Descemet stripping automated endothelial keratoplasty

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Endothelial keratoplasty has evolved significantly in the past few decades. It has now become the surgery of choice for endothelial failure without stromal scarring. At its inception, endothelial keratoplasty was performed from the anterior route, and now, the approach is gradually shifted toward the posterior route. The first case of posterior lamellar keratoplasty (PLK) was performed by Tillett in 1956 using manual lamellar dissection of posterior recipient stroma and attachment of donor lenticule with sutures and air tamponade.[1] Melles et al were first to describe endothelial keratoplasty through the posterior approach, and this technique was known as PLK.[2] A 9 mm scleral tunnel was made to dissect posterior stroma, descemet membrane (DM), and endothelium and same-sized posterior donor lenticule were implanted with air tamponade without suture fixation.[3] PLK was introduced in the United States by Terry and Ousley, who called it as deep lamellar endothelial keratoplasty (DLEK).[4] Later, Melles et al described technique, in which the dissection of diseased DM (descemetorhesis) was done without dissecting posterior stroma and transplanting donor’s DM through 5 mm incision.[5] However, maintaining apposition of graft in anterior chamber (AC) was difficult with rolling of the graft. In 2005, Price and Price performed refined technique wherein the recipient’s DM was dissected using Melles' technique and donor tissue was manually dissected similar to PLK/DLEK technique and donor posterior lenticule with DM was folded 60/40 over fold and transplanted through 5-mm incision. The posterior graft was apposed using air tamponade without sutures.[7] This technique was known as descemet stripping endothelial keratoplasty (DSEK). As the technique involved manual dissection, obtaining uniformly thick and smooth surface of donor posterior stroma was surgically challenging. This issue was solved by Gorovoy, who modified DSEK technique using automated microkeratome to dissect donor lenticule, and this technique was popularized as descemet stripping automated endothelial keratoplasty (DSAEK).[8] As per Eye Bank Association of America, DSAEK is the most frequently utilized keratoplasty procedure in the United States.[9] This article reviews the current indications, surgical techniques, and outcomes of DSAEK with an aim to provide up-to-date information to the experienced as well as beginners of endothelial keratoplasty (EK).

Indications

Patients with endothelial dysfunction causing visual loss or visual disability in the form of glare and fluctuating vision affecting day-to-day activities such as reading, writing, or driving are suitable candidates for EK. The only absolute contraindication is significant corneal scarring and high irregular astigmatism. The diseases where DSAEK is indicated are summarized in Table 1.[7-12]

Surgical Technique

The surgery involves three principal steps, which includes donor preparation, recipient preparation, and donor lenticule

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Various techniques have been described in literature for these three major steps.

**Donor preparation**

The aim of the surgeon in donor preparation is to achieve the thinnest lenticule possible. All the methods described for donor cut employ the use of an artificial AC which the corneoscleral rim is mounted. The central corneal thickness (with the epithelium on) of the donor tissue is measured using an ultrasonic pachymeter. The donor tissue can be prepared in the following manner.

**Manual method**

Preset depth calibrated blades are used to make a vertical lamellar incision in the cornea at the desired depth. The dissection is then carried out at this depth to create an interface between the anterior and posterior layers of the cornea. This technique avoids the use of expensive equipment. However, uniformity of the dissection is difficult to reproduce, often leading to an irregular stromal bed and a reduced final visual acuity.

**Automated microkeratomes**

Donor lenticule is prepared using a microkeratome with the cutting head of 350 or 400 µm. Different types of microkeratomes are available in the market. The microkeratome head is either passed straight or in a rotational manner over the mounted cornea. The Moria Surgical (Antony, France) offers two types of blade attachments; one has a rotational and the other has a translational effect. Gebauer SLc Original and SLc Expert Microkeratomes offer to provide ultrathin lenticules (<100 µm) with a single-pass or double-pass technique.

