

# Surgical Outcomes of Non Descemet's Stripping Endothelial Keratoplasty: Analysis of 100 Consecutive Cases

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**Abstract:** ***Purpose:** To analyze the surgical outcome of Non-Descemet's stripping endothelial keratoplasty (DSEK) in 100 consecutive cases performed by a single surgeon at tertiary eye hospital. **Study design:** A prospective, non randomized, non-comparative surgical case series. **Methods:** A prospective, non randomized, non-comparative surgical case series in which first consecutive 100 patients (age  $\geq 18$  years and BCVA  $\leq 20/400$ ) with endothelial dysfunction underwent non stripping descemet's membrane endothelial keratoplasty (Non-DSEK). The patients were followed up for a period of 1 year at regular intervals. The best corrected visual acuity (BCVA), refractive and keratometric astigmatism, endothelial cell density, graft rejections and failure, dislocation of graft and other complication like secondary glaucoma were evaluated for 1 year after surgery. **Results:** Hundred eyes of hundred consecutive patients included in this study were analyzed. There were 54 males and 46 females with a mean age of  $58.69 \pm 10.2$  years (range: 18 to 82 years). Indications of the surgery were pseudophakic bullous keratopathy (70 eyes; 70%), Fuch's dystrophy (14 eyes; 14%), aphakic bullous keratopathy (5 eyes; 5%). After three months, 78% ( $n=78/100$ ) patients recovered from corneal endothelial dysfunction and regained 20/60 or better vision with best available refractive correction. At three months follow up, mean endothelial cell density was  $1554 \pm 160$  cells/mm<sup>2</sup> with mean endothelial cell loss was  $33 \pm 4$  %. Graft dislocation in 12 eyes which were managed by rebubbling. However, Graft rejection was seen in 4 eyes (4%). **Conclusions:** Non DSEK provides rapid visual recovery and it is a safe and effective technique to restore corneal endothelial dysfunction.*

**Keywords:** Descemet's membrane stripping endothelial keratoplasty; Endothelial dysfunction; Descemet scoring; Bullous keratopathy; Hyperopic shift

## 1. Introduction

Endothelial dysfunction has been the leading cause for corneal transplantation after cataract surgery. The only solution for this dysfunction over the last 100 years has been Penetrating Keratoplasty<sup>1</sup>. Penetrating Keratoplasty (PK) had been considered the gold standard for treating corneal endothelial dysfunction but delayed rehabilitation, prolonged visual recovery time, and astigmatism limits the role of this 19<sup>th</sup> century surgical technique. Suture-related problems, risk of graft rejection, infection, steroids associated secondary glaucoma and long term follow-up further attenuates its effectiveness.

Last two decades has witnessed the evolution of endothelial keratoplasty from manual to femto assisted donor lenticule preparation. In 1998, Melles and co-workers<sup>2</sup> first described a new technique of component keratoplasty and called it 'posterior lamellar keratoplasty' or PLK. Terry and Ouslay<sup>3</sup> performed a series of newly designed similar posterior lamellar transplantation surgery with technical modifications and termed them as 'Deep Lamellar Endothelial Keratoplasty' or DLEK in 2000. All these efforts in different parts of world brought a radical change from the conventional PK technique to endothelial replacement without manipulating most of the recipient's corneal tissue.

Francis W. Price<sup>4</sup> further modified and simplified the technique in preparation of the recipient's bed by stripping off the recipient descemet membrane, now popularly called 'Descemet stripping endothelial keratoplasty' or DSEK. The technique is not only easy for the surgeon to perform as

compared to DLEK, but it also provides of a smoother interface between host and recipient.

DSEK offers faster visual recovery, better visual quality attributed to minimal astigmatism. but it has higher rate of primary graft failure, longer operating time (45- 60 min) and a steep learning curve.<sup>7,8</sup> However we hypothesised that Non-Descemet membrane stripping endothelial keratoplasty not only reduce the time duration of surgery but also blunt the learning curve of surgery.

The purpose of the present study was to evaluate and report the visual and surgical outcomes of Non DSEK in 100 consecutive cases of endothelial dysfunction due to various aetiologies.

## 2. Material and Methods

It was a prospective, non-randomized, non-comparative surgical case series. The approval was taken from institutional review board and ethics committee of SMS medical college, Jaipur, India. The study was conducted in accordance with the tenets of the Declaration of Helsinki, and informed consent was obtained from each participant. The first 100 consecutive patients (Age  $\geq 18$  years with BCVA  $\leq 20/400$ ) with endothelial dysfunction who were enlisted for corneal grafting in our central register were included for Non DSEK. Patients with dense central corneal stromal scarring, irregular and deformed anterior chamber (AC), gross peripheral anterior synechia (PAS), uncontrolled glaucoma, and gross posterior segment pathology detected by B-scan were excluded from the study.

