ECRONICON OPEN ACCESS

EC MICROBIOLOGY
Research Article

Visual Outcome and Quality of Life after Descemet's Stripping Automated Endothelial Keratoplasty (DSAEK)

Basil Alhusssin[1]*, Nourah Altuwaijri[2], Rabia Bashir[1], Shiji Gangadharan[1], Albandary Alhamzah[2] and Fahad Alfardan[1]

[1]King Abdulaziz Medical City, Riyadh, Saudi Arabia

[2]King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

***Corresponding Author:** Basil Alhusssin, King Abdulaziz Medical City, Riyadh, Saudi Arabia.

Received: January 16, 2021; **Published:** January 20, 2021

Abstract

Purpose: To evaluate the visual outcome and patient-related quality of life (QoL) after Descemets stripping automated endothelial keratoplasty (DSAEK).

Methods: Patients were enrolled if they had pseudophakic bullous keratopathy or Fuchs endothelial dystrophy and underwent DSAEK. Data were collected on patient demographics and best corrected visual acuity (BCVA) before and after DSAEK. Patients completed the National Eye Institute Visual Functioning Questionnaire - 39 (NEI VFQ-39) at least 1 year after DSAEK. Descriptive statistics are reported. The Student t-test was used to compare means between genders. A P value less than 0.05 was considered statistically significant.

Results: The study sample was comprised of 13 patients. Preoperatively, one eye had BCVA 20/100 and all other eyes had vision < 20/200. At last postoperative visit, BCVA improved by 2 or more lines in all eyes. The mean improvement in BCVA was 2.5 lines. Complications after DSAEK included rejection in 2 eyes for which DSAEK was repeated without further sequelae. The NEI VFQ-39 total score was 84.25 ± 18.96. The scores per subscales varied from 72.5 ± 21.38 for the "General health" subscale to 93.27 ± 10.66 for the "Dependency" subscale (Table 2). There were no statistically significant differences between genders for the different subscales (P < 0.05, all between-gender subscale comparisons).

Conclusion: A clinically significant increase in BCVA improved patient related quality of life.

Keywords: *Quality of Life (QoL); Descemets Stripping Automated Endothelial Keratoplasty (DSAEK); Best Corrected Visual Acuity (BCVA)*

Introduction

Corneal endothelial diseases comprise a number of pathologies including, Fuchs' endothelial dystrophy, pseudophakic bullous keratopathy, or Iridocorneal Endothelial Syndrome [1]. Historically penetrating keratoplasty (PK) remained the standard of care for corneal diseases until newer techniques for endothelial keratoplasty were developed [2].

In 1998, Melles and colleagues introduced the concept of posterior lamellar keratoplasy [3]. Over time the technique evolved and improved and in 2004, Melles and colleagues simplified the technique and named it Descemets stripping endothelial keratoplasty (DSEK) [4]. In 2006 the introduction of the keratome allowed Gorovoy to further improve the technique [5]. The updated technique was referred to as Descemets stripping automated endothelial keratoplasty (DSAEK). The surgical technique continues to evolve with the use of thinner endothelial grafts leading to the introduction of Descemets membrane endothelial keratoplasty (DMEK) [6] and ultrathin Descemets membrane endothelial keratoplasty (UT DMEK) [7].

In 2005 there was a major shift from PK to endothelial keratoplasty [8] to become the first-line treatment for corneal endothelial failure [9]. Endothelial keratoplasty is performed for the management of corneal edema in the presence of endothelial dystrophies [10].

Compared to conventional PK, DSAEK is associated with lower perioperative complications. DSAEK and other endothelial keratoplasty procedures have several advantages over PK including, minimal changes to the corneal surface leading to rapid visual recovery and less astigmatism and a tectonically stronger cornea [11-14]. However, there are some complications after DSAEK including graft slippage, initial endothelial cell loss, graft failure, and interface abnormalities [15,16]. DSAEK has lower graft rejection rates and rejection-related failures than PK [17]. The graft rejection rates are due to the smaller volume of cornea tissue, an implantation environment that is more immunologically favorable and lack of corneal sutures used in DSAEK [17]. As with any other graft, DSAEK graft exchange may be required due to endothelial failure (secondary to graft rejection, intraocular surgical damage, or slow idiopathic progressive cell loss) or poor visual outcomes (due to interface pathologies or graft folds) [18-20].

