

Femtosecond Laser Assisted Cataract Surgery after Deep Lamellar Keratoplasty: Case Report

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Abstract

Purpose: To report 2 cases that underwent deep anterior lamellar keratoplasty (DALK) and developed visually significant cataract and subsequently underwent femtosecond laser assisted cataract surgery (FLACS).

Methods: Both patients underwent FLACS with implantation of toric intraocular lens (IOL) for correction of post-keratoplasty astigmatism. Capsulorrhexis was performed with the femtosecond laser; the nucleus was fragmented and aspirated. Three corneal incisions were performed with the femtosecond laser. In the second case, the angle of the side ports was changed to create a more vertical incision.

Results: The preoperative endothelial cell count (ECC) was 1943 and 2446 cells/mm³ for the 1st and 2nd cases respectively and, 1860 and 2356 cell/mm³ for the 1st and 2nd cases postoperatively. At 6 months postoperatively, uncorrected distance visual acuity was 20/30 and 20/20 for the 1st and 2nd cases respectively.

Conclusion: Femtolaser treatment of the crystalline lens may increase safety of the surgery in patients underwent deep anterior lamellar keratoplasty (DALK).

Keywords: Femtosecond laser assisted cataract surgery; Deep lamellar keratoplasty

Introduction

Phacoemulsification during cataract surgery in eyes that have undergone previous keratoplasty may cause significant endothelial injury and affect long-term graft survival [1]. Within the last 3 years, femtosecond lasers have been used in cataract surgery for performing capsulotomies, lens fragmentation, and corneal incisions [2]. The advantage of femtosecond lasers for cataract surgery include better incisions, more regular and predictable capsulotomies, along with a decrease in ultrasound power used for nuclear fragmentation. To date, however, there is no proof that these technical advances translate into improved visual and refractive outcomes.

To our knowledge, there are no reports of femtosecond laser assisted cataract surgery (FLACS) after deep anterior lamellar keratoplasty (DALK) for keratoconus. We present two cases reports of two patients who with a history of DALK, who developed cataracts and underwent FLACS with a LenSx (Alcon LenSx Inc., Aliso Viejo, CA, USA) laser with implantation of a toric IOL to correct post-keratoplasty astigmatism.

Case 1

A 59-year-old male presented to the Magrabi Eye Hospital, Jeddah, Saudi Arabia complaining of painless, progressive blurring of vision in the right eye for the previous 4-5 months. He has history of DALK in the right eye for advanced keratoconus, 14 years prior to presentation. The left eye is also keratoconic that does not require surgery to date.

The patient's diabetes and hypertension were controlled with medications.

On examination, the uncorrected distance visual acuity (UDVA) was 20/200 in the right eye and count fingers in the left eye. Corrected distance visual acuity (CDVA) was 20/30 in the right eye with a manifest refraction of +3.75 -8.00 X 25° and 20/50 in the left eye with a manifest refraction of plano -7.00 X 130°. The cornea in the right eye had a central, clear and compacted lamellar graft with sutures out. Slit lamp examination of the left eye indicated a thinning cornea without stromal scarring, +2 nuclear sclerosis with a +1 posterior subcapsular cataract. Cataracts were graded using the Lens Opacities Classification System III. Preoperative corneal topography and wavefront aberrometry with the OPD Scan III (NIDEK Co Ltd, Gamagori, Japan) showed regular symmetric astigmatism in the right eye (Figure 1). Endothelial cell count on specular microscopy (CEM 530; NIDEK Co Ltd., Gamagori, Japan) was 1943 cells/mm³. Corneal pachymetry measured with the Pentacam HR (Oculus Optikgerate GmbH, Wetzlar, Germany) was 550 µm preoperatively.

A FLACS procedure was planned with toric intraocular lens implantation (TIOL) to address the post-keratoplasty astigmatism. Data were entered in the AcrySof® IQ Toric IOL Online Calculator (<http://www.acrysoftoriccalculator.com/>) to determine the IOL power and axis of implantation. The online IOL calculator suggested an AcrySof® IQ TIOL SN6AT9 with an IOL spherical equivalent of 18.0 D and 6.00 D of cylinder at the IOL plane for 4.11 D at the corneal plane placed at 116°. The preoperative corneal astigmatism was 7.72 D X 116° and the anticipated residual astigmatism was 3.11 D X 116° postoperatively.