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The donor prerequisites were healthy young donor tissue preferably below 60 years of age, and endothelial count >2200 cells/ sq mm as determined by specular microscope with scleral rim of 2 mm all around. All 100 surgeries were performed by a single surgeon from January 2014 to June 2016. The surgery was performed under conventional peribulbar anaesthesia. Pupillary dilation was required only in cases where it was combined with cataract extraction with posterior chamber intraocular lens (PCIOL) implantation or scleral fixated IOL.

### **Surgical technique**

The donor cornea with its scleral rim was mounted on a disposable artificial Anterior Chamber (Katena Products, Inc., NJ, USA). The central point and 8.0 to 9.0 mm trephination site were marked with gentian violet. Initial 5 mm corneal incision was first made at the limbus with 450-micron Guarded knife. Manual lamellar dissection was then carried out at approximately two-thirds depth with a crescent blade and by straight and curved dissectors by close method. After complete lamellar dissection of whole cornea, the donor tissue was transferred on a Teflon block with endothelial side up, and trephined by 8 /8.5/ 9 mm trephines.

Recipient bed preparation: A circular template mark (with a diameter of 8.0 mm) with gentian violet was made on the corneal epithelial surface which served as a reference mark for Descemet stripping. In some cases, loose edematous and hypertrophied epithelium was removed before marking. After making a conjunctival flap and applying wet field cautery, a 6 to 6.5-mm sclero-corneal tunnel was prepared in supero – temporal quadrant.

Patients, who underwent a combined procedure (DSEK and cataract extraction with PCIOL or SFIOL), the IOL (Intraocular lens) power was calculated from the biometry of the same or the other eye and was aimed 0.5 D myopia.

The posterior lamellar donor lenticule was then transferred on the recipient's corneal surface with the endothelial side up. The Disc was then glided inside the AC with help of a bent 26G needle and the anterior chamber was filled half air below the graft . After proper centration is achieved, AC is completely filled with air and venting procedure was done at this point. After about 10 mins time some air is evacuated so as to relieve pressure.

The patients were discharged after 24 to 48 h. Postoperatively, the patients received topical Prednisolone 1% eight times, moxifloxacin four time a day, timolol maleate (0.5%) twice, homatropine twice daily and topical lubricant qid for the first 2 weeks.

The patients were followed up at third day, first week, first month, third month and twelfth month after surgery and uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), refractive and keratometric astigmatism were documented. Endothelial cell density was calculated using specular microscopy at regular follow ups.

### **3. Results**

In our series, non- DSEK was performed on hundred eyes of hundred consecutive patients. Amongst which, 54 were males and 46 were females with a mean age of  $58.69 \pm 10.2$  years (range: 18 to 82 years). Indications of the surgery were Pseudophakic bullous keratopathy (70 eyes; 70%), Fuch's dystrophy (14 eyes; 14%), aphakic bullous keratopathy (8 eyes; 8%), failed penetrating keratoplasty (8 eyes; 8%) and others. (Table 1)

#### **Functional outcomes**

The mean visual acuity was 20/800 preoperatively which improved to 20/80 with best available refractive correction at third month follow up. 78% of the eyes (n=78/100) recovered from endothelial dysfunction and regained 20/60 vision at six months follow up. At one year follow up, 70% (n=70/100 ) of the eyes retain the visual acuity of 20/60 (Table: 2). Induced hyperopia ranges from 1D to 2D with mean hyperopia of 1.5 D which was attributed to non uniform thickness of donor lenticule. The average astigmatism in our study was 1.5 D (Range: 0.75D-2D) .

#### **Intra Operative Complications**

There was no problem during donor button preparation in the artificial AC except the mild variation in the depth of dissection. The unfolding of the donor lenticule was difficult in few cases, but there was no occurrence of reverse unfolding (endothelial-side up against the recipient's stroma).

#### **Postoperative Complications**

##### **Endothelial cell density**

In our study, mean donor endothelial cell count was  $2354 \pm 250$  (Range: 2200-2800 cell/mm<sup>2</sup>) preoperatively which was reduced to  $1554 \pm 166$  (Range: 1350 – 2238 ) cells mm<sup>2</sup> and  $1007 \pm 141$  (Range: 1012- 1350) at 3 months and 1 year follow up respectively. Endothelial cell loss was  $31 \pm 4\%$  (Range: 15.4- 40.3%) at 3 months,  $40 \pm 4\%$  at 6 months and  $43.5 \pm 4\%$  at 1 year follow up.[Table 2]

Graft dislocation was seen in 12 % of the eyes (n=12) with highest incidence in first post operative month which was resolved using air re-injection.

Signs of graft rejection were seen in 6 eyes which were managed by pulse, oral and topical steroids however 2 of the eyes (n=2/100 eyes) progressed to graft failure. 4 % of the eyes (n=4/100 eyes) underwent graft failure due to progressive endothelial cell loss at the end of 1 year. [Table 3]

##### **Co-morbid Conditions:**

Co-morbid conditions were seen in 3% (n=3/100) eyes, detected after the surgery, like advanced glaucomatous cupping in two cases and advanced age related macular degeneration (ARMD) in one case.