Aim of the Study

The aim of this study is to evaluate the visual outcomes and assess the quality of life (QoL) after DSAEK.

Materials and Methods

This study evaluated patients who had undergone DSAEK between January 2013 and January 2018 at the ophthalmology department of King Abdul Aziz Medical City, Riyadh, Saudi Arabia. A retrospective chart review was performed to collect data on visual outcomes and post-operative QOL was evaluated using a cross-sectional design. Data were collected on patient demographics, chronic diseases and best corrected visual acuity (BCVA) Preoperative and postoperatively.

Data were collection on DSAEK performed by one surgeon to mitigate bias and variability across surgeons. During the study, period, a total of 18 eyes underwent DSAEK. In the current study only patients who underwent DSAEK after pseudophakic bullous keratopathy or Fuchs endothelial dystrophy were included, resulting in a sample size of 13 patients. The quality of life was assessed with the National Eye Institute Visual Functioning Questionnaire - 39 (NEI VFQ-39), version 2000 [21].

Surgical technique

The corneoscleral rim was mounted on an artificial chamber maintainer (Moria SA, Antony, France) and balanced salt solution was used to fill and pressurize the system. Epithelium was removed followed by marking to aid centration during trephination. A 350-micron microkeratome head was used to remove the anterior cornea with an approximate diameter of 9 mm. The cap was sent for culturing and a DSAEK disc was created from the residual tissue using a Hanna donor punch trephine (Moria SA, Antony, France). The DSAEK was placed in Optisol-GS while preparing the patient.

After epithelial debridement of the host cornea, a marking ring was used to place orientation marks at 9 mm. Vertical self-sealing limbal paracenteses were created with 23G straight blades. An initial 2.8 mm temporal wound was made to allow Descemet's membrane stripping using the irrigating 90 degrees stripper and four mid- peripheral corneal venting incisions were created for better graft adhesion. Subsequently, the temporal limbal wound was enlarged to 5.2 mm. The DSAEK graft was removed from the trephine bed with 0.12 forceps and placed on a flat trephination block. Viscovisc ocular viscoelastic device was place on the endothelial side of the graft and then slowly folded in a 70:30 configuration ("taco technique") with 2 forceps. The graft was then inserted using non-crushing Ogawa forceps (Moria SA, Antony, France). After brisk insertion of the graft, the main wound was closed using 3 interrupted 10-0 nylon sutures. A small bubble was used for graft unfolding and intraocular pressure (IOP) was lowered as needed to facilitate central graft placement. Filtered air was then injected through one of the paracenteses into the anterior chamber and a complete air fill was performed to maintain an IOP around 40 - 50 mmHg for 7 minutes. Interface fluid allowed to drain through the venting incisions using a Sinskey hook and Weck cel with gentle wiping. Dilating eye drops were instilled and approximately 20% of the air was allowed to escape through one of the side ports. A bandage contact lens was placed over the eye and a clear shield is applied. Patients were checked two hours postoperatively to ensure a safe bubble size and pupillary clearing inferiorly before discharge.

Data collection and statistical analysis

Patients completed a written questionnaire during at the last follow up visits (at least 1 year postoperatively) in the presence of one of the co-authors. Difficulties in understanding questions were addressed by the interviewers. All co-authors were trained to use the same protocol when facing any question. The VFQ-39 was developed by the National Eye Institute, USA and is comprised of (VFQ-25 questionnaire + Optional items) a total of 39 items, which generate 12 subscales for the following dimensions of vision-related QoL: general vision, difficulty with near and distance vision activities, limitations in social functioning, role limitations, dependence on others, mental health symptoms, driving difficulties, limitations with peripheral and color vision, ocular pain, and the general health of the patient. The questionnaire was translated to Arabic with back translation to English. An independent third party (verified translators) performed the translation to avoid any bias in translation. The translated English copies were compared and there were no major errors and minors errors were corrected before administering the questionnaire to patients. The score produced for the VFQ-39 is converted to numeric values which range from 0 to 100. The higher the scores the better QoL [21]. The Student t-test was used to compare means between genders. SPSS version 21 (IBM Corp., Armonk, NY, USA) was used for data entry and statistical analysis. A *P* value less than 0.05 was considered statistically significant.

