Australian Corneal Graft Registry Annual Report 2023

1 The Database

The Australian Corneal Graft Registry (ACGR) was established in 1985 and has now been in continuous operation for 38 years. The following document summarises the data contained in the Registry database on 30th June 2023. Only grafts performed up to 31st December 2022 had been entered by this date. Registrations for further grafts performed prior to 2023 are likely to still be added to the database in the future.

The database contains the following types of graft. The date range given for each graft type shows the years these have been registered with the ACGR.

- Penetrating Keratoplasty (PK): 1985 to 2022.
- Descemet's Stripping (Automated) Endothelial Keratoplasty (DS(A)EK): 2006* to 2022. *Encompassing both manual (from 2006) and automated (from 2008) versions of the technique, as well as an ultra-thin variant (from 2012).
- Descemet's Membrane Endothelial Keratoplasty (DMEK): 2007 to 2022.
- Deep Anterior Lamellar Keratoplasty (DALK): 2000 to 2022.
- Traditional/Tectonic Lamellar Keratoplasty (TLK): 1985 to 2022.
- Limbal/Stem Cell: 1987 to 2021.

Table 1 shows the breakdown of the database in terms of number of grafts registered, as well as the percentage of registered grafts with follow-up provided, known to have failed, and known to have failed from primary non-function. Primary non-function was defined as grafts that the surgeon reported did not clear in the immediate post-operative period. The cut-off time-point for these was 7 days for PK and 92 days (3-months) for lamellar grafts. In endothelial grafts this is often linked to graft detachment. Grafts performed overseas using Australian corneal donor tissue are not registered with the ACGR and so are excluded from these analyses.

Table 1 Overview of the Australian Corneal Graft Registry database at 30th June 2023

	Registered	Followed	Failed	Primary non-function
PK	28023	83%	26%	<1%
DS(A)EK	8056	77%	24%	5%
DMEK	4519	64%	17%	9%
DALK	2250	63%	8%	1%
TLK	1794	74%	21%	<1%
Limbal	92	74%	34%	1%
Total	**44734**	**79%**	**24%**	**2%**

Note: Percentage failed includes primary non-functioning grafts

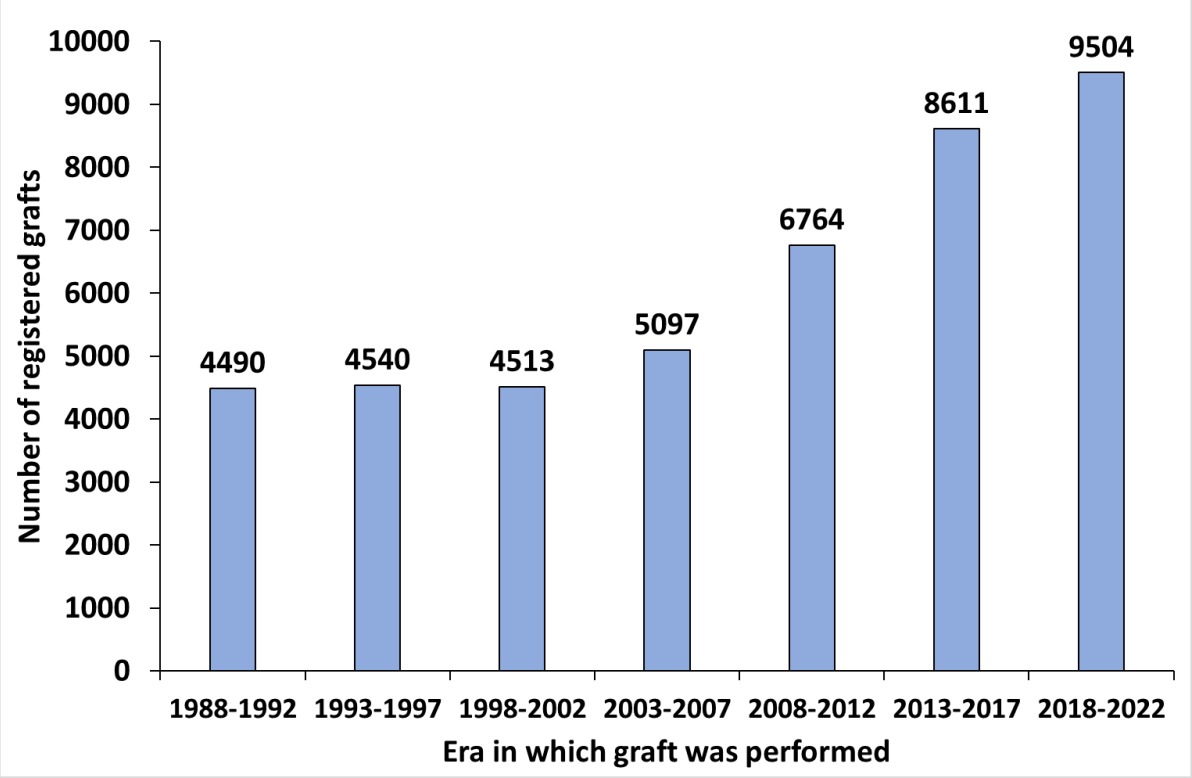
An annual follow-up request is sent to contributing surgeons in September. In some instances, the ACGR may be informed that the graft recipient is known to have died, or has been "lost to follow-up", i.e., is no longer seen by the surgeon, with no forwarding address available. Grafts will also be lost to follow-up after five-years without follow-up data provision but can be reactivated if the recipient is subsequently seen, e.g. for a contralateral or repeat graft. Linkage with the National Death Index is undertaken, where consent has been granted, to finalise records for deceased recipients. This is performed no more than once every 5 years, with the most recent linkage prior to the census date for this report completed in 2022. Table 2 shows the status of registered grafts in the database, including the number of each graft type for which follow-up information is still actively sort.

Table 2 Status of grafts in the Australian Corneal Graft Registry database at 30th June 2023

	PK	DS(A)EK	DMEK	DALK	TLK	Limbal	Total
Registered grafts	28023	8056	4519	2250	1794	92	44734
Failed graft	26%	24%	17%	8%	21%	34%	24%
Lost without follow-up received	7%	5%	7%	20%	8%	15%	7%
Lost post follow-up	24%	11%	7%	28%	25%	22%	20%
Died without follow-up received	5%	3%	2%	<1%	10%	4%	5%
Died with surviving followed graft	20%	12%	4%	3%	19%	13%	16%
Active in database	**17%**	**44%**	**63%**	**40%**	**17%**	**12%**	**28%**

Following the introduction of the new varieties of partial thickness endothelial grafts from 2006 onwards, there was a steady increase in the number of grafts registered annually, as shown in Figure 1.

