

# Chandelier retroillumination–assisted torsional oscillation for cataract surgery in patients with severe corneal opacity

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We describe a technique that uses 25-gauge transconjunctival chandelier endoillumination in combination with a torsional oscillation system for cataract surgery in cases with severe bullous keratopathy. Because of the hands-free and self-retaining nature of the chandelier fiber, continuous curvilinear capsulorhexis and subsequent bimanual intraocular manipulation can be performed easily. Torsional oscillation efficiently emulsifies lens particles along with the fluidics, preventing posterior capsule rupture and endothelial cell damage. After the chandelier fiber is removed at the end of surgery, the 25-gauge incision self-seals. This technique is safe and provides excellent visualization during cataract surgery in patients with severe corneal opacities.

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 Online Video

Cataract complicated by corneal haze presents a challenging situation for crystalline lens removal and intraocular lens (IOL) implantation. In most patients, especially those with bullous keratopathy, penetrating keratoplasty (PKP) followed by cataract surgery or PKP combined with cataract surgery has been the surgical treatment of choice.<sup>1,2</sup> The recent introduction of Descemet's stripping endothelial keratoplasty (DSEK) has resulted in better surgical results than PKP in the treatment of bullous keratopathy.<sup>3,4</sup>

The surgical manipulations of DSEK are easier and safer in a pseudophakic eye with a deepened anterior chamber than in a phakic eye.<sup>5</sup> In eyes with bullous

keratopathy and cataract, cataract surgery with IOL implantation is recommended before DSEK, especially in eyes with a shallow anterior chamber.<sup>5</sup> If the IOL–iris diaphragm is intact after cataract surgery, DSEK can be performed with good results because of easy manipulation in the deepened anterior chamber.

In cataract surgery through a hazy cornea, capsulorhexis and phacoemulsification are difficult because of poor visibility of the crystalline lens and anterior capsule.<sup>6</sup> To overcome this difficulty in eyes with bullous keratopathy, a transconjunctival chandelier illumination system for a wide-angle view during vitreous surgery<sup>7</sup> was used in combination with torsional oscillation. In this article, we describe the safety and feasibility of this technique for cataract surgery in patients with severe corneal haze.

## SURGICAL TECHNIQUE

After topical and retrobulbar anesthesia are induced with lidocaine 2% and the conjunctiva is disinfected using povidone–iodine solution, a 25-gauge or 27-gauge chandelier illumination fiber (Synergetics, Inc.) (Figure 1) is inserted into the vitreous cavity transconjunctivally through the pars plana (Figure 2, A).<sup>7</sup> In combination with a xenon or mercury vapor light source (Synergetics, Inc.), the light fiber provides sufficient endoillumination.<sup>7,8</sup> Because the chandelier light fiber is self-retaining, the surgeon can perform cataract surgery bimanually. Retroillumination from the

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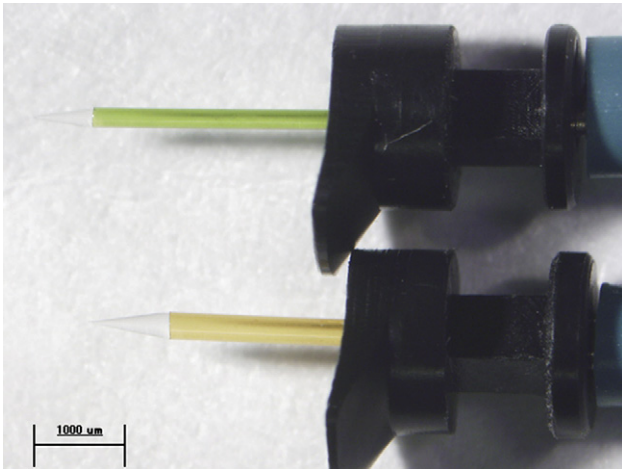
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**Figure 1.** The 27-gauge (top) and 25-gauge (bottom) chandelier endoilluminator. The tip of the light fiber is cone-shaped for wide-angle illumination. A polyamide sleeve covers the microfiber to prevent scleral damage from thermal burns; a black footplate keeps the chandelier in contact with the eye to retain the position in the eye.

posterior side by chandelier endoillumination provides excellent visibility of the entire lens, making it possible to perform capsulorhexis with a capsule forceps after staining the capsule with trypan blue (Figure 2, B).

The lens nucleus can be observed clearly and chopped using a phaco tip and chopper bimanually, as usually done in cataract surgery (Figure 2, C). Under stable, diffuse chandelier retroillumination, lens particles can be observed clearly. Phacoemulsification performed with the torsional oscillation system (Alcon Laboratories) can be safely and effectively performed by grasping the nuclear cortex and emulsifying the lens particles without particle rebound.<sup>9</sup> The lens particles are smoothly aspirated into the phaco tip along with the fluidics.

Irrigation and aspiration to remove the residual cortex are also performed under retroillumination. The residual cortex is clearly visible under chandelier illumination without obstruction by the hazy cornea (Figure 2, D). Minimal movement of the tip is sufficient to grasp the residual cortex, preventing posterior capsule rupture and endothelial cell damage.

Insertion of a foldable acrylic IOL through a 2.2 mm clear corneal microincision using an injector and cartridge is safely accomplished under retroillumination. Chandelier retroillumination provides excellent intracapsular visibility during IOL insertion. Repositioning the IOL haptics using a Sinsky hook can be viewed clearly and controlled using chandelier illumination

only (Figure 2, E). At the end of surgery, the surgeon simply removes the tip of the chandelier fiber from the pars plana. The scleral wound easily self-seals without the need for suture placement, as previously reported.<sup>7,8</sup>

## DISCUSSION

Cataract surgery under conventional microscopic illumination is challenging in eyes with corneal opacities because of poor visibility of the lens and anterior capsule. To enhance visibility, anterior capsule staining with indocyanine green or trypan blue may be helpful for the capsulorhexis but is insufficient for completing the subsequent surgical procedures.<sup>10,11</sup> The anterior chamber illumination technique using a light pipe has been reported to be helpful in cases with mild or moderate corneal haze.<sup>6</sup> However, spotlight illumination from a small light pipe is insufficient to clearly visualize the anterior and posterior chambers in eyes with severe bullous keratopathy. The need to hold the light pipe makes it difficult for the surgeon to perform bimanual manipulations in complex cases.

We have overcome these challenges using transconjunctival chandelier retroillumination and torsional oscillation emulsification for cataract removal and IOL implantation. In eyes with corneal haze, this technique offers several advantages. Chandelier retroillumination provides sufficient intracapsular illumination and clear visibility through a hazy cornea. The self-retaining nature of the chandelier fiber enables bimanual manipulation during cataract surgery, and easy entry and removal of the chandelier fiber eliminates the need for suture placement. Although conventional phacoemulsification can be performed, torsional oscillation seems to be much safer in challenging cases. With minimal movement of the phaco tip, torsional oscillation efficiently emulsifies lens particles along with the fluidics, enhancing the level of safety and preventing posterior capsule rupture and endothelial cell damage.

Because this technique keeps the IOL-iris diaphragm intact after cataract surgery, DSEK for bullous keratopathy can be performed with favorable results (Figure 3). Cataract surgery and IOL implantation in eyes with bullous keratopathy may become a new indication for and a key step in subsequent DSEK surgery.

To our knowledge, this is the first description of transconjunctival chandelier illumination for complex cataract surgery. Self-retaining chandelier retroillumination-assisted torsional oscillation seems to be the best way to perform cataract surgery safely in patients with severe corneal opacity.

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