Results

The study sample was comprised of 13 eyes that underwent surgery by one surgeon (ALFF). The mean age of the participants was 67.6 ± 12.1 years (range, 37 years to 81 years) (Table 1). There were 53.8% females in the study sample.

	Sample size n = 13	**%**
Female/Male	7/6	46.2/53.8
Age Mean (SD)	67.6 (12.1)	
Range	37 - 81	
DM	8	61.5
HTN	9	69.2
DLP	9	69.2

Table 1: *Demographics and comorbidities of patients who underwent Descemet's stripping automated endothelial keratoplasty.*

Visual outcomes

Preoperatively, one eye had BCVA 20/100 and all other eyes had vision < 20/200. At last postoperative visit, BCVA improved by 2 or more lines in all eyes. The mean improvement in BCVA was 2.5 lines. Patients with previously diagnosed glaucoma as continued to use antiglaucoma medications postoperatively. Complications after DSAEK included rejection in 2 eyes for which DSAEK was repeated without further sequelae to date.

NEI VFQ-39 scores

The NEI VFQ-39 total score was 84.25 ± 18.96 (range,37.5 to 100) (Table 2). The scores per subscales varied from 72.5 ± 21.38 for the "General health" subscale to 93.27 ± 10.66 for the "Dependency" subscale (Table 2). "General health" and "Driving" had the lowest scores (Table 2). Table 3 presents Spearman's correlation coefficients between the 12 subscales of the NEI VFQ-39 questionnaire. Driving was not analyzed in the correlation because none of the female participants were driving at this time so this part of the questionnaire was omitted.

Subscales of NEI VFQ-39 Questionnaire	Number of items	Mean	Standard deviation	Range
General Health	2	72.50	21.38	42.5-100
General Vision	2	80.39	19.42	50-100
Ocular Pain	2	87.50	21.65	50-100
Near Activities	6	81.09	23.82	37.5-100
Distance Activities	6	80.13	20.91	50-100
Vision Specific				
Social Functioning	3	87.82	15.82	58.3-100
Mental Health	5	88.46	14.35	60-100
Role Difficulties	4	88.46	14.17	68.8-100
Dependency	4	93.27	10.66	68.8-100
Driving	3	76.39	26.57	41.7-100
Color Vision	1	86.54	19.41	50-100
Peripheral Vision	1	88.46	19.41	50-100
Total Score	39	84.25	18.96	37.5-100

Table 2: *Mean postoperative scores of the National Eye Institute Visual Function Questionnaire-39 survey instrument for patients who underwent Descemet's Stripping Automated Endothelial Keratoplasty. NEI VFQ denotes National Eye Institute Visual Function Questionnaire.*

		General Health	General Vision	Ocular Pain	Near Activities	Distance Activities	Social Functioning	Mental Health	Role Difficulties	Dependency	Driving	Color Vision	Peripheral Vision
General Health	Pearson Correlation	1	.416	.264	.279	.565*	.467	.034	.284	.183	-.065	.665*	.452
	Sig. (2-tailed)		.157	.383	.355	.044	.108	.912	.348	.550	.903	.013	.121
	N	13	13	13	13	13	13	13	13	13	6	13	13
General Vision	Pearson Correlation	.416	1	.384	.933**	.858**	.944**	.616*	.888**	.315	.868*	.734**	.621*
	Sig. (2-tailed)	.157		.195	.000	.000	.000	.025	.000	.294	.025	.004	.023
	N	13	13	13	13	13	13	13	13	13	6	13	13
Ocular Pain	Pearson Correlation	.264	.384	1	.454	.355	.532	.201	.509	.508	.c	.558*	.868**
	Sig. (2-tailed)	.383	.195		.119	.234	.061	.510	.075	.077	0.000	.048	.000
	N	13	13	13	13	13	13	13	13	13	6	13	13
Near Activities	Pearson Correlation	.279	.933**	.454	1	.815**	.889**	.507	.772**	.132	.871*	.624*	.540
	Sig. (2-tailed)	.355	.000	.119		.001	.000	.077	.002	.667	.024	.023	.057
	N	13	13	13	13	13	13	13	13	13	6	13	13
Distance Activities	Pearson Correlation	.565*	.858**	.355	.815**	1	.922**	.387	.700**	.187	.927**	.869**	.543
	Sig. (2-tailed)	.044	.000	.234	.001		.000	.191	.008	.540	.008	.000	.055
	N	13	13	13	13	13	13	13	13	13	6	13	13
Social Functioning	Pearson Correlation	.467	.944**	.532	.889**	.922**	1	.461	.851**	.323	.999**	.892**	.748**
	Sig. (2-tailed)	.108	.000	.061	.000	.000		.112	.000	.282	.000	.000	.003
	N	13	13	13	13	13	13	13	13	13	6	13	13
Mental Health	Pearson Correlation	.034	.616*	.201	.507	.387	.461	1	.828**	.744**	.752	.219	.380
	Sig. (2-tailed)	.912	.025	.510	.077	.191	.112		.000	.004	.085	.473	.200
	N	13	13	13	13	13	13	13	13	13	6	13	13