Figure 1 Number of grafts registered with the ACGR stratified by graft era, 1988 to 2022



The annual number of registrations has been stable over the last five years (Figure 2), though the impact of restrictions placed on elective surgery due to COVID-19 may have influenced these figures. There has been a shift in the type of grafts being registered with the ACGR (Figure 2 and Table 3), with fewer PK registrations coinciding with continued increases in registrations of DS(A)EK and then DMEK. In 2019 the number of registrations of each of these three graft types was almost equal. DMEK became the most frequently registered graft type in 2020 and retained this spot through to 2022. The most recent 12 months saw a small drop in the number of PKs and DMEK registered compared to 2021, while the proportion of DS(A)EK increased back to 30%.

Figure 2 Number of grafts registered annually with the ACGR, by graft type, 2013 to 2022

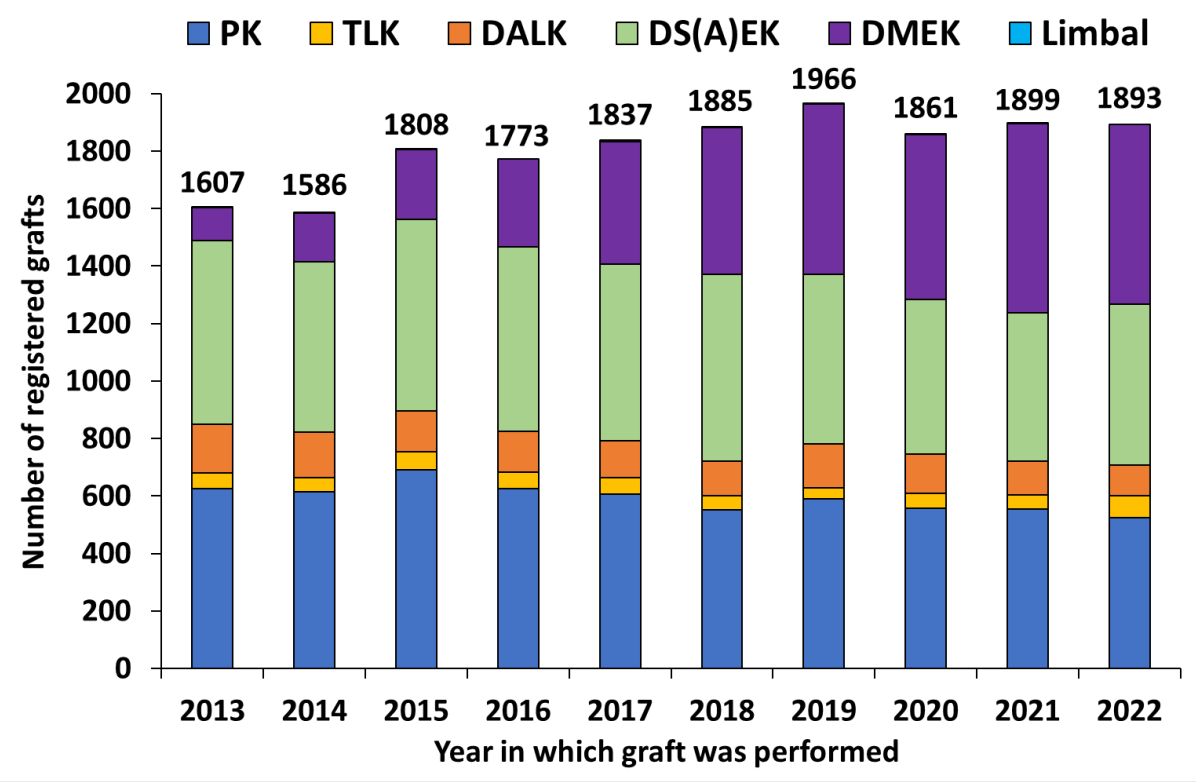


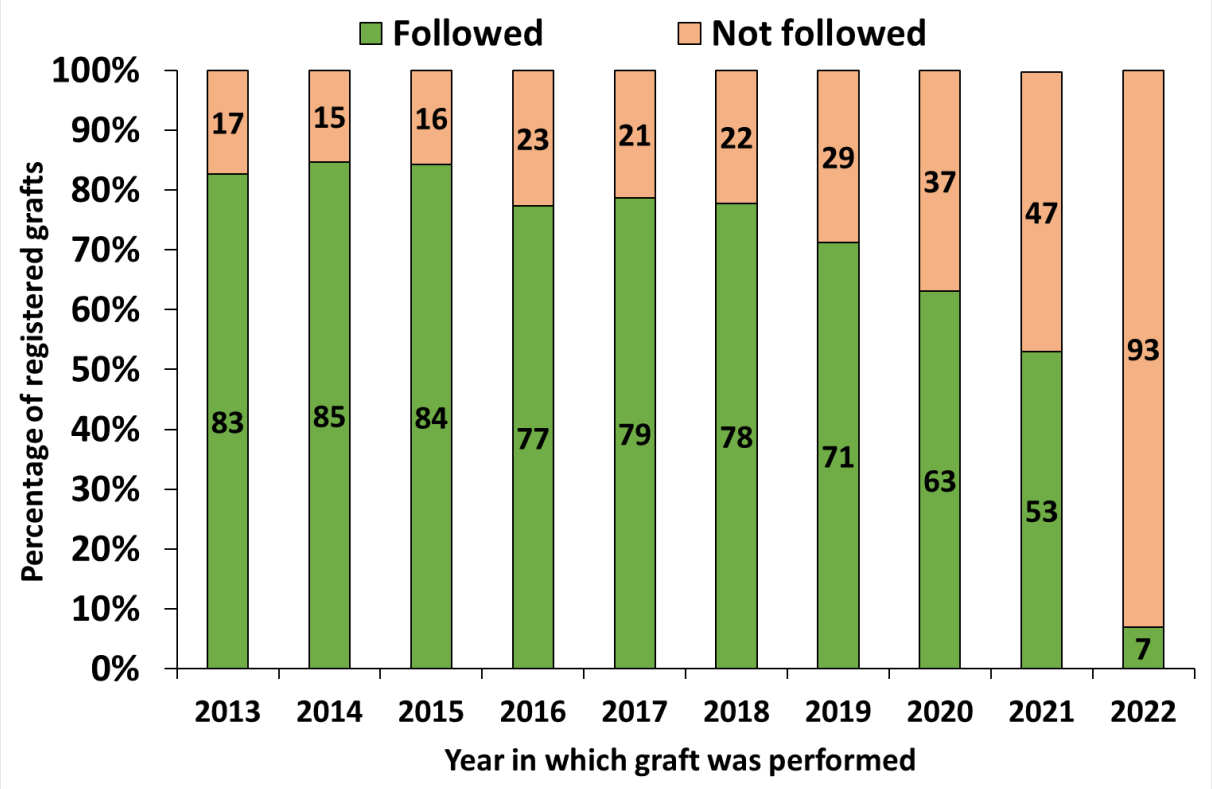
Table 3 Percentage of grafts registered annually with the ACGR, by graft type, 2013 to 2022