**Single-pass technique**

Vajpayee et al. using a 400 µm microkeratome head slowed the speed of the pass to achieve a thinner donor lenticule without any complications during the donor preparation. A single, slow pass of 400 µm microkeratome yielded thin donor lenticules in all the cases, and the mean graft thickness achieved at the end of 6 months was 111 ± 17.62 µm (range 70–134 µm). Excellent visual outcomes were obtained in the majority of the patients.

**Double-pass technique**

In this technique, initial debulking cut is performed using a microkeratome with a 300-µm head. A second cut (refinement cut) is carried out from the direction opposite to the one of the first cut. The size of the head used for this step is selected such that a residual bed with a central thickness of approximately 100 µm is left. Intraoperative pachymetry or anterior segment optical coherence tomography helps in deciding the residual stromal thickness during the procedure.

The double-pass technique, in experienced hands and when successful, results in excellent outcome. However, it has some issues such as the potential higher risk of donor tissue perforation (microkeratome is passed twice), difficult manipulation of a thinner graft which may lead to increased endothelial loss, prolonged time for second cut, chances of second pass creating a smaller diameter cut, and unpredictability when donor thickness exceeds 600 µm.

**Precut tissue**

Tissue preparation is done either in advance by the operating surgeon or by an eye bank technician before surgery. This precut tissue is then shipped to surgeons when needed. This has the advantage of reducing the cost as well as the time of surgery. Moreover, in countries like India where every corneal surgeon does not have the microkeratome, it will be extremely useful.

**Femtosecond laser-assisted endothelial keratoplasty**

Femtosecond laser-assisted EK is another addition to the existing techniques ofEK donor lenticule preparation. In this technique, the donor cornea undergoes a lamellar cut from the epithelial side with the femtosecond laser at the desired depth. This may be followed by excimer laser photoablation of the stromal tissue to achieve a smooth surface. While femtosecond laser dissection yields a thin and reproducible endothelial graft cut with a high level of safety and accuracy, excimer photoablation provides a smooth, high-quality interface.

Few studies have shown disappointing results when the grafts have been cut from the epithelial side using femtosecond laser. This has been attributed to the attenuation of the laser beam in a swollen donor cornea and an uneven surface when planpated from the epithelial side. These can be alleviated by mounting the graft endothelial side up on the artificial AC (ZeimerPort, Switzerland) followed by creation of the lenticule with femtosecond laser cut by planpating the surface from the endothelial side. One of the major concerns with this technique is the endothelial cell loss attributed to direct planpation of the endothelial side. This can be minimized.
Outcomes of Descemet Stripping Automated Endothelial Keratoplasty

The outcomes and complications of DSAEK reported from various studies are summarized in the Table. Figs. 1 and 2 show the postoperative outcomes after DSAEK and ultrathin DSAEK, respectively. Fig. 3 shows intraoperative optical coherence tomography showing complete attachment of the donor lenticule.

Graft survival

Graft clarity

The reported long-term graft clarity of DSAEK reported in studies, including a large number of cases with follow-up ranging from 6 months to 3 years ranges from 90% to 99%. The published studies showed rates from 0% to 29%, with an average PGF rate of 1%.

Primary graft failure

Primary graft failure (PGF) is characterized by the clinical situation, in which a corneal graft does not clear as expected after surgery usually by 2 months. It can result mostly from poor quality donor tissue, unhealthy recipient circumstances (blood, interface foreign bodies, infection, and flat chamber), or poor surgical technique. The published studies showed rates from 0% to 29%, with an average PGF rate of 1%.

Late graft failure

Late endothelial failure is due to progressive endothelial cell loss. Analysis of the available studies suggests endothelial cell loss in the range of 25%–61% at 3-year follow-up. At 5 years follow-up, it has been reported to be around 51.9%.

Functional outcomes

Visual acuity

The greatest advantage of DSAEK over penetrating keratoplasty (PKP) is early and predictable visual recovery. The procedure is usually sutureless and the anterior corneal surface is not affected. Both these factors allow for rapid and better uncorrected as well as best-corrected visual acuity (BCVA).

