

Preloaded DMEK Survival Is Better Than Pre-Cut DSAEK in Cases of Long Process to Transplant Time

Muhammad A Ahad, MRCOphth, FRCS, PhD & Ahmed AlRubaian MD

King Khaled Eye Specialist Hospital, Saudi Arabia

Introduction:

Descemet's membrane endothelial keratopathy (DMEK) is now becoming a new standard for the management of the corneal endothelial disease. Compared to Descemet's stripping automated endothelial keratoplasty (DSAEK), it has a steep learning curve but unlike DSAEK, does not need specialized devices. To overcome tissue processing difficulties, pre-cut DSAEK and pre-loaded DMEK is becoming increasingly popular. Many countries particularly the third world rely on the imported cornea from the USA. However, this leads to longer preservation time and risk of endothelial damage associated with overseas transport. There is good evidence from clinical studies in Japan and in-vitro studies in the USA that both DMEK and DSAEK processed tissue can survive overseas transport for up to 4 days [1-5]. In Saudi Arabia, due to flight/freight connections, the processed tissue hardly arrives at or before the 4th-day post-processing.

Aim: To compare the primary failure rates between pre-loaded DMEK and pre-cut DSAEK in cases of the very long intervals between tissue processing and transplantation.

Methods

Venue/ Setting : King Khaled Eye Specialist Hospital, Riyadh; A tertiary eye care centre in Saudi Arabia.

It was a retrospective study of all DMEK cases performed between December 2019 till March 2021. Results were compared with all pre-cut DSAEKs performed by the same surgeons during this period. All the corneal tissue was procured from USA eye banks. In cases of DMEK, the tissue was stripped, S-marked, trephined and loaded in the modified Jones injector and shipped to Saudi Arabia. The surgery was standard DMEK surgery using SF6 gas as a tamponade

In cases of DSAEK, the tissue was cut and transported in the medium along with its cap to the destination. The tissue was trephine to the desired size and Busin glide was used to insert the graft. The tamponade was mainly with air but in some cases, SF6 gas was used.

Clinical and demographic details related to the donors and patients were collected. The operative and postoperative data were gathered and compared for the two groups. The main outcome measure was clear graft 3 months after surgery

All possible variables that could have affected the outcome were analyzed. This included but was not limited to, surgeon, Eye bank source, recipient demographics, primary diagnosis, co-pathologies, Donor factors (preservation time/cut to implant time, endothelial cell count), operative time & complication.

Results:

There were 25 DMEK and 50 DSAEK cases. The demographic and clinical details are shown in table-1 The DSAEK cases had more advanced corneal oedema, on the other hand in DMEK groups there were quite a few Fuchs' cases and many underwent combined phacoemulsification & IOL with DMEK.

Tabble-1 showing demographic and clinical details

		DMEK (25)	DSAEK (50)
Mean Age, years		67.9	68.8
Gender	Male	48%	49%
Combined with phaco		24%	8%
Primary Diagnosis	Bullous	74%	92%
	Fuch's	36%	8%
Pre Op BVCA	≤ 20/60	6%	6%
	>20/60-20/200	12%	10%
	>20/200	82%	84%
Corneal Edema	With Scar	20%	38%
History of Diabetes	Yes	27%	26%
PAS	Yes	4%	10%
Glaucoma	Yes	16%	16%
Type of ocular Surgery	cataract	68%	92%
	PPV	2%	2%
	SLT	2%	0%
	Trab	4%	4%
	Tube	0%	4%

The donor details are shown in Table-2. Mean age was significantly higher in the DMEK group due to known reasons of the difficult unfolding of tight DMEK scrolls. The preservation time ranged from 6 to 14 days and cut to transplant time ranged from 4-to 12 days. The mean times were slightly more in the DMEK group.