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
PK	39%	39%	38%	35%	33%	29%	30%	30%	29%	28%
TLK	3%	3%	3%	3%	3%	3%	2%	3%	3%	4%
DALK	10%	10%	8%	8%	7%	6%	8%	7%	6%	6%
DS(A)EK	40%	37%	37%	36%	34%	34%	30%	29%	27%	30%
DMEK	7%	11%	13%	17%	23%	27%	30%	31%	35%	33%
Limbal	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	0%
Total	**1607**	**1586**	**1808**	**1773**	**1837**	**1885**	**1966**	**1861**	**1899**	**1893**

The ACGR requests follow-up in September. The first follow-up request will occur the year following the graft, so between 9 and 21 months after it is performed. Because of the delay in time to first follow-up, the percentage of grafts with follow-up is lowest the more recently the graft was performed, as shown in Figure 3. Most grafts with follow-up in the first year post-graft will be failed grafts where the eye has been regrafted and therefore the failure of the prior graft is known to the Registry.

Three-quarters of grafts will have follow-up provided at least once by 4-to-5 years post-graft. A final request for first follow-up will be sent at 5-years post-graft, and if none is received, the graft will be recorded as lost to follow-up. From 5-years onwards, the proportion of grafts followed in single annual cohorts can sometimes reach 90% but tends to average closer to 85%. As shown in Table 2, small proportions of recipients are also known to die prior to follow-up information being received.

Figure 3 Percentage of grafts with follow-up provided to the ACGR stratified by year of graft



2 Indication for Graft

The four most common indications for graft in the database are failed previous graft (25%), keratoconus (23%), Fuchs' endothelial dystrophy (19%), and endothelial failure/bullous keratopathy (17%). These account for 84% of all grafts. Indication for graft varies depending on the type of graft, as does the likelihood that the graft is a repeat procedure. Table 4 shows the proportion of grafts that are repeat procedures. The top three indications for each type of graft excluding repeat procedures, are highlighted, showing the variation across groups.

Table 4 Indication for graft, 1985 to 2022, stratified by type of graft

	PK	TLK	DALK	DS(A)EK	DMEK	Total
Failed previous graft	28%	15%	4%	25%	22%	25%
Keratoconus	**30%**	7%	**74%**	0%	0%	23%
Fuchs' Endothelial Dystrophy	**8%**	<1%	0%	**43%**	**61%**	19%
Endothelial failure/bullous keratopathy	**16%**	<1%	<1%	**29%**	**14%**	17%
Herpetic eye disease	5%	6%	**5%**	<1%	<1%	4%
Trauma	3%	3%	2%	**2%**	**<1%**	2%
Corneal ulcers/perforations	2%	**12%**	1%	<1%	0%	2%
Non-herpetic infection	2%	3%	**4%**	<1%	0%	2%
Beta-Radiation	<1%	**14%**	<1%	0%	0%	<1%
Pterygium	<1%	**12%**	0%	0%	0%	<1%
Other	6%	27%	10%	1%	1%	6%
Total	28023	1794	2250	8056	4519	44642

Note: Limbal grafts not included

Table 5 shows the same data but confined to the 10-year period from 2013 to 2022. Fuchs' endothelial dystrophy is now the second most common indication for graft behind repeat procedures.

Table 5 Indication for graft, 2013 to 2022, stratified by type of graft

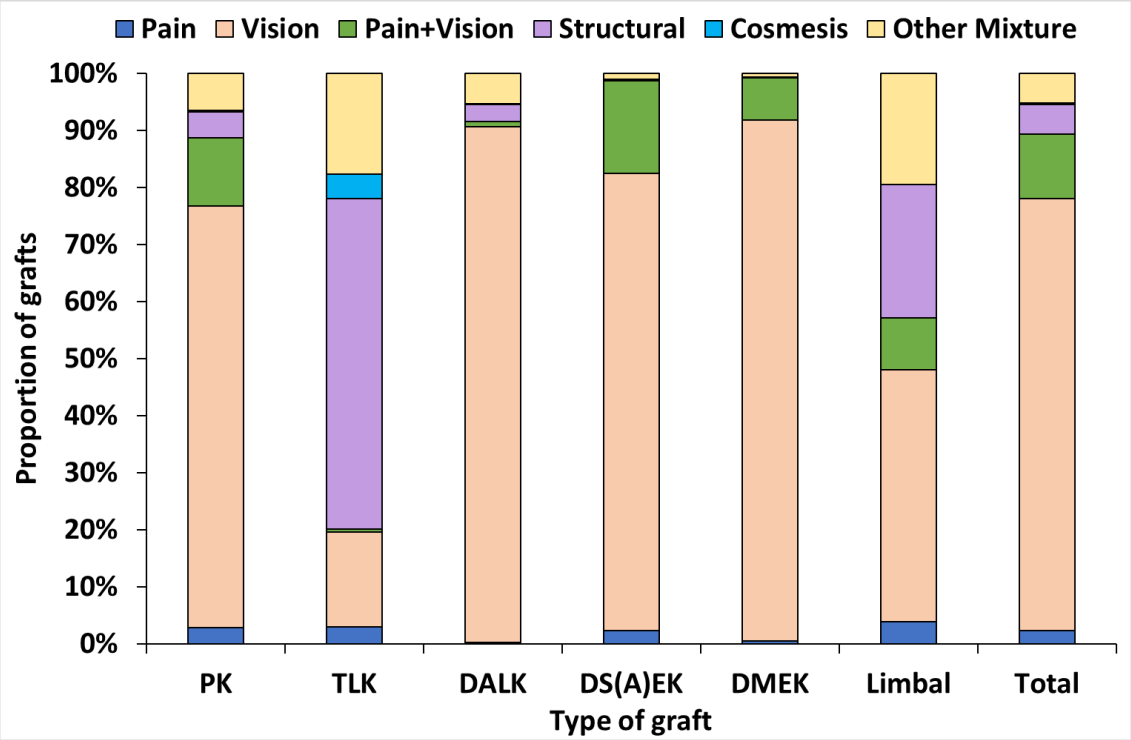
	PK	TLK	DALK	DS(A)EK	DMEK	Total
Failed previous graft	48%	15%	5%	27%	21%	30%
Fuchs' Endothelial Dystrophy	2%	0%	0%	**41%**	**62%**	29%
Keratoconus	**24%**	7%	**72%**	0%	0%	14%
Endothelial failure/bullous keratopathy	**5%**	<1%	<1%	**28%**	**14%**	14%
Herpetic eye disease	**5%**	7%	**5%**	<1%	<1%	3%
Trauma	4%	4%	2%	**2%**	**<1%**	2%
Non-herpetic infections	4%	5%	**4%**	<1%	<1%	2%
Corneal ulcers/perforations	3%	**18%**	2%	<1%	0%	2%
Beta-Radiation	0%	**10%**	<1%	0%	0%	<1%
Glaucoma	0%	**9%**	<1%	0%	0%	<1%
Other	5%	26%	11%	2%	1%	4%
Total	5941	548	1372	6012	4223	18096