Role Difficulties	Pearson Correlation	.284	.888**	.509	.772**	.700**	.851**	.828**	1	.693**	.813*	.666*	.754**
	Sig. (2-tailed)	.348	.000	.075	.002	.008	.000	.000		.009	.049	.013	.003
	N	13	13	13	13	13	13	13	13	13	6	13	13
Dependency	Pearson Correlation	.183	.315	.508	.132	.187	.323	.744**	.693**	1	.640	.344	.663*
	Sig. (2-tailed)	.550	.294	.077	.667	.540	.282	.004	.009		.171	.250	.013
	N	13	13	13	13	13	13	13	13	13	6	13	13
Driving	Pearson Correlation	-.065	.868*	.c	.871*	.927**	.999**	.752	.813*	.640	1	.526	.c
	Sig. (2-tailed)	.903	.025	0.000	.024	.008	.000	.085	.049	.171		.283	0.000
	N	6	6	6	6	6	6	6	6	6	6	6	6
Color Vision	Pearson Correlation	.665*	.734**	.558*	.624*	.869**	.892**	.219	.666*	.344	.526	1	.798**
	Sig. (2-tailed)	.013	.004	.048	.023	.000	.000	.473	.013	.250	.283		.001
	N	13	13	13	13	13	13	13	13	13	6	13	13
Peripheral Vision	Pearson Correlation	.452	.621*	.868**	.540	.543	.748**	.380	.754**	.663*	.c	.798**	1
	Sig. (2-tailed)	.121	.023	.000	.057	.055	.003	.200	.003	.013	0.000	.001	
	N	13	13	13	13	13	13	13	13	13	6	13	13

Table 3: *Correlation matrix for the Subscale of the National Eye Institute Visual Function Questionnaire-39 for patients who underwent Descemet's Stripping Automated Endothelial Keratoplasty.*

P < 0.05 is statistically significant.

NEI VFQ-39 scores by gender

The mean NEI VFQ-39 composite scores by gender were, 88.403 ± 13.91 for males and 81.08 ± 20.43 for females. The scores per subscales varied from 70.35 ± 20.43 (General health) to 88.39 ± 12.72 (Dependency) among the female participants, and from 75.0 ± 24.1 (General health) to 100 (Peripheral vision and Ocular pain) for males. There were no statistically significant differences between genders for the different subscales ($P < 0.05$, all between-gender subscale comparisons). Figure 1 presents the mean scores by gender.

