Photorefractive keratectomy in posterior polymorphous dystrophy with vesicular and band subtypes

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PURPOSE: To evaluate the safety and efficacy of photorefractive keratectomy (PRK) in patients with posterior polymorphous dystrophy (PPMD) with vesicular and band subtypes.

SETTING: Walter Reed Center for Refractive Surgery, Washington, DC, USA.

DESIGN: Case series.

METHODS: The records of patients with PPMD who had PRK between January 2002 and May 2009 were reviewed. Data for analysis included sex, age, ablation depth, residual stromal bed thickness, manifest spherical equivalent, uncorrected (UDVA) and corrected (CDVA) distance visual acuities, central corneal thickness (CCT), endothelial cell density (ECD), intraocular pressure (IOP), and complications. Preoperative and postoperative results were compared using the Wilcoxon signed-rank test, with $P<.05$ considered significant.

RESULTS: Fourteen eyes of 7 men (mean age 29.1 years ± 9.1 [SD]; range 21 to 42 years) with at least a 6-month follow-up were reviewed. At the final follow-up (mean 19.5 months; range 6.3 to 58.3 months), all eyes had a UDVA of 20/15 and all eyes were within ±0.50 diopter of emmetropia. The CDVA was unchanged from preoperatively in 71.4% of eyes and improved by 1 line in 28.6%. There were no significant complications. The IOP did not change significantly over the follow-up ($P=.272$). At the final visit, the mean ECD (2795.3 ± 366.0 cells/mm^2) was unchanged from baseline (2809.1 ± 338.3 cells/mm^2) ($P=.114$).

CONCLUSIONS: Photorefractive keratectomy in PPMD patients with vesicular and band subtypes resulted in excellent visual outcomes and a low incidence of adverse effects. Endothelial cell densities did not change significantly in the early postoperative period.

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Corneal conditions often coexist with ametropia and are discovered when evaluating patients for possible keratorefractive surgery. Posterior polymorphous dystrophy (PPMD), an autosomal dominant disorder affecting the corneal endothelium and Descemet membrane, is one such condition. A previous study[1] reports results in patients with PPMD who had laser in situ keratomileusis (LASIK); however, there are no such reports after photorefractive keratectomy (PRK). In the present study, we reviewed the outcomes of PRK in 7 patients with PPMD. To our knowledge, these are the first reported cases of PRK in eyes with PPMD.

PATIENTS AND METHODS

Before the study, the Institutional Review Board, Walter Reed Department of Clinical Investigation, granted approval for the retrospective records review. Records of refractive surgery patients treated at the Walter Reed Center for Refractive Surgery between January 2002 and May 2009 were reviewed for pertinent data. Any patient with a preoperative diagnosis of PPMD was selected for review. The diagnosis of PPMD was based on clinical findings of vesicles, bands, or other characteristic changes in Descemet membrane or the endothelium, with or without elevated intraocular pressure (IOP). Patients with a minimum of 6 months of postoperative follow-up were included.

Epithelial removal was performed using an Amoils rotary brush (Innovative Excimer Solutions, Inc). Conventional and

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wavefront-guided treatments were performed with the LadarVision 6000 excimer laser system (Alcon Laboratories, Inc.). Wavefront-optimized treatments were performed with the Allegretto Wave Eye-Q 400 Hz excimer laser (Wavelight AG) using a 6.5 mm optical zone.

Data for analysis included sex, age, ablation depth, residual stromal bed thickness, surgical complications, manifest spherical equivalent (SE), uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), keratometry readings, central corneal thickness (CCT), IOP, endothelial cell density (ECD), and postoperative complications.

