

Original Article

Descemet Stripping Automated Endothelial Keratoplasty Combined with Phacoemulsification; a Follow up Study

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Abstract

Purpose: To evaluate the surgical outcome and refractive status after triple procedure in patients with Fuchs' dystrophy combined with cataract.

Patients and Methods: Thirty four consecutive eyes of 29 patients with coexisting cataract and Fuchs' dystrophy entered the study. All patients underwent phacoemulsification and IOL implantation through a temporal incision followed by 4 Descemet stripping automated endothelial keratoplasty (DSAEK). Patients were assessed regarding best corrected visual acuity (BCVA), refractive cylinder and refractive sphere before surgery, after 3 months and 3 years of follow-up.

Results: The mean BCVA was 0.87 ± 0.448 LogMAR pre-operatively which increased to 0.29 ± 0.164 LogMAR at three months ($P < 0.001$), and 0.19 ± 0.129 at three years ($P < 0.001$) post-operatively. The mean preoperative sphere was 0.758 ± 2.384 , which reached 0.32 ± 0.55 and 0.24 ± 0.46 ; three months and three years after the simultaneous surgery, respectively. The mean preoperative cylinder was -1.43 ± 1.141 which reached -0.87 ± 0.55 and -0.69 ± 0.39 ; three months and three years after the simultaneous surgery, respectively.

Conclusion: Refractive and visual outcomes after triple surgery are favorable in terms of BCVA, refractive cylinder and refractive sphere. Therefore, triple procedure might be recommended in older patients due to its rapid visual rehabilitation.

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Introduction

Descemet stripping automated endothelial keratoplasty (DSAEK) has been known as the gold standard for the treatment of corneal endothelial diseases¹. This innovation opened a new chapter in the field of corneal transplantation. The major indication of DSAEK is any kind of abnormality in corneal endothelium such as Fuchs' endothelial dystrophy and pseudophakic bullous keratopathy². DSAEK is a lamellar corneal procedure which has been of growing interest in terms of rapid visual rehabilitation, maintaining corneal integrity and less postoperative limitations³.

Performing penetrating keratoplasty (PK) after cataract extraction; a 2-staged surgery, has shown convincing results compared with PK alone in patients suffering from cataract and a coexisting endothelial disease; however; there are a number of limitations and/or complications. Some studies have indicated endothelial cell loss after the two-step surgery, delayed visual rehabilitation which questions the cost-effectiveness of the procedure, and difficulties in measuring IOL power due to uncertainty in post-PK corneal curvature measurements⁴. The alternative technique would be a combination of DSAEK with simultaneous phacoemulsification, named new triple procedure, which might reduce the possibility of above mentioned complications.

There is an ongoing controversy in the existing literature regarding whether sequential or triple surgery leads to better postoperative results. The aim of present study was to present 3-year follow-up results of patients with cataract and Fuchs' dystrophy undergoing DSAEK combined with phacoemulsification in terms of visual outcomes and refraction.

Patients and Methods

In the present study triple-DSAEK (DSAEK with simultaneous phacoemulsification and IOL implantation) was performed in 34 consecutive eyes of 29 patients (11 male and 18 female patients) with Fuchs' dystrophy. All patients fulfilled indication of surgery which was Fuchs' endothelial decompensation along with cataract. The study was approved by the ethics committee of Basir Eye Health Center, Basir Eye Clinic, Tehran, Iran, and all patients gave informed written consent before entering the study.

Surgical procedure

Patients underwent combined phacoemulsification and DSAEK. At first phaco was performed using a 2.8 mm temporal incision (infinity) and PC IOL was inserted in bag; then we performed DSAEK by adding 1 incision for forceps. Lenticule was attached to recipient cornea using air bubble support and centered. Finally we sutured all incisions while 60 percent of air remained.

Follow-up

As well as pre-operation, patients were assessed 3 months and 3 years after surgery in terms of BCVA (LogMAR and decimal), refractive sphere and refractive cylinder.

Statistical analysis

We performed statistical evaluation using SPSS version 18.0 (SPSS Inc, Chicago, Illinois, USA). Dependent T-test was employed for detecting differences between pre-operative and post-operative results. Level of significance was considered less than 0.05 in our analysis.

Results

Thirty-four eyes from 29 consecutive patients were included in the present study. There were 18 females and 11 males with the mean age of 59.05 ± 10.56 . All patients had clinically approved cataract along with Fuchs' dystrophy. Five eyes had very low pre-operative visual acuity (hand motion).

BCVA measurement

Table 1 represents achieved BCVA after 3 months and 3 years of follow up. The mean BCVA was 0.87 ± 0.448 LogMAR (0.13 \pm 4.48 line) pre-operatively and increased to

0.29 ± 0.164 LogMAR (0.5 \pm 1.64 line) at three months ($P < 0.001$), and 0.19 ± 0.129 (0.63 \pm 1.29 line) at three years post-operatively ($P < 0.001$). The increase in BCVA within the first three months ($P < 0.001$), between 3 months and 3 years ($P < 0.001$), and within three years ($P < 0.001$) were all statistically significant.

Refractive sphere

Table 2 shows the mean preoperative sphere of 0.758 ± 2.384 which reached 0.32 ± 0.55 and 0.24 ± 0.46 three months and three years after the simultaneous surgery, respectively.