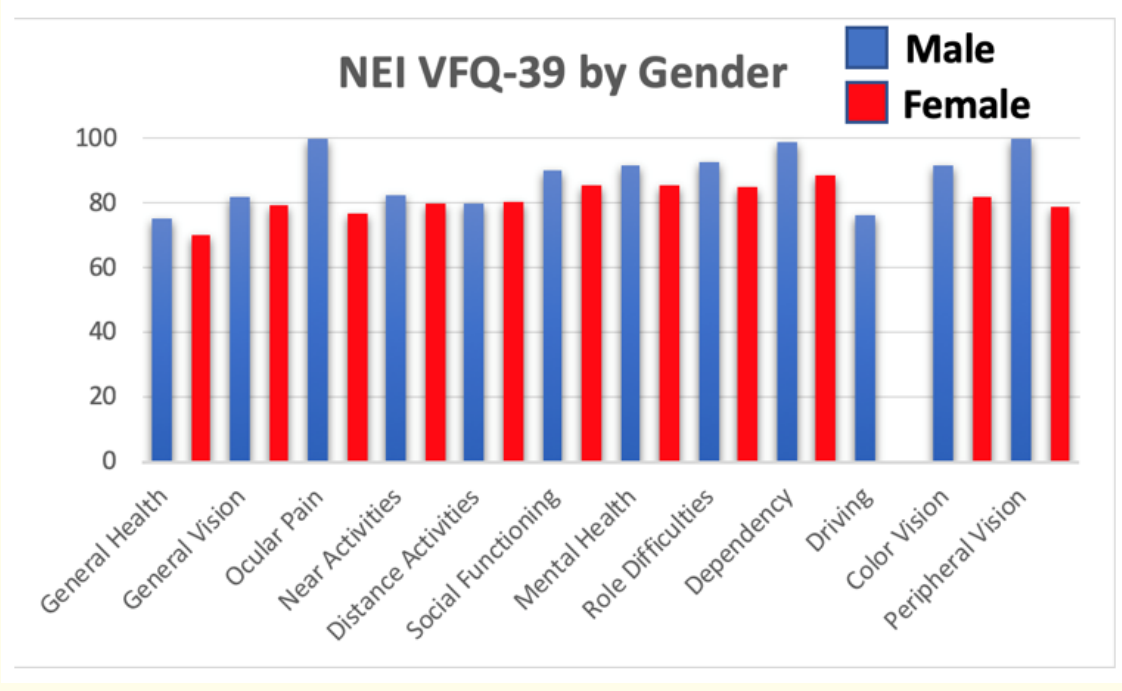

Figure 1: *National Eye Institute Visual Function Questionnaire-39 (NEI VFQ-39) subscale scores by gender for patients who underwent Descemet's Stripping Automated Endothelial Keratoplasty. Driving data are missing for females as they were not allowed to drive at the time of this study.*

Discussion

DSAEK has number of advantages over PKP including, a smooth and uneventful postoperative course in patients with ocular surface disorders, preservation of the corneal sensation and an intact corneal nerve plexus, prevention of possible complications of open sky surgery, use of larger donor disks containing more endothelial cells compared with donor buttons in PKP [11-14]. This case series of visual outcomes and patient satisfaction after conventional DSAEK indicates increases in both parameters. For example, all eyes had an increase in BCVA postoperatively and there were improvements in QoL. The gains in visual acuity after DSAEK likely resulted in the gains in QoL as reflected in subscales. However, BCVA was measured at last postoperative visit for the study sample and the follow up visit differed between patients but was at least 1 year postoperatively in all cases. The outcomes of a mean increase of 2.5 lines in BCVA in the current study are well within the range of reported in previous studies. A previous study of patients who underwent DSAEK after failed PKP reported an average of 5.2 lines improvement in BCVA postoperatively [23]. A study in 2014 comparing DSAEK and DMEK reported an average visual improvement of (3.3 lines) in the DMEK group and an average of 1.3 lines in the DSAEK group (P = 0.047) [24].

In the current study, NEI-VFQ-39 subscales had a considerable range of satisfaction. Although driving data were only available for males it had a particularly strong association with QOL, especially in Saudi Arabia which has limited public transportation. Driving is a function that offers independence to older individuals [24]. In the current study the highest mean for the subscales was "Dependency" and the lowest was "General Health". Ocular pain and peripheral vision was highest among males with score of 100, while in females "Dependency" was the highest. The lowest subscale score for both males and females was "General Health". The highest difference regarding males and females in regards to subscales scores was "ocular pain". However, there were no statistical differences between genders in QoL. This study has some limitation including the retrospective study design and the small sample size.

Conclusion

All patients had who had undergone DSAEK experience at least a two line improvement in BCVA which in turn improved patient QoL in terms of dependency.

Bibliography

1. Sorkin N., *et al.* "Outcomes of Descemet Membrane Endothelial Keratoplasty in Eyes With a Previous Descemet Stripping Automated Endothelial Keratoplasty Graft". *Cornea* 37.6 (2018): 678-681.

2. Williams KA., *et al.* "Long-term outcome after corneal transplantation. Visual result and patient perception of success". *Ophthalmology* 98.5 (1991): 651-657.