### **4. Discussion**

Descemet stripping endothelial keratoplasty represents the most preferred type of posterior lamellar keratoplasty in recent times. It allows selective replacement of diseased host endothelium with a suitable and healthy donor posterior la-

mella. However, stripping the DM entirely can be trouble some even in the experienced hands especially in oedematous corneas. Furthermore, retained descemet fragments may result in incomplete donor graft coverage which may result topical edema in the recipients after EK. In contrast, the non-DSEK, which does not require the removal of the DM, is effective in simplifying the procedure, shortening the surgical period, reducing inflammatory reactions and also reduces the probability of falling of descemet fragments in vitreous cavity in cases of aphakic bullous keratopathy.

Pseudophakic bullous keratopathy is the major cause of corneal decompensation in our study which accounts for 70% (n=70/100) of the cases which followed by Fuch's dystrophy contributing 14%(n=14/100) of the cases. In our study, hard cataract, advance age, complicated cataract surgery, and delayed consultation were the major contributing factors in development of Pseudophakic and aphakic bullous keratopathy

The study shows that functional outcomes like best corrected visual acuity (BCVA), induced hyperopia and astigmatism were comparable with the results of DSEK from previous studies.[6,7,8,9,10]

Masaki *et al* [4] reported that non-DSEK did not influence the attachment of donor grafts and the recovery of visual acuity when the DM is non-pathological. The results of postoperative visual acuity in our study indicated that the remnant DM did not interfere with the recovery of visual acuity.

In our study, the Endothelial cell loss was 31 +/-4% (Range: 15.4- 40.3%) at 3 months, 40 +/-4 % at 6 months and 43.5% +/-4 % at 1 year follow up, comparable to previous studies which have reported mean endothelial cell loss of 14.9% to 59% in DSEK with follow up from 6 months to 3 years.[11,12,13]. Postoperatively, donor dislocation occurred in 12 cases (12.0%) within 72 h after surgery and all of them were successfully reattached by re-bubbling immediately on diagnosis. Dislocation and re-bubbling rate was significantly decreased in later half of series when proper 3 to 4 venting incision was introduced and interface substance was evacuated thoroughly. Other minor postoperative complications were similarly comparable with other reports[5] and settled easily. Price et al reported a graft rejection rate of 7.6 % at 1 year follow up in DSAEK. However, Zhang et al[3] has shown that non-DSEK has low graft rejection rate as compared to DSAEK which was further confirmed by our study. In our study, graft rejection occurred in 6% of the eyes which were managed with steroids however 2 eyes progressed to graft failure. Graft failure due to progressive loss of endothelial cells was seen in 4 percent of the patient at the end of 1 year. The incidence of graft rejection and graft failure due to progressive endothelial cell loss was seen more in more in patients of endotheliitis, aphakic bullous keratopathy (ABK) and failed keratoplasty.

In conclusion, Non-DSEK is a short surgical procedure that does not involve the removal of the DM. It provides rapid visual recovery with minimum astigmatism for the patients with endothelial dysfunctions and can be safely combined with cataract surgery or SFIOL (scleral fixated intraocular

lens). This modified EK technique (non-DSEK) for the treatment of endothelial dysfunction produced excellent clinical outcomes such as good visual acuity and low rejection rate. However the success rate of the surgery is low in complicated cases like ABK, endotheliitis, and failed keratoplasty.

Therefore, non-DSEK is a safe, effective and amenable alternative to restore corneal decompensation due to endothelial dysfunction but should be performed with caution in complicated cases.

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**LEGENDS**

Table-1: Showing Indications of DSEK.

Table-2: Functional outcomes and endothelial cell loss at 3, 6 and 12 months follow up.

Table-3: Complications after surgery during 1 year follow up.

**Table 1:** Demographic profile and Indications of the patient undergoing DSEK

Age (Years)( Mean and Range)	58.69 (18 to 82)
Male : Female -	54/46 (55% M)
Pre-op BCVA	HMCF to 20/800
<b>Indications:</b>	
PBK	70(70%)
PCIOL	62(62%)
ACIOL	8(8%)
FUCH' s Dystrophy	14(14%)
Failed PK	3 (3%)
Failed DSEK	5(5%)
Post-Endothelitis Dysfunction (Phakic)	3(3.33%)
ABK	5(6.22%)

**Table 2:** Functional outcome: Postoperative results after 3, 6 and 12 months

	3 months	6 months	12 months
Mean BCVA	20/80	20/60	20/60
ECD (Cells/mm <sup>2</sup> )	1554+/-166	1320 +/- 145	1007+/- 141
ECL (%)	31%	40%	43.50%
Mean CCT	696+/-38	647+/-33	637+/-32
Hyperopic shift	1.5 D	1.5D	1.5 D

**Table 3:** Complications after surgery within 1 year follow up

Complications	N(%)
Pupillary Block	Nil
Partial Detachment/Decentration	4 (5%)
Donor dislocation	12(15%)
Delayed Graft failure	4(4%)
Graft Rejection	6 (6%)
Co-morbid ocular condition	3(3 %)