Table 1: Visual acuity of patients before surgery, as well as 3 months and 3 years after surgery

	BCVA	
	Decimal	LogMAR
Pre-operation	0.13 ± 4.48 line	0.87 ± 0.448
Post-operation After 3 months	0.5 ± 1.64 line	0.29 ± 0.164
Post-operation After 3 years	0.63 ± 1.29 line	0.19 ± 0.129
P value when comparing pre-operation and three months post-operation results		0.000*
P value when comparing pre-operation and three years post-operation results		0.000*
P value when comparing three months and three years post-operation results		0.000*
P value when comparing pre-operation, three months post-operation, and three years post-operation results		0.000**

*Wilcoxon Test

**Friedman Test

Table 2: Refractive outcomes of patients before surgery, as well as 3 months and 3 years after surgery

	Pre-Operation	Three Months Post-Operation	Three Years Post-Operation
Sphere	0.758 ± 2.384	0.32 ± 0.55	0.24 ± 0.46
Cylinder	$- 1.43 \pm 1.141$	$- 0.87 \pm 0.55$	$- 0.69 \pm 0.39$
Axis	88.66 ± 53.15	80.83 ± 43.63	88.96 ± 45.14

Refractive cylinder

The mean preoperative cylinder was -1.43 ± 1.141 which reached -0.87 ± 0.55 ($P < 0.001$) and -0.69 ± 0.39 ($P < 0.001$) in three months and three years after the simultaneous surgery, respectively.

Discussion

Today, the treatment of choice for thick Descemet membrane due to corneal endothelial decompensations such as Fuchs' dystrophy is endothelial keratoplasty. We found in previous studies that traditional PK is no longer the point of interest compared with DSAEK and DMEK^{5,6}, while in eyes presenting with Fuchs' dystrophy and concomitant cataract without thickened epithelium, the choice of treatment would be cataract extraction and lens implantation⁷. DSAEK provides rapid visual rehabilitation and better refractive results after surgery compared with PK; and the difference depends on pre and post-operative factors as well as the surgical technique⁸. Triple procedure have some disadvantages including notable alteration in anterior and posterior curvature which leads to myopic shift and reduction in the predictability of post-operative refraction; whereas delayed cataract surgery in many surveys shows better refractive outcomes using Toric IOLs⁹. The difficulty in accurate measurement of IOL power is the other chief drawback in triple surgery. Deviations from the aimed refraction after suture removal may be the result of pre-operative biometric information including K-readings and anterior chamber depth in triple method; however there are multiple proposed correcting formulas in the literature to improve refractive outcomes among patients who undergo triple surgery¹⁰. Fuchs' endothelial corneal dystrophy (FECD) is a progressive condition characterized by endothelial cell loss, formation of corneal guttae and stromal edema. Patients with FECD are at higher risk of

developing cataract as their endothelial damage progresses¹¹. This may be a unique challenge for ophthalmologists when faced with a combination of both FECD and cataract since they should determine how much of patients' visual loss is caused by each condition and what is the best surgical approach.

Theoretically, several factors are involved in the management of a patient with both FECD and cataract. The crucial consideration should be the severity of each condition in patient; also the age at the time of surgery matters as there is a direct relation between cataract and advanced age. Long-term results have showed that advance age in the time of penetrating keratoplasty is a predisposing factor for upcoming cataract surgery¹². In a retrospective study, Payant et al.,¹³ showed that after an average follow up of 6.62 years, post keratoplasty cataract happens in 75 % of patients aged 60 years or older. Also females are at higher risk of developing cataract after PK surgery¹⁴. In the present study, all of 34 eyes achieved desired BCVA three months and three years postoperatively; which is favorably comparable to previous reported visual outcomes after triple surgery indicating between 48 % and 81 % of eyes achieving desired BCVA; although follow-up periods varied between studies^{15,16}. This finding is in line with previous observations by Scorcio et al.,¹⁷ who proposed DSAEK and phacoemulsification with implantation of a hydrophilic acrylic bitoric IOL as an effective treatment for eyes with post-PK astigmatism and corneal endothelial damage. Das et al.,¹⁸ showed good refractive and visual outcomes following PK-only without a significant difference with the triple surgery; therefore triple surgery has been introduced as the treatment of choice in elderly patients who suffer from both Fuchs' dystrophy and co-existing mild to moderate cataract¹⁸. Sykakis

et al.,¹⁹ have reported the results of staged and combined DSAEK and phacoemulsification with intraocular lens implant (Phaco + IOL). Complications such as re-bubbling and dislocation of endothelial disc were higher among the group undergoing combined triple surgery while visual outcomes did not differ significantly¹⁹. Nonetheless, combined triple surgery in most cases is performed in one session without the need for waiting for secondary cataract extraction. There is a relatively high risk of suprachoroidal hemorrhage in the cataract extraction of simultaneous surgery while it is accomplished in the open-sky state²⁰. A crucial determinant of the success of combined surgery is the proficiency of the surgeon. We believe that triple procedure should be performed by experienced corneal surgeons to prevent any complication in the implantation of IOLs in capsular bag.

The limitations of the present study were the lack of a control group undergoing PK plus cataract extraction; relatively small sample size and no assessment of endothelial cell density. To decide the best surgical technique in this regard, future randomized controlled investigations are needed to investigate the best choice of procedure. We also did not report complications of the performed triple surgery; which has been indicated in the literature; like donor disc dislocation, primary graft failure and posterior capsule opacity requiring YAG laser capsulotomy^{6,21}.

Conclusion

Refractive and visual outcomes after triple surgery are favorable in terms of BCVA, refractive cylinder and sphere. Therefore, triple procedure might be recommended in older patients due to its rapid visual rehabilitation.

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Footnotes and Financial Disclosures

Conflict of Interest:

The authors declare no conflict of interest with the subject matter of the present manuscript.