3. Melles GR., *et al.* "A surgical technique for posterior lamellar keratoplasty". *Cornea* 17.6 (1998): 618-626.

4. Melles GRJ., *et al.* "A technique to excise the Descemet membrane from a recipient cornea (descemetorhexis)". *Cornea* 23.3 (2004): 286-288.

5. Gorovoy MS. "Descemet-stripping automated endothelial keratoplasty". *Cornea* 25 (2006): 886-889.

6. Melles GRJ Ong., *et al.* "Descemet membrane endothelial keratoplasty (DMEK)". *Cornea* 25.8 (2006): 987-990.

7. Busin M Madi., *et al.* "Ultrathin descemets stripping automated endothelial keratoplasty with the microkeratome double-pass technique: two-year outcomes". *Ophthalmology* 120.6 (2013): 1186-1194.

8. Price MO and Price FW. "Descemet's stripping endothelial keratoplasty". *Current Opinion in Ophthalmology* 18 (2007): 290-294.

9. Mitry D., *et al.* "Descemet Stripping Automated Endothelial Keratoplasty After Failed Penetrating KeratoplastySurvival, Rejection Risk, and Visual Outcome". *JAMA Ophthalmology* 132.6 (2014): 742-749.

10. Park CY Lee., *et al.* "Keratoplasty in the United States: A 10-Year Review from 2005 through 2014". *Ophthalmology* 122.12 (2015): 2432-2442.

11. Lee WB., *et al.* "Descemet's stripping endothelial keratoplasty: Safety and outcomes: A report by the American Academy of Ophthalmology". *Ophthalmology* 116 (2009): 1818-1830.

12. Bahar I., *et al.* "Comparison of posterior lamellar keratoplasty techniques to penetrating keratoplasty". *Ophthalmology* 115 (2008): 1525-1533.

13. Hjortdal J and Ehlers N. "Descemet's stripping automated endothelial keratoplas- ty and penetrating keratoplasty for Fuchs' endothelial dystrophy". *Acta Ophthalmology* 87 (2009): 310-314.

14. McLaren JW., *et al.* "Corneal wavefront errors 24 months after deep lamellar endothelial keratoplasty and penetrating keratoplasty". *American Journal of Ophthalmology* 147 (2009): 959-965.

15. Price MO., *et al.* "Descemet's stripping automated endothelial keratoplasty outcomes compared with penetrating keratoplasty from the Cornea Donor Study". *Ophthalmology* 117 (2010): 438-444.

16. Price MO and Price FW. "Endothelial cell loss after descemet stripping with endothelial keratoplasty in uencing factors and 2-year trend". *Ophthalmology* 115 (2008): 857-865.

17. Yoeruek E., *et al.* "Histological and ultrastructural findings of corneal tissue after failed descemet membrane endothelial keratoplasty". *Acta Ophthalmologica* 92 (2014): e213-e216.

18. Dirisamer M., *et al.* "Identifying causes for poor visual outcome after DSEK/DSAEK following secondary DMEK in the same eye". *Acta Ophthalmologica* 91 (2013): 131-139.

19. Ham L., *et al.* "Secondary DMEK for poor visual outcome after DSEK". *Cornea* 29 (2010): 1278-1283.

20. Weller JM., *et al.* "Descemet membrane endothelial keratoplasty as treatment for graft failure after Descemet stripping automated endothelial keratoplasty". *American Journal of Ophthalmology* 159 (2015): 1050- 1057.

21. Mangione CM., *et al.* "National Eye Institute Visual Function Questionnaire Field Test Investigators. Development of the 25-item National Eye Institute Visual Function Questionnaire". *Archives of Ophthalmology* 119.7 (2001): 1050-1058.

22. Zitte K., *et al.* "DSAEK after failed penetrating keratoplasty". *The Journal français d'ophtalmologie* 38.1 (2015): 22-33.

23. Green M and Wilkins M. "Comparison of DSAEK and DMEK learning curves". *Clinical and Experimental Ophthalmology* 42 (2014): 85.

24. Sengupta S., *et al.* "Driving habits in older patients with central vision loss". *Ophthalmology* 121 (2014): 727-732.

Volume 17 Issue 2 February 2021