Note: Limbal grafts not included

3 Reason for Graft

Surgeons are asked to report the reason a patient has undergone corneal transplantation. They can select any applicable answers from the following options: relief of pain, visual rehabilitation, structural repair, cosmesis. The reason for graft has been provided for 88% of grafts. The most common reason for graft is visual rehabilitation, with this selected in 92% of grafts for which these data have been provided. In one-sixth of cases this is in conjunction with another reason, most often pain relief. The reason for graft varies depending on type of graft, as shown in Figure 4.

Figure 4 Reason for graft, 1985 to 2022, stratified by type of graft



Reason for graft was only provided for 65% of grafts performed prior to 1998. By the late 90s, 95% of grafts were having this information provided at registration (Table 6). The proportion performed solely for visual rehabilitation has increased, to over three-quarters of grafts performed from 2018 to 2022. In contrast, the proportion performed for pain, either individually or in conjunction with other reasons, has halved, from 20% to less than 10%.

Table 6 Reason for graft, 1988 to 2022, stratified by era of graft

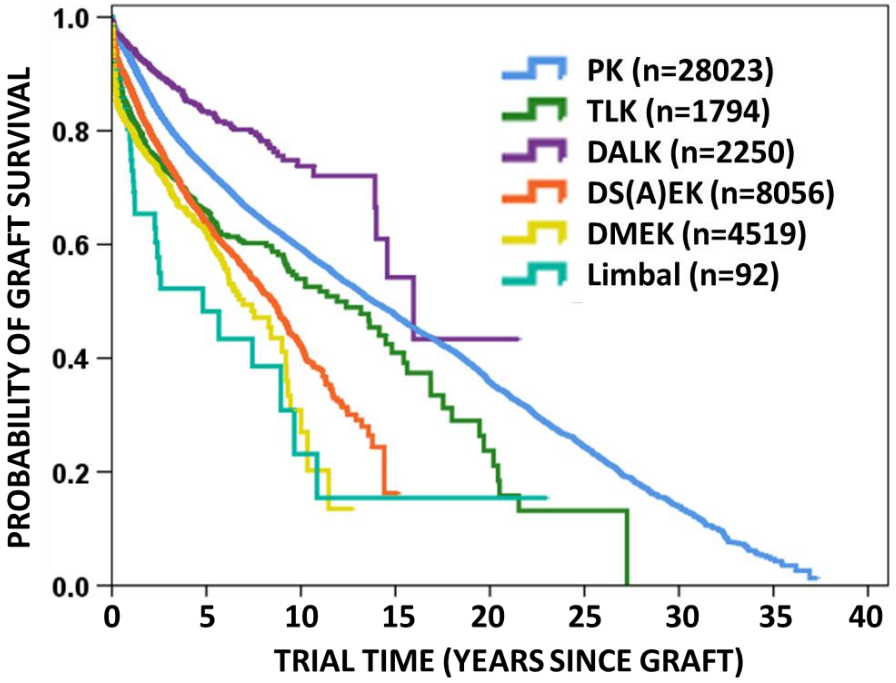
	Vision	Vision + Pain	Pain	Structural	Cosmesis	Other Mix**	Not specified	Total
1998-2002	65%	15%	3%	6%	<1%	7%	4%	4513
2003-2007	70%	14%	2%	6%	<1%	6%	3%	5097
2008-2012	71%	12%	2%	4%	<1%	6%	5%	6764
2013-2017	75%	9%	1%	5%	<1%	5%	5%	8611
2018-2022	77%	7%	1%	4%	<1%	4%	6%	9504
All grafts*	27%	10%	2%	5%	0%	5%	12%	44642

*Includes registered grafts performed from 1985 to 1996. **May also include pain and/or vision.

4 Graft Survival

Surgeons report follow-up to the date they last saw the patient, rather than standardised time-points (e.g. 12 months) and survival is calculated in terms of days since graft. Grafts for which follow-up information has not yet been received are assumed to be surviving at one day post-graft and are treated as such in analyses. The survival of registered grafts is assessed using Kaplan-Meier survival curves. The number at risk tables show how many grafts are followed in each group, at each time point. The survival probability tables extend to the point where a minimum of 20 grafts have follow-up data available. Survival of all grafts stratified by type of graft, is shown in Figure 5.

Figure 5 Survival of all grafts registered from 1985 to 2022, stratified by type of graft

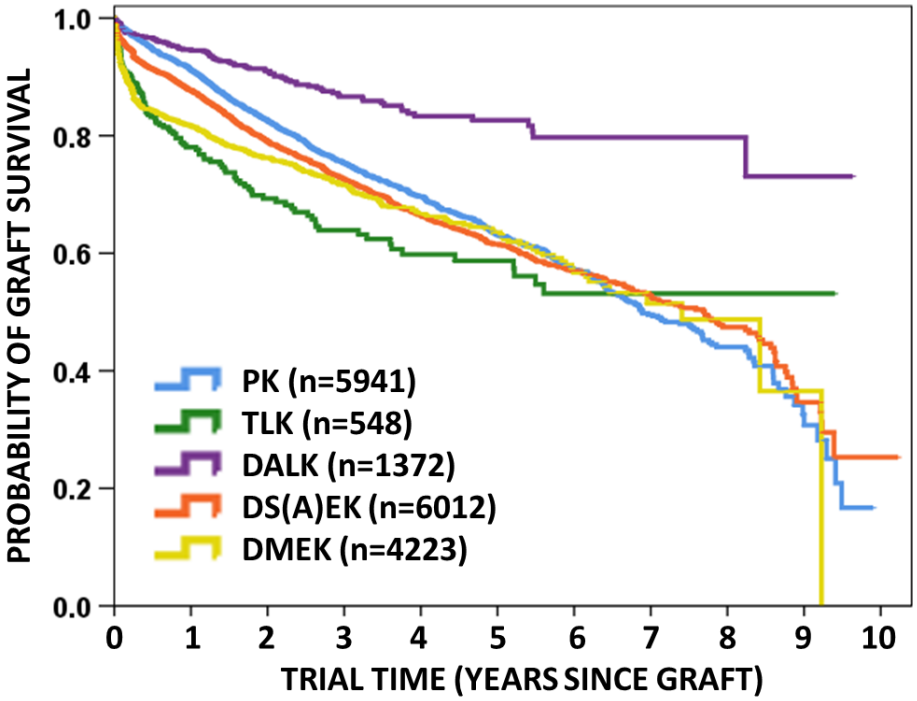


Number at risk	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years
PK	19468	14870	8163	3753	1890	972	460	163	13
TLK	822	577	270	80	26	9	1	NA	NA
DALK	1201	841	321	63	7	1	NA	NA	NA
DS(A)EK	4547	3432	1454	220	2	NA	NA	NA	NA
DMEK	1736	1015	222	8	NA	NA	NA	NA	NA
Limbal	42	28	12	3	2	2	NA	NA	NA