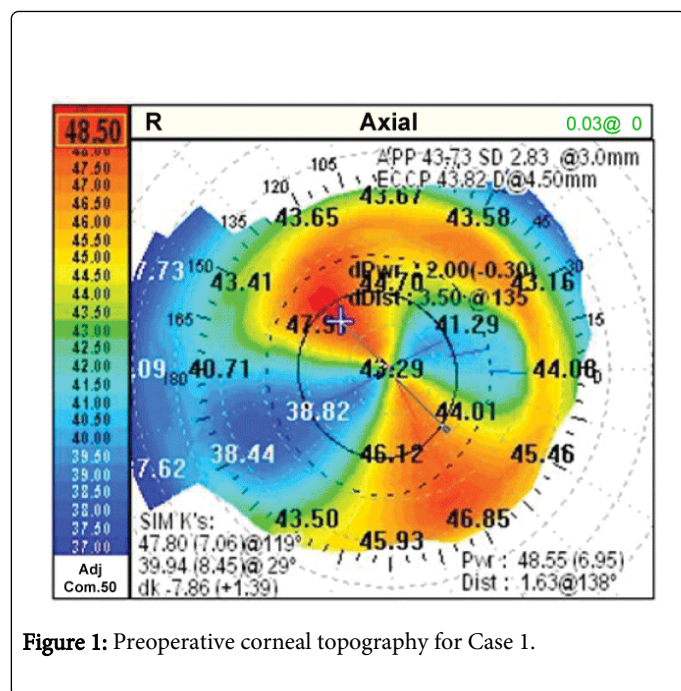


Figure 1: Preoperative corneal topography for Case 1.

Femtosecond laser-assisted cataract surgery (Alcon LenSx Inc., Aliso Viejo, CA, USA) was performed. The corneal scar was peripheral to the planned capsulotomy. Centration was assessed using the pupillary edge. A 4.8-mm capsulorrhexis was performed with the femtosecond laser and the nucleus was fragmented. Three corneal incisions were created with the femtosecond laser (a 2.8 -mm two-plane main incision and two 1.0 mm single-plane side-port incisions). Intraoperatively, changes consistent with surgical emphysema occurred at the side ports at the host-donor junctions (Figure 2). The nuclear material was aspirated and a toric intraocular lens was (TIOL) was implanted. There were no intraoperative complications.

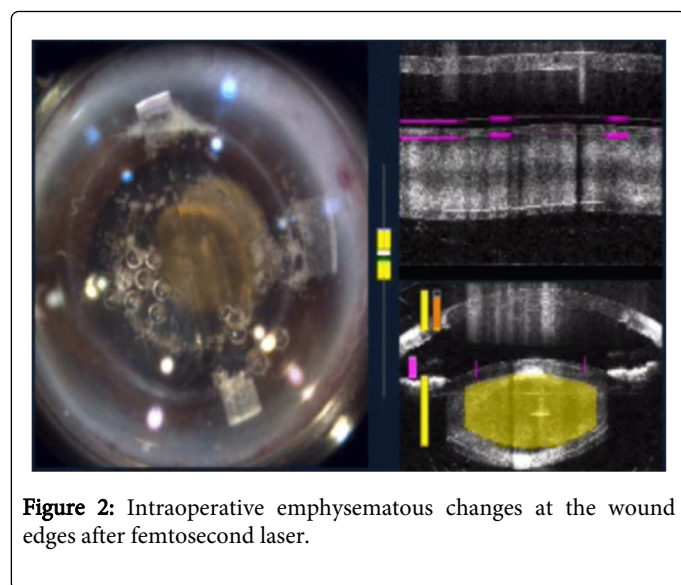


Figure 2: Intraoperative emphysematous changes at the wound edges after femtosecond laser.

At 1 day postoperatively, UDVA was 20/40 due to slight corneal edema and improved to 20/30 over the following 3 months. CDVA was 20/20 with a manifest refraction of +1.50 D sphere and -4.50 D cylinder that remained stable out to 1-year postoperatively. At 6

months postoperatively, the corneal pachymetry was 542 μm and the endothelial cell count was 1860 cells/ mm^3 .