Table-2 comparing the donor details between the two groups

	DMEK		DSEAK		p Value
	Mean	SD	Mean	SD	
Donor age, years	62.6	6.86	52.92	13.45	0.01
Preservation time (6-14) days	8.52	1.76	8.99	2.17	
ECD Pre op	2908.24	179.88	2931.6	141.77	
Death to preservation - Hrs	8.92	3.43	8.72	2.3	
Preservation to process- days	2.92	1.22	3.36	1.38	
Process to receive - days	6.24	2.2	6.96	2.51	
Cut-transplant – Days (4-12)	7.6	1.73	8.44	2.36	0.07

The surgical details are shown in table-3 and postoperative complications are shown in table-4. As shown in table-4, in 40% of DMEK cases the cornea was clear by 1 week compared to only 10% in the DSAEK group. By 1 month all the DMEK cases that survived were clear and oedema free

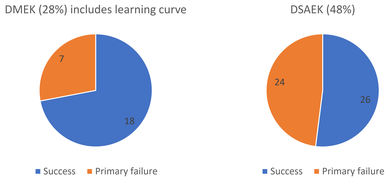
Table-3. showing the operative details differences between the two groups

		DMEK (25)	DSEAK (50)
Intra Operative Gas	Air	36%	92%
	Gas	64%	8%
Full air/Exchange	Full	92%	40%
	Exchange	8%	60%
Surgical iridectomy	Yes	28%	0%
Synechiolysis	Yes	4%	16%
Tube trimming	Yes	0%	2%

Table-4, showing complications and post-operative recovery between the two groups

	DMEK (25)	DSAEK (50)	P value
Rebubble	16%	6%	0.06
High IOP	8%	4%	
Hyphema	0	2%	
Clear cornea 1 week	40%	10%	0.01
Clear cornea 1 month	72%	48%	0.07
Clear cornea 3 months	72%	52%	0.09

As seen in figure-1 the primary failure rate at 3 months was 28% in the DMEK group compared to 48% in the DSAEK group



Following risk factors were independently associated with primary failure

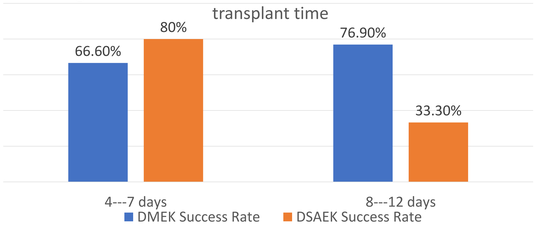
1) Re-bubbling was seen as a moderate risk factor in both groups (RR=1.8 DMEK, RR= 1.6 DSAEK)

2) Surgeon factor was seen in DMEK group only (RR 3.1) DSAEK (RR 1.1)

3) Cut to transplant time was seen as risk factor in DSAEK group only (RR 2.8). No association was noted in DMEK group (1.07)

As seen in figure-2, in cases where the cut to transplant time for 7 days or less the success rate for DSAEK was 80%, and for DMEK 66.6%. However, the success rate dropped to 33.3% in the DSAEK group when the cut-to-transplant time was 8 or more days. No such decline was seen in the DMEK group

Figure-2 Relationship between success rate and cut-to-transplant time



Discussion

Limitations:

Multiple (3) surgeons did surgeries, there were more bullous keratopathy cases in the DSAEK group, however, this was counterbalanced by the learning curve cases in the DMEK groups

Conclusion

Preloaded DMEK can survive a longer duration of cut-to-transplant time (even including the learning curve cases)

Pre-cut DSAEK has a very high primary failure rate in long cut to implant time

In DSAEK, the failure rate increases as the duration increases

Studies are needed to find out the reasons behind this. This could be related to swollen stroma in DSAEK lenticules that can affect the endothelial cell either physically or biochemically

Warrants	Confirms
• Invitro studies (longer duration of process tissue) • Further clinical studies (prospective if possible)	• Preloaded DMEK tissue (1 week old or even longer) is safe in short term

References:

Cornea 2013;32:741–744
Am J Ophthalmol 2014;157:50–55
BMJ Open Ophth 2021;6:e000679
(Cornea 2017;36:484–490)
Cornea. 2019 August ; 38(8): 1023–1028

Contact details
Dr Muhammad A Ahad (FRCS, MRCOphth, PhD)
Senior Consultant and Chair Anterior Segment Division
King Khaled Eye Specialist Hospital , Riyadh
Saudia
Email: mahad@kkesh.med.sa,
ahad.Muhammad@gmail.com