Survival probability	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years
PK	0.93	0.86	0.73	0.59	0.48	0.36	0.24	0.14
TLK	0.83	0.76	0.66	0.54	0.41	NA	NA	NA
DALK	0.95	0.91	0.83	0.74	NA	NA	NA	NA
DS(A)EK	0.88	0.80	0.64	0.42	NA	NA	NA	NA
DMEK	0.81	0.75	0.62	NA	NA	NA	NA	NA
Limbal	0.77	0.65	NA	NA	NA	NA	NA	NA

As shown earlier in Figure 3, the different era in which each type of graft has been performed affects the likelihood that follow-up information will have been received. Figure 6 and the associated tables show the survival of grafts performed in the ten-year period from 2013 to 2022, stratified by type of graft. Limbal grafts are excluded from this analysis as fewer than 20 performed during this time period had follow-up data available.

Figure 6 Survival of all grafts registered from 2013 to 2022, stratified by type of graft

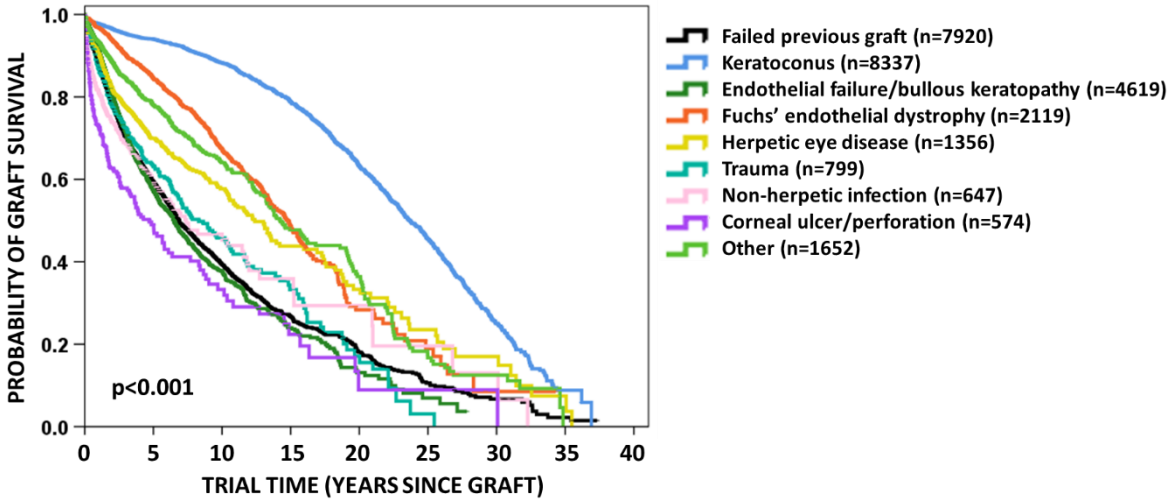


Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
PK	3305	2229	1527	1057	697	420	215	98	18	NA
TLK	196	127	92	63	46	27	13	7	3	NA
DALK	620	428	273	171	106	63	39	16	2	NA
DS(A)EK	3116	2237	1605	1093	732	445	257	114	26	2
DMEK	1622	941	562	309	182	89	28	7	1	NA

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years
PK	0.91	0.83	0.75	0.70	0.63	0.57	0.50	0.44	NA
TLK	0.78	0.69	0.64	0.60	0.59	0.53	NA	NA	NA
DALK	0.95	0.91	0.87	0.83	0.83	0.80	0.80	NA	NA
DS(A)EK	0.88	0.79	0.73	0.67	0.62	0.57	0.53	0.47	0.35
DMEK	0.82	0.76	0.72	0.67	0.64	0.57	0.52	NA	NA

One of the major factors affecting graft survival has consistently been found to be indication for graft. The following analyses show the survival for each individual type of graft, stratified by the indications for graft, for each type of graft. Grafts where an underlying condition is known to have led to endothelial failure, perforation, or scar/opacity, are categorised according to the original condition.

Figure 7 Survival of PKs performed from 1985 to 2022, stratified by indication for graft

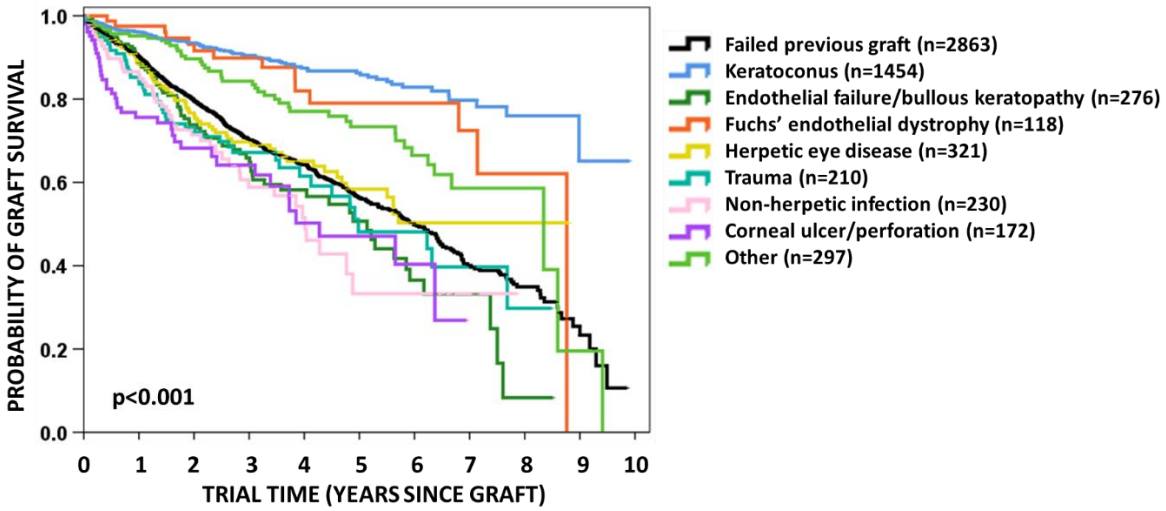


Number at risk	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years
Failed previous graft	5188	3873	1930	689	260	112	39	14	3
Keratoconus	6318	5040	3137	1838	1168	695	363	125	8
Endothelial failure/BK	3073	2133	878	258	78	21	6	NA	NA
Fuchs' endothelial dystrophy	1707	1453	952	444	155	34	10	1	NA
Herpetic eye disease	932	680	357	152	63	35	16	8	2
Trauma	509	379	189	72	31	11	1	NA	NA
Non-herpetic infection	329	237	111	34	11	6	3	2	NA
Corneal ulcer/perforation	246	162	72	24	9	2	1	NA	NA
Other	1166	913	537	243	114	56	21	12	NA

