Corneal Edema After Descemet Membrane Stripping Automated Endothelial Keratoplasty With the Use of Gentian Violet Staining

In recent years, endothelial keratoplasty has been commonly used as an alternative to penetrating keratoplasty as a surgical treatment for corneal endothelial pathologies. The most common form of endothelial keratoplasty is Descemet membrane stripping automated endothelial keratoplasty (DSAEK), which involves stripping the host’s Descemet membrane and endothelium and replacing them with donor posterior stroma and endothelium. To delineate the orientation of donor DSAEK tissue, it is often marked by gentian violet (GV) dye on its stromal side.1

Gentian violet has long been thought to be nontoxic. However, using a standard rabbit eye irritation test, Ballantyne et al2 found that GV produced blepharitis, edema, and necrosis of the conjunctivae and nictitating membrane, keratitis, and elevation of intraocular pressure. Two subsequent studies3,4 discovered an increased incidence of corneal edema following the injection of GV solutions into the anterior chamber of the human eye during cataract surgery. Chang et al5 later discovered cell damage to rabbit corneal endothelium after exposure to GV. Furthermore, a dose-response relationship was exhibited in the study by Chang et al.5 Most recently, using a vital dye assay on a human donor cornea, Ide et al6 demonstrated that marking the DSAEK donor stromal surface with a GV marking pen damaged the corneal endothelium.

These studies1-5 support the hypothesis that GV dye is toxic to the corneal endothelium. Currently, however, there is no evidence that the changes to the corneal endothelium caused by GV are clinically significant, but the potential long-term effects are still unknown. For this report of cases, we present 2 patients who underwent DSAEK with donor grafts marked with GV to demonstrate that GV may cause clinically significant edema.

The grafts, which are typically between 80 and 150 µm thick, were marked with an “S” on their stromal side using a metal stamp. First, ink from an Accu-Line P-2 skin marking pen was pooled onto the processing technician’s sterile glove. The ink was then transferred from the glove to the stamp. After waiting a few seconds for the ink to dry, we gently pressed the stamp against the stromal side of the graft. The eye bank that we use provides the “S” on the graft unless a surgeon specifically requests not to have it present. The mean (SD) volume of ink in the AccuLine P-2 skin marking pen is 1.4 (0.1) g, with 3% to 8% of this being GV dye by weight. The 2 cases were from different batches of GV markers.

Report of Cases. Case 1. A 50-year-old man with Fuchs endothelial dystrophy presented to us with blurry vision in the left eye. On examination, it was found that his best-corrected visual acuity was 20/30 in the right eye and 20/50 in the left eye. There was 2/1100 cornea edema and 3/1100 endothelial guttata observed in the left eye. There were clear crystalline lenses noted in both eyes. An uneventful DSAEK was performed on the left eye using a 60-µm thick endothelial graft.

On postoperative day 1, the patient was noted to have 20/100 in the left eye and a well-attached graft. The cornea was diffusely edematous, and the GV marking of the “S” was prominent on the stroma of the graft.

Figure 1. A 50-year-old man with Fuchs endothelial dystrophy (case 1) 1 week after undergoing Descemet membrane stripping automated endothelial keratoplasty of the left eye. There is focal bulla noted clinically in the area of gentian violet markings with surrounding microcystic edema (A). A slit beam demonstrates the focal edema (B).
Case 2. A 67-year-old woman with a history of Fuchs endothelial dystrophy presented with gradual onset of blurry vision of the right eye. On examination, it was found that her best-corrected visual acuity was 20/60 in the right eye and 20/30 in the left eye. There was 3+ guttata with 1+ edema of the right eye. There was a well-centered posterior chamber intraocular lens on the right. His left eye had 1+ guttata and a 1+ nuclear sclerotic cataract. An uneventful DSAEK was performed (thickness of graft unknown).

On postoperative day 1, the graft was fully attached, there was 2+ diffuse corneal edema present, and her visual acuity was 3/200. The edema was most prominent in the area of the purple markings (Figure 2). At postoperative week 1, the patient’s visual acuity was unchanged. Interface haze was noted at the area of the markings. At the 2-week postoperative visit, her visual acuity was 20/400, and her best-corrected visual acuity was 20/80. No change occurred 1 month after surgery. At postoperative week 6, the patient had a best-corrected visual acuity of 20/40 with a clear cornea.

**Comment.** Using a rabbit model, Chang et al. illustrated that endothelial cells are destroyed via the effects of the dye. We presume that the eventual improvement of the edema over time with gradual visual rehabilitation results from the compensatory measures of the surrounding unaffected cells. Current best practice dictates that a surgeon preserve as many endothelial cells as possible during DSAEK. Given the novelty of DSAEK, we do not know the natural history of a DSAEK graft in terms of longevity. However, if one applies the same logic as that used for a penetrating keratoplasty, the reasonable conclusion is to presume that more endothelial cells will result in a better chance for long-term graft survival. The findings behind this case report are limited given the sample size. However, given the data in the previously reported studies, in conjunction with our clinical observations, we recommend that the use of GV (including the dose and duration of exposure) on donor grafts be limited as much as possible because of concern over irreversible damage to the corneal endothelium.

**Figure 2.** A 67-year-old woman with a history of Fuchs endothelial dystrophy (case 2) 1 day after undergoing Descemet membrane stripping automated endothelial keratoplasty of the right eye. There is 2+ diffuse corneal edema present (A). The edema is most prominent in the area of the gentian violet markings (B).

**Lagophthalmos in Severe Anorexia Nervosa: A Case Series**

Anorexia nervosa is characterized in the Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) by (1) a refusal to maintain a minimally normal body weight (eg, a body weight of ≪85% of expected body weight or a body mass index (BMI); calculated as weight in kilo-

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**Financial Disclosure:** None reported.