Figure 1: (a) Postoperative photograph of a patient 1 month after descemet stripping automated endothelial keratoplasty with a clear graft. (b) The anterior segment optical coherence tomography shows a postoperative graft thickness of 165 µm at 1 month
Table 2: Outcomes and complications of descemet stripping automated endothelial keratoplasty

| Author          | Technique                  | Number of eyes | Follow-up | Indication                        | Final BCVA       | Graft rejection (number of eyes/%) | Graft failure (number of eyes/%) | Endothelial cell loss | Graft dislocation (number of eyes/%) | Complication                                      |
|-----------------|----------------------------|----------------|-----------|-----------------------------------|------------------|------------------------------------|----------------------------------|----------------------|--------------------------------------|-------------------------------------------------|
| Vajpayee et al. | Thin lenticule DSAEK       | 15             | 6 months  | PBK, FED, CHED, failed graft      | 0.109±0.11 logMAR| 1                                  | Nil                              | 26.33±1.34%           | Nil                                  | Interface fluid=1                                |
| Pedersen et al. | DSAEK                      | 78             | 4 years   | PBK, trauma, uveitis, other causes* | -                | 4                                  | 7                                | -                    | -                                    |                                                 |
| Nakatani et al. | DSAEK                      | 22             | 3 years   | ALI-BK                            | 0.15 logMAR      | 9.1                                | 1 eye                           | 46.5%                | Nil                                  | Posterior synechiae=31.8%                     |
| Ang et al.      | DSAEK Group 1 Group 2      | 100            | 3 years   | PBK, FED                         | -                | Group 1=2.1                        | Group 1=29.7±20.9%          | -                    | Group 2=38.5±24%                      |                                                 |
|                 | (endoglide) Group 2 (sheets glide) | 119           |           |                                   |                  | Group 2=13.5                       | Group 2=38.5±24%          | -                    | -                                    |                                                 |
| Nakagawa et al. | DSAEK with precut tissue  | 134            | 3 years   | ALI-BK, FED, glaucoma surgery, PBK, ABK, graft failure | 0.22±0.19 logMAR | 2.2                                | PGF=0.7                        | 51%                  | 8.9                                  | Pupillary block=2.2% infection=0.7%            |
| Tityal et al.   | DSAEK with internal air tamponade | 27             | 6 months  | -                                 | 6/18–6/9         | Nil                                | 18.19%                          | Nil                  | -                                    |                                                 |
| Sacthre et al.  | DSAEK                      | 40             | 6 months  | -                                 | -                | -                                  | -                               | 29.65%               | 7.5                                  | -                                               |
| Beltz et al.    | DSAEK                      | 12             | 4 years   | Buphthalmos                       | 0.74±0.66 logMAR | -                                  | Late=1                          | 40.5±8.9%            | 2 cases                             | Glaucoma progression=1                      |
| Price et al.    | DSAEK                      | 173            | 3 years   | FED                               | -                | 9                                  | Graft survival in FED 96, 86 in non-FED cases | 46% in FED, 59% in nonfuchs cases | -                                  | Unsatisfactory visual outcome in 1.7%               |
| Khor et al.     | DSAEK                      | 100            | 1 years   | FED, PBK                          | 20/40            | 2.6                                | PGF=1 eye                       | 14.9%                | 2 eyes                              | Glaucoma/ocular hypertension=34.1%           |
| Tery et al.     | DSAEK Group 1 Group 2      | 100            | -         | FED                               | -                | -                                  | Late failure=1 eye           | In Group 1=25% in Group 2=33% | 2 in Group 2 | -                                  |                                                 |

Contd...
Table 2: Contd...