Survival probability	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years
Failed previous graft	0.89	0.79	0.59	0.39	0.27	0.18	0.11	NA
Keratoconus	0.98	0.97	0.94	0.88	0.79	0.63	0.46	0.25
Endothelial failure/BK	0.91	0.81	0.58	0.38	0.24	0.13	NA	NA
Fuchs' endothelial dystrophy	0.97	0.94	0.85	0.68	0.49	0.28	NA	NA
Herpetic eye disease	0.91	0.82	0.70	0.58	0.44	0.33	NA	NA
Trauma	0.87	0.78	0.63	0.46	0.33	NA	NA	NA
Non-herpetic infection	0.82	0.74	0.60	0.47	NA	NA	NA	NA
Corneal ulcer/perforation	0.73	0.63	0.49	0.33	NA	NA	NA	NA
Other	0.93	0.89	0.78	0.64	0.48	0.36	0.17	NA

As shown in tables 4 and 5, the indications reported for PKs have changed in recent years. Figure 8, and its related tables, present the results for PK performed from 2013 to 2022.

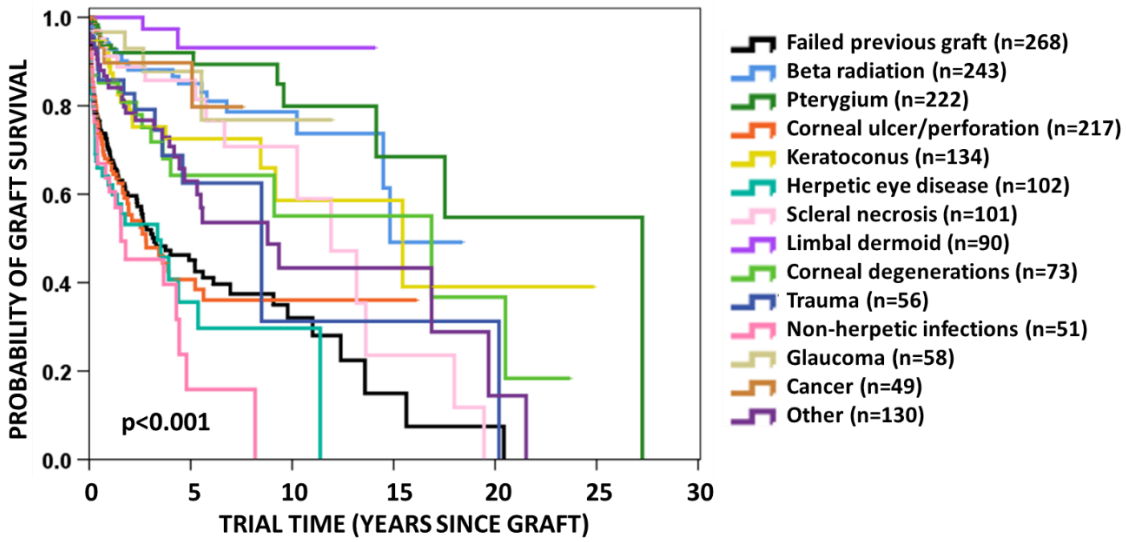
Figure 8 Survival of PKs performed from 2013 to 2022, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years
Failed previous graft	1582	1067	734	528	347	209	108	53	12
Keratoconus	861	587	389	265	182	105	56	27	5
Endothelial failure/BK	160	97	64	40	24	13	6	1	NA
Fuchs' endothelial dystrophy	75	60	46	28	20	15	10	4	NA
Herpetic eye disease	180	118	87	59	36	21	10	5	NA
Trauma	105	72	44	29	17	14	8	2	NA
Non-herpetic infection	100	57	33	19	7	5	2	NA	NA
Corneal ulcer/perforation	62	41	28	17	11	4	NA	NA	NA
Other	180	130	102	72	54	34	15	6	1

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
Failed previous graft	0.90	0.80	0.70	0.64	0.56	0.50	0.40	0.35
Keratoconus	0.96	0.94	0.91	0.87	0.86	0.83	0.80	0.76
Endothelial failure/BK	0.89	0.74	0.66	0.58	0.51	NA	NA	NA
Fuchs' endothelial dystrophy	0.98	0.93	0.90	0.82	0.79	NA	NA	NA
Herpetic eye disease	0.88	0.77	0.70	0.65	0.58	0.50	NA	NA
Trauma	0.85	0.73	0.67	0.62	NA	NA	NA	NA
Non-herpetic infection	0.86	0.71	0.59	NA	NA	NA	NA	NA
Corneal ulcer/perforation	0.76	0.68	0.64	NA	NA	NA	NA	NA
Other	0.95	0.90	0.84	0.77	0.73	0.67	NA	NA

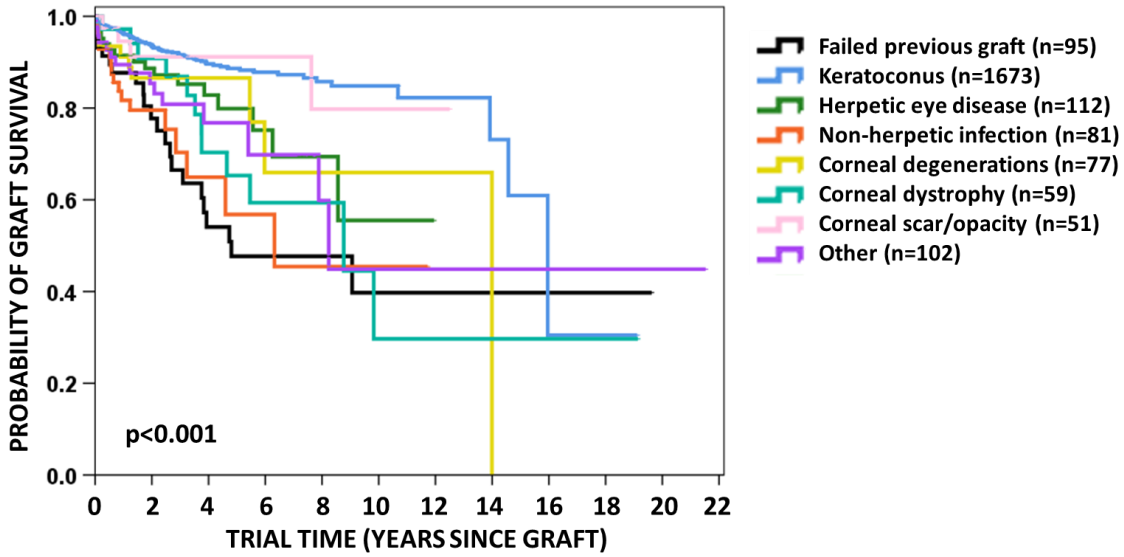
Figure 9 Survival of TLKs performed from 1985 to 2022, stratified by indication for graft



