Changes in Postoperative Refractive Outcomes Following Combined Phacoemulsification and Pars Plana Vitrectomy for Rhegmatogenous Retinal Detachment

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• PURPOSE: To evaluate changes in postoperative refractive outcomes following combined phacoemulsification and pars plana vitrectomy for rhegmatogenous retinal detachment (RRD) compared with other retinal diseases.
• DESIGN: Retrospective observational case-control study.
• METHODS: A total of 55 patients who had combined surgery between January 2007 and December 2012 were enrolled. The 25 patients who underwent combined surgery for RRD were included in the RRD group, and 30 patients who underwent combined surgery for other vitreoretinal pathology were included in the control group. Refractive axial length and intraocular pressure (IOP) measurements were performed, and the factors influencing the postoperative refractive outcomes were analyzed.
• RESULTS: The mean differences between the postoperative and predicted refractive outcomes in the RRD group and the control group were −0.43D ± 0.67 ($P = .046$) and −0.08D ± 0.53 ($P = .767$), respectively. The mean preoperative IOPs of the affected eye and the fellow eye in the RRD group were 11.44 mm Hg ± 3.15 and 13.16 mm Hg ± 2.73 ($P = .045$), but no differences were found in the affected eyes and fellow eyes of the control group. The differences were 14.20 mm Hg ± 2.95 and 14.17 mm Hg ± 3.50, respectively ($P = .974$). The mean postoperative IOPs in the affected eyes and the fellow eyes of the 2 groups were not significantly different. For all eyes, the refractive differences correlated with IOP changes in the RRD group. ($r = .659$, $r^2 = .435$, $P < .001$).
• CONCLUSIONS: The postoperative refractive outcomes in the RRD group shifted toward myopia by a mean of 0.35 diopters compared with the control group. Normalizing preoperative lowered IOP after combined surgery in RRD may be the key factor in understanding this myopic shift. (Am J Ophthalmol 2014;158:251–256.
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VITREORETINAL DISORDERS AND CATARACTS ARE often comorbid, presenting in geriatric patients at the same time. Combined phacoemulsification and pars plana vitrectomy (PPV) has therefore become a common procedure.[1–5] This combined approach is more time consuming and technically challenging; however, it allows for faster recovery and reduces treatment costs.[6,7] In the combined surgical approach, achieving the best uncorrected visual acuity for patients is preferable to achieving the best corrected visual acuity such that patients do not require subsequent optical correction with glasses. It is therefore crucial for the postoperative refractive errors to be close to the expected refractive errors.

Numerous variables can affect the postoperative refraction. Previous studies have reported a myopic shift following intraocular lens (IOL) implantation following vitrectomy, as compared with the calculated expected value using the SRK (Sanders, Retzlaff and Kraft) formula.[8,9] Additionally, previous reports of combined cataract and vitrectomy surgery have produced promising results.[10,11] It has been reported that intraocular pressure (IOP) may affect the refractive outcome. Zhang and associates[12] showed that the refractive outcome of cataract surgery on a trabeculectomized eye was correlated with a change in IOP. Francis and associates[13] evaluated changes in the axial length after trabeculectomy and glaucoma drainage device surgery.

Previous studies have suggested that PPV and IOP are the 2 key factors that contribute to a postoperative myopic shift.[8,12] Rhegmatogenous retinal detachment (RRD) is known to be related to a preoperative low IOP.[14] Furthermore, combined surgery has become a common procedure for RRD. This study hypothesized that PPV in RRD could show a significant postoperative myopic shift.

The present study evaluated the postoperative refractive outcomes in patients with RRD who underwent combined surgical treatment. These results were compared to those obtained in patients who underwent combined surgical intervention for other vitreoretinal conditions. In addition, this study aimed to elucidate the risk factors that affect changes in refractive outcome.

MATERIAL AND METHODS

THIS RETROSPECTIVE OBSERVATIONAL CASE-CONTROL study was conducted in accordance with the tenets of the Declaration of Helsinki and was approved by the Institutional Review Board of Hallym University Sacred Heart

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Hospital. The medical records of all patients who underwent combined PPV and phacoemulsification between January 2007 and December 2012 at the Hallym University Sacred Heart Hospital were reviewed.

Patients who underwent combined phacoemulsification and PPV for RRD were included in the RRD group. Patients who underwent combined surgery for other vitreoretinal pathologies were included in the control group. The changes in the refractive errors of the 2 groups at 3 and 6 months following surgery were compared. The refractive errors were converted into spherical equivalents (spherical power + one half cylinder power) for direct comparison. The postoperative refractions were compared with the expected refractive outcomes, as determined by the SRK-T formulas. Visual acuity was converted into logarithm of the minimum angle of resolution (logMAR) equivalents for comparative analyses.