| Author     | Technique | Number of eyes | Follow-up | Indication | Final BCVA | Graft rejection (number of eyes/%) | Graft failure (number of eyes/%) | Endothelial cell loss | Graft dislocation (number of eyes/%) | Complication |
|------------|-----------|----------------|-----------|------------|------------|-----------------------------------|---------------------------------|----------------------|-------------------------------------|--------------|
| Foster et al. [46] | DSAEK     | 175 (105 small incision forceps, 70 with injector) | 6 months  | BK, FED    | ≥20/4; 74% injector, 72% forceps | - | 1.4 - injector 6.5 - forceps 28.3 - injector 44.1% forceps | 5.7 - injector 27.6 - forceps | - | - |
| Wu et al. [46]       | DSAEK     | 353            | 3 years   | PBK, FED, intraocular surgery, ABK | - | 22 Late failure 8 cases | - | - | - | - |
| Jangi et al. [46]    | DSAEK     | 30             | 3 months  | Failed PK | Increased BCVA in 19 | 1 eye PGF=1 Late failure=4 | - | 16.7 Graft detachment=5 | - | - |
| Li et al. [47]       | DSAEK     | 108            | 3 years   | PBK, FED  | 20/25      | - | - | - | - | - |
| Phillips et al. [46] | DSAEK     | 100            | 6 months  | FED, PBK, failed PK, trauma, ICE | 20/29 | 1 Nil 16% | 2 | CME=2% PAS=1%, glaucoma 24% | - | - |
| Wendel et al. [46]   | DSAEK     | 179            | 1 year    | Phakic and pseudophakic corneal edema | Group 1=0.171±0.015 Group 2=0.253±0.039 | - | Group 1; PGF=3.5, late failure=1.4 Group 1; PGF=2.8 | Group 1=42.5±23% Group 2=51.4±26% | Group 1=19.6 Group 2=27.8 | - |
| Tsui et al. [50]     | DSAEK     | 10             | 1 years   | FED        | 20/24      | - | 1 eye | - | - | Cataract=40% Pupillary block=3 eyes |
| Clements et al. [51] | DSAEK     | 97             | 6 months  | Failed PK  | 0.55 logMAR | - | PGF=2 | - | Dislocation=31 | - |
| Khor et al. [54]     | DSAEK     | 25             | 1 year    | PBK, FED, PPCD, ALI-PBK | 12 eyes ≥20/40 | - | Nil 15.6% | Nil | PED - 1 eye, glaucoma=2 cases | - |
| Ratanasit et al. [52] | DSAEK     | 51             | 5 years   | PBK, ABK, FED, failed PKP | 20/20-20/40 in 75% 1 eye eyes | 1 eye | PGF=1 Late failure=3 | 51.4% | - | Epithelial down growth=3 case |
| Busin et al. [53]    | DSAEK     | 15             | 15.9 months | CHED       | 8 eyes ≥20/40 | - | - | 30% | 4 | - |
| Chen et al. [54]     | DSAEK     | 305            | 1 year    | Endothelial dysfunction | - | - | 27% | - | - |
| Esquenazis et al. [50] | DSAEK  | 25             | 2 years   | ACIOL      | - | Nil | 28±13% | 1 | - |
| Allen et al. [56]    | DSAEK     | 68             | 11.3±7.8 months | - | - | - | - | Increased IOP in=54% | - |