Number at Risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years
Failed previous graft	112	80	57	46	38	29	16	10
Beta radiation	123	86	72	61	44	37	25	16
Pterygium	118	79	62	46	37	31	24	14
Corneal ulcer/perforation	76	42	28	22	18	12	7	2
Keratoconus	58	42	34	24	20	18	11	8
Herpetic eye disease	30	21	15	8	6	4	3	2
Scleral necrosis	41	32	27	25	21	15	8	7
Limbal dermoid	56	42	35	25	21	16	8	5
Corneal degeneration	45	30	24	18	14	10	9	6
Trauma	31	26	20	12	9	5	4	1
Non-herpetic infection	19	9	8	5	2	1	1	NA
Glaucoma	27	23	13	10	9	4	2	1
Cancer	22	15	11	9	9	4	NA	NA
Other	64	50	41	33	22	15	11	8

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years
Failed previous graft	0.70	0.60	0.52	0.47	0.45	0.41	NA
Beta radiation	0.94	0.88	0.88	0.88	0.85	0.81	0.79
Pterygium	0.94	0.92	0.92	0.92	0.92	0.89	0.89
Corneal ulcer/perforation	0.67	0.55	0.48	0.41	NA	NA	NA
Keratoconus	0.89	0.79	0.75	0.73	0.73	NA	NA
Herpetic eye disease	0.62	0.53	NA	NA	NA	NA	NA
Scleral necrosis	0.91	0.89	0.86	0.86	0.86	NA	NA
Limbal dermoid	1.00	1.00	0.97	0.97	0.93	NA	NA
Corneal degeneration	0.85	0.81	0.75	NA	NA	NA	NA
Trauma	0.86	0.83	0.79	NA	NA	NA	NA
Non-herpetic infection	NA	NA	NA	NA	NA	NA	NA
Glaucoma	0.97	0.93	NA	NA	NA	NA	NA
Cancer	0.90	NA	NA	NA	NA	NA	NA
Other	0.84	0.78	0.77	0.71	0.63	NA	NA

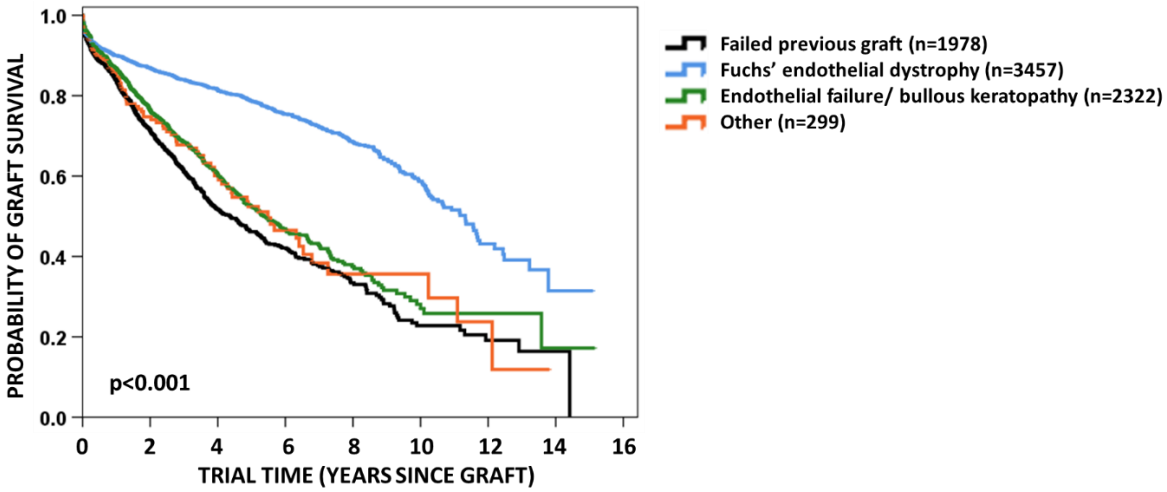
Figure 10 Survival of DALKs performed from 2000 to 2022, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years	12 Years
Failed previous graft	44	29	23	17	15	12	8	5	1
Keratoconus	892	611	429	306	229	178	102	46	16
Herpetic eye disease	69	61	43	35	23	15	6	2	NA
Non-herpetic infection	41	26	13	10	7	6	3	1	NA
Corneal degenerations	40	27	23	15	9	6	4	3	1
Corneal dystrophy	32	24	21	16	13	9	5	2	2
Corneal scar/opacity	32	25	17	14	11	8	7	2	1
Other	51	38	28	18	14	9	5	2	1

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years
Failed previous graft	0.88	0.78	0.67	NA	NA	NA	NA	NA
Keratoconus	0.96	0.94	0.92	0.90	0.89	0.88	0.86	0.85
Herpetic eye disease	0.92	0.89	0.85	0.83	0.80	NA	NA	NA
Non-herpetic infection	0.82	0.80	NA	NA	NA	NA	NA	NA
Corneal degenerations	0.91	0.87	0.87	NA	NA	NA	NA	NA
Corneal dystrophy	0.97	0.91	0.87	NA	NA	NA	NA	NA
Corneal scar/opacity	0.95	0.91	NA	NA	NA	NA	NA	NA
Other	0.90	0.85	0.81	NA	NA	NA	NA	NA