Keratometry and CCT measurements were obtained using scanning-slit topography (Orbscan IIz, Bausch & Lomb) or rotating Scheimpflug anterior segment tomography (Pentacam, Oculus GmbH). Residual stromal bed thickness was calculated using the preoperative CCT minus ablation depth minus 55 μm (estimated epithelial thickness).[2–4] All IOP measurements were by Goldmann applanation tonometry. Endothelial cell densities were performed at baseline, 6 months and 12 months postoperatively, and annually thereafter when patient follow-up at Walter Reed was possible. The ECD was performed using confocal microscopy (Confoscan4, Nidek Inc.). One drop of topical anesthesia (proparacaine hydrochloride 0.5%) was instilled in the lower conjunctival fornix of each eye, and the patient was asked to fixate on a target. Each scan was performed using a 40× water-immersion lens. One drop of hypromellose 0.3% (GenTeal gel) was applied to the front of the lens as a coupling agent. Real-time image capture enabled in vivo capture of all corneal layers; the images were transferred to the CS4 Navis application (Nidek Advanced Vision Information System) for analysis. The best-focused and most representative endothelial cell image was selected, and a region of interest was designated for automated endothelial cell analysis. Automatic cell counts were performed with manual editing to ensure correct identification and counting of cells and to obtain the degree of polymegathism and pleomorphism.

All data were entered directly from the patient's record to a password-protected spreadsheet for analysis. Data were analyzed using SPSS software (version 15.0, SPSS, Inc.). Preoperative and postoperative IOP results were compared over time using repeated-measures analysis of variance. The Wilcoxon signed-rank test was used to compare preoperative and postoperative ECD. Data are presented as the mean ± standard deviation. A P value less than 0.05 was considered statistically significant.

RESULTS

Fourteen eyes of 7 male patients were included in the review. The mean age of the patients was 29.1 ± 9.1 years (range 21 to 42 years).

Slitlamp examination of the cornea showed abnormal changes, such as vesicles and band lesions, in Descemet membrane and the endothelium (Figure 1). No patient with iris abnormalities, corneal edema, or elevated IOP was treated. Findings on confocal microscopy included areas of dark sunken craters and crack-like lesions, endothelial vesicular lesions protruding into the anterior chamber, and bright, prominent endothelial cell nuclei (Figure 2).

Patients were followed for a mean of 19.5 months postoperatively (range 6.3 to 58.3 months). The mean preoperative manifest SE was −3.82 ± 1.48 diopters (D) (range −1.88 to −6.25 D) and the mean preoperative cylinder, −0.43 ± 0.37 D (range 0.00 to −1.00 D). The mean preoperative pachymetry was 552.9 ± 53.9 μm (range 462 to 645 μm). The mean ablation depth was 59.91 ± 20.91 μm (range 30.62 to 84.24 μm). Five patients (10 eyes) had wavefront-optimized PRK (Allegretto Wave Eye-Q 400 Hz excimer laser), 1 patient had bilateral conventional PRK (LadarVision 6000), and 1 patient had bilateral wavefront-guided PRK (LadarVision Custom Cornea, Alcon Laboratories, Inc.). Table 1 shows the patient, treatment, and ECD data.

The UDVA was 20/15 or better postoperatively and met or exceeded the preoperative CDVA in all eyes. Eleven eyes (78.6%) were within ±0.25 D of emmetropia, and all eyes were within ±0.50 D. The CDVA was unchanged or improved by 1 line from the preoperative baseline in all eyes. Figure 3 shows the UDVA, manifest SE, and CDVA summary statistics. There were no significant intraoperative complications. Postoperatively, patient 2 developed anterior stromal scarring secondary to delayed epithelial healing in the left eye. This was treated with topical prednisolone acetate 1.0%; during treatment, the patient developed steroid-induced ocular hypertension requiring addition of a single topical agent (brimonidine 0.15%). The IOP returned to baseline when the topical steroidal agent was discontinued. The final UDVA in this patient was 20/15 despite a faint residual anterior stromal scar. Patient 7 developed transient trace corneal haze that resolved by 3 months postoperatively (Table 1). The mean IOP did not change significantly over time (preoperative, 13.6 ± 3.3 mm Hg; 1 month, 12.92 ± 2.75 mm Hg; 3 months, 14.3 ± 1.86 mm Hg;

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