Contd...
| Author          | Technique | Number of eyes | Follow-up | Indication              | Final BCVA | Graft rejection (number of eyes/%) | Graft failure (number of eyes/%) | Endothelial cell loss | Graft dislocation (number of eyes/%) | Complication                                      |
|-----------------|-----------|----------------|-----------|-------------------------|------------|----------------------------------|---------------------------------|----------------------|-----------------------------------|---------------------------------------------------|
| Koeing et al[57]| DSAEK     | 6              | 9.1 months| FED, amantadine toxicity | 20/28      | Nil                              | Graft failure=2 (amantadine-induced) | -                    | -                                 | -                                                |
| Phillips et al[58]| DSAEK with previous glaucoma filtering surgeries | 28 | - | Endothelial dysfunction | - | - | PGF=0 | - | 3.6 | Decentered graft=3.6% |
| Price et al[59] | DSAEK (5 and 3.2 mm incision) | 167 | 1 year | FED | - | Group 1=8 Group 2=4 Group 1=98 Group 2=97 | Group 1=31±19% Group 2=44±22% | Group 1=3 Group 2=8 | Raised IOP Group 1=20%, Group 2=14% |
| Price et al[60] | DSAEK     | 173            | 1 year    | PBK, FED               | -          | 5                               | PGF=0, regraft rate 2.3        | -                    | 5.8 | - |
| Shih et al[61]  | DSAEK     | 126            | 2 years   | Endothelial dysfunction | - | 2                               | 12                              | -                    | 22.4 | Choroidal effusion=2, epithelial growth=2, endophthalmitis=1, papillary block=1 |
| Terry et al[62] | DSAEK     | DSAEK=315, DSAEK triple=149 | 1 year    | FED | 20/32 | - | PGF=0 | 32±15% | DSAEK=4 DSAEK triple=1.8 | Pupillary glaucoma=1 |
| Chen et al[63]  | DSAEK     | 42             | 6 months  | FED PBK Other          | 20/33      | 5.2                             | PGF=0 | 32% | 2.4 | No pupillary block |
| Chen et al[64]  | DSAEK     | 327            | 6 months  | FED PBK Other          | Group 1=20/37 Group 2=20/36 | - | - | PGF=0 | Group 1=32% Group 2=35% | In Group 1=2 In Group 2=1 No pupillary block |
| Terry et al[65] | DSAEK     | 350            | 1 year    | PBK, FED, other        | -          | -                               | PGF=0 | 36% | Dislocation=2.6 | - |
| Mehta et al[29] | DSAEK     | 10             | 7.5 months| PBK, FED               | 0.38 logMAR | - | Nil | 25.3% | Nil | - |
Table 2: Contd...  

| Author          | Technique                  | Number of eyes | Follow-up | Indication          | Final BCVA       | Graft rejection (number of eyes/%) | Graft failure (number of eyes/%) | Endothelial cell loss | Graft dislocation (number of eyes/%) | Complication                        |
|-----------------|----------------------------|----------------|-----------|---------------------|------------------|------------------------------------|-------------------------------|----------------------|--------------------------------------|-------------------------------------|
| Busin et al.    | DSAEK with glide technique | 10             | 2 years   | -                   | -                | -                                  | -                             | -                    | -                                    | -                                   |
| Sarnicola et al| DSAEK with suture          | 16             | 1 year    | PBK, FED           | ≥20/40 in 38%   | -                                  | -                             | 30%                  | 6.25                                | -                                   |
| Chen et al.     | DSAEK                      | 148            | 6 months  | -                   | 20/38 in 97%    | Group 1=38%, Group 2=26%           | -                             | -                    | -                                    | -                                   |
| Kaiserman et al | DSAEK (suture or forceps)  | 28             | 6 months  | PBK, FED, other    | Suture=0.30±0.14, forceps=0.25±0.16 logMAR | Suture=nil, forceps=5 | PGF=12.5, forceps=0 | Suture=39.4±21%, forceps=37.8±16.5% | Interface opacity; suture=12.5%, forceps=10% Glaucoma=15%, CME=5% | RD=4% CME=5% Pupillary block=2% SCH=1% Epithelial ingrowth=1% |
| Suh et al.      | DSAEK                      | 118            | -         | FED, PBK, ABK, DSAEK failure | -                | 6                                  | Graft failure=17 | PGF=6 eyes | 23                                   | RD=4% CME=5% Pupillary block=2% SCH=1% Epithelial ingrowth=1% |
| Van Cleyenbreugel et al | DSAEK                  | 12             | 6 months  | -                   | 20/42           | Mean count - 1614 cells/mm2       | 0                             | -                    | -                                    | -                                   |
| Hashemi et al   | DSAEK                      | 78             | 6 months  | PBK, ABK, FED, failed PKP/DSAEK, CHED | 0.77 logMAR     | 3.9                                | Graft failure=10.2 | 61%                  | 21.8                                | Raised IOP=11.5%, keratitis=2.6% |