To minimize the bias that affects the refractive outcomes before and after surgery, the axial lengths of the 2 groups were matched, and only the macula on RRD was selected as the inclusion criterion for patients in the RRD group. Exclusion criteria for the RRD group was long axial length (>27.0 mm), macula off retinal detachment (RD), serous RD, tractional RD, or a coexisting vitreoretinal disorder including glaucoma. Indications for PPV in the control group included diabetic retinopathy, branch or central retinal vein occlusion, macular hole, epiretinal membrane, or vitreous opacity due to previous uveitis. The vitreoretinal disorders that could affect the refractive error, such as macular edema >300 μm or long axial length >27.0 mm, were excluded. Additionally, patients being treated with medication to lower IOP were excluded from this study.

Optometrists measured the spherical equivalent and keratometric values using an Auto-Refracto-Keratometer KR-8100 (Topcon, Tokyo, Japan), both preoperatively and 3 and 6 months postoperatively. In addition, the axial length was measured preoperatively by 2 physicians to eliminate a corneal indentation bias. The patients were assessed in a seated, upright position, using an ultrasonic biometer, model 820 (A-scan; Carl Zeiss Meditech, Dublin, California, USA) and an Aviso imaging system (A-scan; Quantel Medical, Cournon-d'Auvergne, Auvergne, France). More than 10 axial length measurements were taken in each eye, and the mean value was calculated. The IOL power was biometrically calculated using the SRK-T formulas. All IOP measurements were obtained using Goldmann applanation tonometry, across various time points during the daylight hours of 8:30 and 11:30 am. This was performed, in most cases, by a resident physician prior to observation of the patient by the treating physician. The IOP was remeasured by the treating physician when discrepancies in the results arose, in order to improve the accuracy of the measurement.

All the combined surgeries were performed by 1 surgeon. A foldable IOL (Tecnis ZCB00; Abbot Medical Optics, Abbott Park, Illinois, USA) was inserted into the capsular bag prior to the PPV. Before the cataract operation, a 3 mm clear corneal incision was made at the 10:30 o'clock position. A continuous curvilinear capsulorhexis was created, and phacoemulsification and aspiration were performed. Standard 3-port vitrectomy was performed using a 23-gauge vitreous cutter and an endo-illuminator. The vitreous was removed and additional vitreoretinal procedures, including fluid-air or fluid-gas exchange and endophotocoagulation, were performed when required.

A Student *t* test, paired *t* test, or simple linear regression, was used to analyze the refractive outcomes and IOPs. A $P < .05$ was considered to indicate a statistically significant difference. All the analyses were performed using SPSS v 12.0.0 for Windows (SPSS, Chicago, Illinois, USA).

RESULTS

THE 55 EYES OF 55 PATIENTS MET THE INCLUSION CRITERIA for enrolment in the present study. Of the 55 patients, 25 underwent combined surgery for RRD and thus were assigned to the RRD group. The remaining 30 patients were assigned to the control group. The mean age of the patients in the RRD group was 60.28 ± 12.56 years, of which 9 were men and 16 were women. The mean age of the patients in the control group was 59.43 ± 11.00 years, of which 20 were men and 10 were women. There was no significant difference in the mean ages in the 2 groups ($P = .791$). However, the RRD group contained a significantly higher proportion of female patients ($P = .032$). The vitreoretinal pathologies of the control group were as follows: diabetic retinopathy (17 eyes, 56.6%); branch or central retinal vein occlusion (7 eyes, 23.3%); macular hole (2 eyes, 6.6%); epiretinal membrane (2 eyes, 6.6%); vitreous opacity due to previous uveitis (2 eyes, 6.6%). The mean preoperative refractive outcomes in the RRD and control groups were −2.11 ± 4.94 diopters (D) and −1.35 ± 2.37 D, respectively ($P = .464$, Student *t* test). The mean axial lengths in the RRD group and the control group were 24.76 ± 2.08 mm and 24.42 ± 1.28 mm, respectively. There was no significant difference between the 2 groups ($P = .459$, Student *t* test) (Table 1).

The mean keratometric values were not significantly different in the preoperative and postoperative measurements in the 2 groups. The mean differences were −0.04 ± 0.36 D ($P = .255$, paired *t* test) and 0.03 ± 0.33 D ($P = .486$, paired *t* test), respectively (Table 2).

The RRD group had a significantly greater myopic refractive surprise as compared with the control group. The mean prediction difference between the predicted and postoperative 6-month refractive outcomes in the RRD and control groups were −0.43 ± 0.67 D ($P = .046$, paired *t* test) and −0.08 ± 0.53 D ($P = .767$, paired *t* test) (Table 3). A mean of 0.35 D to the myopic side was comparable with the control group.

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