16] contrast sensitivity,[6–8,10,14–17] and mobility,[10,17] evidence regarding the patient-reported benefits of second eye cataract surgery, especially relative to first eye surgery, remains controversial. A systematic review by Ishikawa et al[18] found only "moderate" evidence of

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improvement in patient-reported visual functioning due to second eye cataract surgery. The authors concluded that evidence of improvement in patient-reported health-related quality of life due to second eye surgery was "mixed" and "not definitive," emphasizing the need for more high-quality studies regarding this widely performed procedure.

Measuring vision-related quality of life (VRQoL) poses a methodological challenge that has likely limited studies on this topic. Generic quality-of-life questionnaires such as the EuroQol-5D[8] and Health-Related Quality of Life Questionnaire[19] fail to capture the substantial VRQoL gains known to occur after ophthalmic procedures. Customized questionnaires developed for use in single studies prevent comparisons across multiple procedures and patient populations. Questionnaire responses scored using an ordinal Likert scale must be validated via Rasch analysis for results to be considered psychometrically valid.[20] Rasch analysis converts ordinal numeric values corresponding to choices on a Likert scale into continuous logit scores, allowing more valid comparison of latent variables such as VRQoL across patients and procedures. Therefore, an ideal patient-reported VRQoL instrument must be vision specific, widely used, and validated in the design and analysis phase using Rasch analysis.

This study used a Rasch-refined version of the 25-item National Eye Institute Visual Function Questionnaire, the most commonly used patient-reported outcome measure in ophthalmology, to examine the impact of first eye versus second eye cataract surgery on visual function and quality of life among 328 patients undergoing separate first eye and second eye cataract surgeries at 5 Veterans Affairs ophthalmology centers in the United States.

Methods

Study Design

The Veterans Health Administration (VHA) reports more than 400 000 operative cases per year, with cataract surgery accounting for more than 54 000 of these cases in fiscal year 2012. In 2007, VHA ophthalmology was charged with developing a pilot project measuring outcomes of ophthalmic surgical procedures, including preoperative evaluation, intraoperative risk factors, and postoperative outcomes. In 2009, the Ophthalmic Surgical Outcome Database (OSOD) pilot project was initiated to collect data on cataract surgeries performed at 5 VHA Medical Centers (Boston, MA; Philadelphia, PA; Houston, TX; St. Louis, MO; and Nashville, TN). The OSOD data collection took place from February 2009 to March 2012. Veterans received a complete ophthalmic examination including manifest refraction, slit-lamp examination, tonometry, dilated fundus examination, and biometry. Cataracts were classified by anatomic type (nuclear sclerotic cataract [NSC], cortical cataract [CC], or posterior subcapsular cataract [PSC]) and grade for each type (grades 1–4) on the basis of the Lens Opacities Classification System II,[21] with assignment of multiple anatomic types allowed for each cataract. After undergoing phacoemulsification cataract surgery, patients received routine postoperative care that typically consists of clinic visits and postoperative visual acuity measurements at 1 day, 1 week, and approximately 30 to 90 days after surgery. Best-corrected visual acuity (BCVA) was measured 30 to 90 days preoperatively and postoperatively using a Snellen chart and converted to logarithm of the minimum angle of resolution (logMAR) units for analysis. Patients were requested to complete the 25-item National Eye Institute Visual Functioning Questionnaire (NEI-VFQ) 30 to 90 days preoperatively and 30 to 90 days postoperatively. Questionnaires were collected in 1 of 3 ways: self-completion, face-to-face interviews, or telephone interviews. Nurse reviewers at each site were charged with completion of a 3-part risk assessment form recording data from the VHA's Computerized Patient Record System as patients matriculated through the surgical process. Completed data sets from each of the pilot sites were compiled via an Access database (Microsoft, Redmond, WA). After local institutional review board approval at all 5 sites and VHA National Surgery Office's Surgical Quality Data Utilization Group approval for data use, retrospective analysis was performed on the OSOD project data. The research presented adhered to the tenets of the Declaration of Helsinki.

Analysis was limited to patients undergoing phacoemulsification cataract surgery with intraocular lens implantation who had complete preoperative data for first eye surgery, complete postoperative data for first eye surgery or preoperative data for second eye surgery, and complete postoperative data for second eye surgery. A subset of patients underwent a single evaluation 30 to 90 days after first eye surgery that also served as a preoperative evaluation for their second eye surgery. Patients with previous surgery in either eye, postoperative endophthalmitis, postoperative retinal detachment, reoperation within 30 days of cataract surgery, dementia, anxiety disorder, hearing difficulty, or history of drug abuse were excluded.

Statistical Analysis

The NEI-VFQ scores were calculated in 2 ways: the traditional NEI-VFQ scoring algorithm[22,23] and the more psychometrically valid Rasch-refined scoring approach.[20] The traditional NEI-VFQ scoring approach, which has been used in numerous prior studies, sorts responses to each of the survey's 25 questions to produce 12 function-specific subscale scores (General Health, General Vision, Ocular Pain, Near Activity, Distance Activity, Social Function, Mental Health, Role Difficulties, Dependence, Driving, Color Vision, and Peripheral Vision) and a composite score that purportedly reflects overall VRQoL. However, Pesudovs at al[20] demonstrated that the NEI-VFQ does not necessarily measure 12 distinct function-specific latent constructs and an overall construct of visual function, but rather measures only 2 distinct latent constructs: visual function and socioemotional quality of life. The authors' Rasch-refined scoring approach sorts questions in the NEI-VFQ into 2 subscales (visual function and socioemotional quality of life), each of which has superior unidimensionality and construct validity to the traditional subscales. After sorting NEI-VFQ responses into 2 subscales using this Rasch-refined scoring approach, we used the Rasch approximation method devised by Pesudovs et al[20] to convert ordinal responses corresponding to answer choices on a Likert scale into logits corresponding to latent variable measurements on a linear scale.

Primary outcomes were postoperative NEI-VFQ scores after each cataract surgery and change in NEI-VFQ score (calculated as postoperative score minus preoperative score) across each cataract surgery. Outcomes were compared for first eye cataract surgery versus second eye cataract surgery. To account for repeated measures in the statistical analysis, differences in ordinal variables across 2 groups were assessed via the Wilcoxon signed rank-sum test, binary variables were assessed via the Fisher exact test, and continuous variables were assessed via the paired t test. Results