*Other causes; ABK, ICE, and prior failed PK grafts. DSAEK: Descemet stripping automated endothelial keratoplasty, BCVA: Best-corrected visual acuity, FED: Fuchs endothelial dystrophy, PBK: Pseudophakic bullous keratopathy, ABK: Aphakic bullous keratopathy, CHED: Congenital hereditary endothelial dystrophy, ALI: Argon laser trabeculoplasty induced, logMAR: Logarithm of the minimum angle of resolution, PKP: Penetrating keratoplasty, BK: Bullous keratopathy, PGF: Primary graft failure, ICE: Iridocorneal endothelial syndrome, PAS: Peripheral anterior synechiae, PPCD: Posterior polymorphous corneal dystrophy, IOP: Intraocular pressure, AQOL: Anterior chamber intraocular lenses, PK: Penetrating Keratoplasty, RD: Retinal Detachment, SCH: Subconjunctival Hemorrhage, CME: Cystoid Macular Edema, PED: Persistent Epithelial Defect
Mean BCVA of 20/40 or better is achieved in more than 70% of cases.[51-54,73-75]

Hyperopia
The hyperopia induced ranges from 0.7 to 1.5 D with an average induced hyperopia of 1 D.[10,37,76] The induced hyperopia is primarily due to nonuniform thickness profiles of donor lenticules.[10,50] Donor lenticules prepared with the microkeratome are thinner centrally and thicker in the periphery, resulting in a reduced radius of curvature of the posterior corneal surface and reduced effective corneal power.[73,76] The hyperopic shift from DSAEK must be considered while calculating intraocular lens (IOLs) power in cases undergoing triple procedure. Target refraction should be aimed at 0.5–1.0 D of myopia in these cases.

Astigmatism
The average postoperative astigmatism after DSAEK is 1.5 D.[10,32,78] The amount of astigmatism often depends on the type of incision.

Higher order aberration
DSAEK does not change the anterior corneal curvature but the posterior corneal curvature is altered due to differences in curvatures between the host and the donor lenticule as well as an uneven thickness of donor lenticule. These changes can induce posterior corneal higher order aberrations after DSAEK.[77,78]

Complications
The complications of DSAEK can be categorized into intraoperative and postoperative complications and are summarized as follows:

Graft detachment and dislocation
Early postoperative graft detachment/dislocation remains one of the most common complications of DSAEK surgery. It manifests as interface fluid, significant graft displacement, or a graft that is completely dislocated into the AC. The reported average dislocation rate is around 14.5% [Table 1].[10,73]

Graft rejection
The incidence of graft rejection following DSAEK is relatively less compared to PKP. The reported rates range from 0% to 45.5% with an average rate of 10% with follow-up ranging from 3 months to 2 years.[10,36,37,73] The factors accounting for this low incidence are limited exposure of donor cells to host immune surveillance, absence of graft sutures, a lesser donor derived antigen presenting cells, and less disruption to the blood-aqueous barrier compared to PKP.[79,80]

Symptoms are relatively less serious such as small drop in vision or mild photophobia or at times patient may be completely asymptomatic.[80,81] The signs also differ and include scattered keratic precipitates unlike an endothelial rejection line, a localized corneal edema, or simple conjunctival hyperemia.[81]

Endothelial cell loss
Endothelial cell loss is still a major concern in DSAEK. Surgical trauma related to graft insertion appears to be the primary cause for this loss. The endothelial loss reported from larger series (involving ≥100 eyes) ranges from 14.9% to 59% with follow-up ranging from 6 months to 3 years [Table 1].[10,35,45]

Raised intraocular pressure and glaucoma
Glaucoma following DSAEK can occur due to pupillary block, inflammation, or steroid use.[10,73,82] The reported incidence of glaucoma after DSAEK ranges from 0% to 15%, with an average rate of 3.0%.[10,73] Pupillary block is a rare but serious immediate postoperative complication after DSAEK, with a reported incidence of 0%–10%.[39,43,57]