Case 2

A 27-year-old male presented to the cornea unit of the Magrabi Eye Hospital for 9 months follow up after DALK for the right eye with posterior subcapsular cataracts. On examination the UDVA was 20/60, which did not improve with a manifest refraction of -1.00 -4.00 X 135°. OPD Scan III corneal topography was done. Endothelial cell counts with specular microscopy were 2446 cells/ mm^3 . The sutures were removed at 1 year post-DALK and the FLACS procedure was planned for 3 months after suture removal.

Data were entered in the AcrySof® IQ Toric IOL Online Calculator (<http://www.acrysoftoriccalculator.com/>). The IOL calculation suggested an AcrySof® IQ TIOL SN6AT9 with IOL spherical equivalent of 16.5 D and 6.00 D cylinder power (IOL Plane) for 4.11 D at the corneal plane placed at 68°. As the preoperative corneal astigmatism was 5.76 D X 68° and the planned residual astigmatism was 1.15 D X 68° postoperatively.

FLACS with the LenSx using the same parameter as Case 1 was performed with one change - the angle of the side ports was changed from 70° to 30°. The change in the angle allowed a more vertical port making the inner end distant from the graft junction. The nuclear material was aspirated and a TIOL was implanted. The entire surgical procedure was uneventful.

UDVA at 1 day postoperatively, was 20/28, 20/20 at 1 week and 20/20 at 1 month. CDVA was 20/20 at 3 and 6 months postoperatively with a manifest refraction of 0.00 -1.00 X 20°. Corneal topography remained stable. The endothelial cell count was 2356 cells/ mm^3 and corneal pachymetry was 564 μm at 6 months postoperatively.

Discussion

In the case report, we present the first 2 patients who underwent successful FLACS after DALK surgery. FLACS offers minimal tissue damage and extreme precision during corneal incision creation, continuous circular capsulorrhexis (CCC) and nuclear fragmentation. It also allows diminishing the mean average ultrasound power to emulsify the nucleus followed by a coaxial or a biaxial procedure [3]. Masket et al. demonstrate, albeit in cadaver eyes, that femtosecond lasers are able to construct reproducible and stable incisions [2]. This is attributable to the controlled and more reproducible generation of squarer incisions and the multiplanar configuration of the corneal wound created. Three corneal incisions were created with the femtosecond and intraoperatively, changes consistent with surgical emphysema occurred at the side ports at the host-donor junctions in the 1st case, so we changed the angle of the side ports from 70° to 30° to allow a more vertical port making the inner end distant from the graft junction in the second case.

Nagy et al. reported that the use of a femtosecond laser may minimize the ultrasound energy required to remove the nucleus, thereby preserving endothelial cells in post-transplant corneas [4]. In our cases, there was no change in the central corneal thickness and no significant loss of ECC after surgeries. A literature review on DALK by the American Academy of Ophthalmology (AAO) reported that endothelial cell density stabilized within 6 months postoperatively, and eyes that have undergone penetrating keratoplasty have significantly greater endothelial cell loss compared to eyes that have undergone

previous DALK or no surgery with the latter two groups showing similar changes [5,6].

Filkorn et al. showed that FLACS resulted in significantly better predictability of IOL power calculations than conventional phacoemulsification surgery. This difference may be due to the greater precise of the capsulorrhexis, resulting in a more stable IOL position [7]. We implanted TIOLs in both patients although the risk of implanting high power TIOLs in young patients with corneal transplant and successfully achieved the targeted residual astigmatism. For example in Case 1, the planned residual astigmatism was 3.11 D X 116° and we achieved -4.50 D astigmatism. In the second Case the planned residual astigmatism was 1.15 D X 68° and we achieved -1.00 D. Additionally refraction has remained stable in both cases to date.

In summary, we reported 2 cases that underwent FLACS for visually significant cataract after DALK surgery for keratoconus. FLACS can offer extreme precision during corneal incision creation and continuous circular capsulorrhexis (CCC) which may enhance the safety in cataract surgery after DALK surgery. Additional research with a longer follow-up and comparative randomized trials are needed to determine whether over the long term nucleus fragmentation can obviate the need for ultrasound energy and can preserved endothelial cell density.

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