Epithelial ingrowth
Epithelial ingrowth is a rare complication of DSAEK.[83] The source of these epithelial cells can be host epithelial cells transported during donor insertion, donor epithelial cells transferred after eccentric trephination that has included full-thickness tissue beyond the microkeratome dissection and epithelial ingrowth related to the use of mid-peripheral full-thickness venting incisions.[10,83-86]

Infectious keratitis
Bacterial, fungal and herpetic, all form of keratitis have been reported following DSAEK.[87,88] The most commonly isolated
causative organism is Candida albicans. Source of infection is often the donor tissue and rarely from late inoculation from conjunctiva and adnexa microflora. The infiltrate at the onset is often small and involves the donor lenticule or the interface. In addition, the effectiveness of topical antifungal agents may be reduced by posterior lamellar location of infiltrate. All these factors result in a poor prognosis of such cases. Majority of cases may require the removal of the lenticule with a therapeutic PKP.

Interface haze
Interface abnormalities can occur in any form of lamellar keratoplasty, including DSAEK. The source of interface haze may include blood, retained ophthalmic viscoelastic, inflammatory cells, debris, and irregular cut of the donor tissue by the microkeratome, retained fragments of DM, microkeratome-generated plastic particles, and epithelial cells. Most such cases cause minimal effect on BCVA or resolve with time, repeat DSAEK is required for the treatment of refractory cases.

Other less-common complications
Other less-frequent complications of DSAEK include endophthalmitis and folds in donor tissue.

Descemet Stripping Automated Endothelial Keratoplasty in Special Situations

Descemet stripping automated endothelial keratoplasty in the presence of anterior chamber intraocular lens

The primary concerns of performing DSAEK in the presence of an anterior chamber intraocular lens (ACIOL) are increased tissue manipulation, reduced AC depth (ACD), difficulty in graft manipulation, more difficult air-bubble management, and intermittent postoperative IOL touch. In the presence of a well-centered ACIOL and an ACD >3 mm, DSAEK can be performed successfully in such cases.

Descemet stripping automated endothelial keratoplasty in aphakia

The difficulties in performing DSAEK in aphakic eyes are difficulty of air retention in the AC, migration of air posteriorly, chances of graft dislocation into vitreous cavity, and chances of host DM dislocation posteriorly. The various modifications that can be employed to overcome these difficulties are simultaneous DSAEK and IOLs implantation, insertion of an infusion cannula through pars plana route, or placement of temporary anchor sutures to prevent donor dislodgement and improve graft adherence.

Descemet stripping automated endothelial keratoplasty in aniridia

Congenital aniridia or aniridia associated with trauma along with aphakia poses a risk of posterior migration of air into vitreous cavity. This problem can be overcome by performing an aniridia IOLs implantation followed by DSAEK in stepwise manner or placing an anchor suture in the peripheral edge of the donor tissue and securing it to the overlying recipient cornea.

Descemet stripping automated endothelial keratoplasty with previous trabeculectomy or tube shunt implantation

The problems encountered in such cases includes loss of the remaining field of vision due to the transient intraocular pressure (IOP) rise, difficulty in surgery due to presence of tube of the glaucoma valve, tube position contributing to corneal decompensation, and possibility of air escaping through the sclerostomy or tube or large iridotomy. The various technical modifications that can be helpful in such cases include trimming of the tube if it extends centrally, placement viscoelastic between the graft and the iris to block the escape of air from the AC, suture closure of the iridotomy opening and meticulous monitoring of IOP.

With the recent advancements in the techniques of EK, the surgery has become faster and safer with better visual outcomes. Further, an early rehabilitation of patients with DSAEK has made it the procedure of choice over full-thickness PKP to be used in patients with endothelial dysfunction. The creation of ultra-thin lenticules has further led to a reduction in the interface haze with improved visual outcomes and results close to those of DM endothelial keratoplasty. With the added advantages of DSAEK such as a lower rate of graft rejection, preservation of ocular surface, absence of suture-related problems, and the broader spectrum of ocular disorders where it can be safely used, DSAEK will surpass PKP as the first-line surgical treatment modality for cases with endothelial disorders.

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Conflicts of interest
There are no conflicts of interest.

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