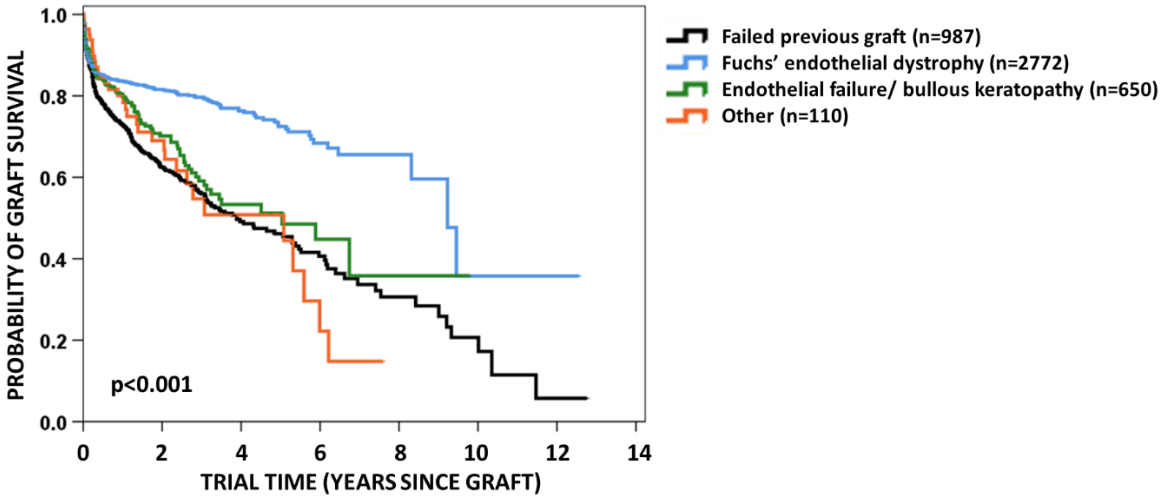
Figure 11 Survival of DS(A)EKs performed from 2006 to 2022, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years	12 Years	14 Years
Failed previous graft	1022	694	486	319	238	171	83	31	13	1
Fuchs' endothelial dystrophy	2166	1781	1448	1149	893	662	367	155	43	4
Endothelial failure/bullous keratopathy	1201	845	588	404	280	191	76	27	9	2
Other	158	112	79	58	43	26	11	7	2	NA

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years	12 Years
Failed previous graft	0.84	0.71	0.61	0.52	0.46	0.42	0.33	0.23	NA
Fuchs' endothelial dystrophy	0.90	0.87	0.84	0.82	0.79	0.75	0.69	0.59	0.43
Endothelial failure/bullous keratopathy	0.87	0.76	0.69	0.61	0.52	0.47	0.38	0.28	NA
Other	0.85	0.75	0.68	0.60	0.52	0.47	NA	NA	NA

Figure 12 Survival of DMEKs performed from 2007 to 2022, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
Failed previous graft	392	228	160	93	65	44	23	19
Fuchs' endothelial dystrophy	1095	651	382	218	128	65	27	11
Endothelial failure/bullous keratopathy	201	105	58	33	21	9	3	2
Other	48	31	14	10	8	3	1	NA

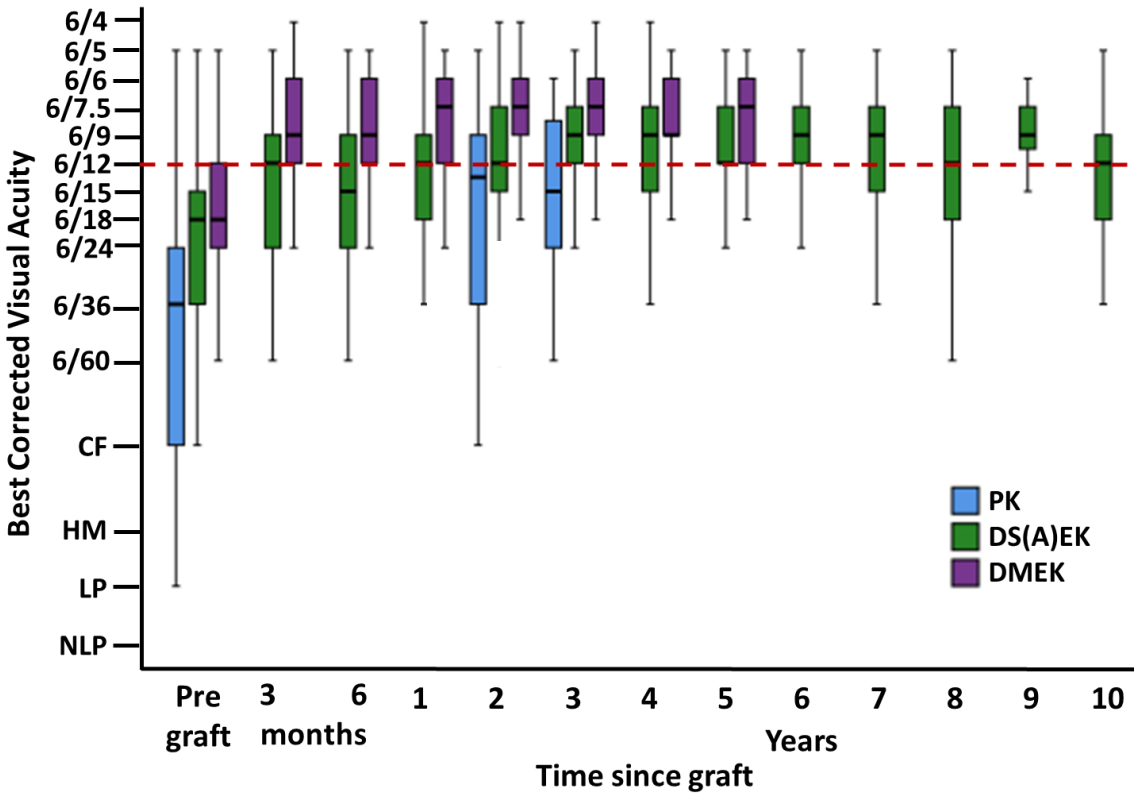
Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years
Failed previous graft	0.73	0.63	0.56	0.49	0.46	0.41	0.34
Fuchs' endothelial dystrophy	0.84	0.82	0.80	0.76	0.73	0.68	0.66
Endothelial failure/bullous keratopathy	0.80	0.70	0.59	0.53	0.51	NA	NA
Other	0.80	0.69	NA	NA	NA	NA	NA

5 Visual Acuity

The most commonly reported aim of corneal grafting is improvement in visual acuity. To be successful, a graft must therefore firstly survive, and then secondly provide a level of best corrected visual acuity (BCVA) that is adequate for the recipient's needs. Data from the ACGR chart the visual outcomes in grafts at various time points post-graft.

Figure 13 and Figure 14 show the BCVA in the grafted eye at various time points, for first grafts performed for Fuchs' endothelial dystrophy (FED) and keratoconus, respectively. These data are for grafts performed since 2008 and include data for surviving grafts at each time point. They are stratified by graft type, with box plots presented for groups with data available for 20 or more grafts. The box indicates the interquartile range (middle 50%) of values, with the central line showing the median value. Functional vision of 6/12 is indicated by the red dashed line. The accompanying tables indicate the number of grafts for which data were available at each time point, with analyses performed where at least 20 grafts had data provided. Improvements in BCVA were found in surviving grafts, for all graft types, for both indications for graft.

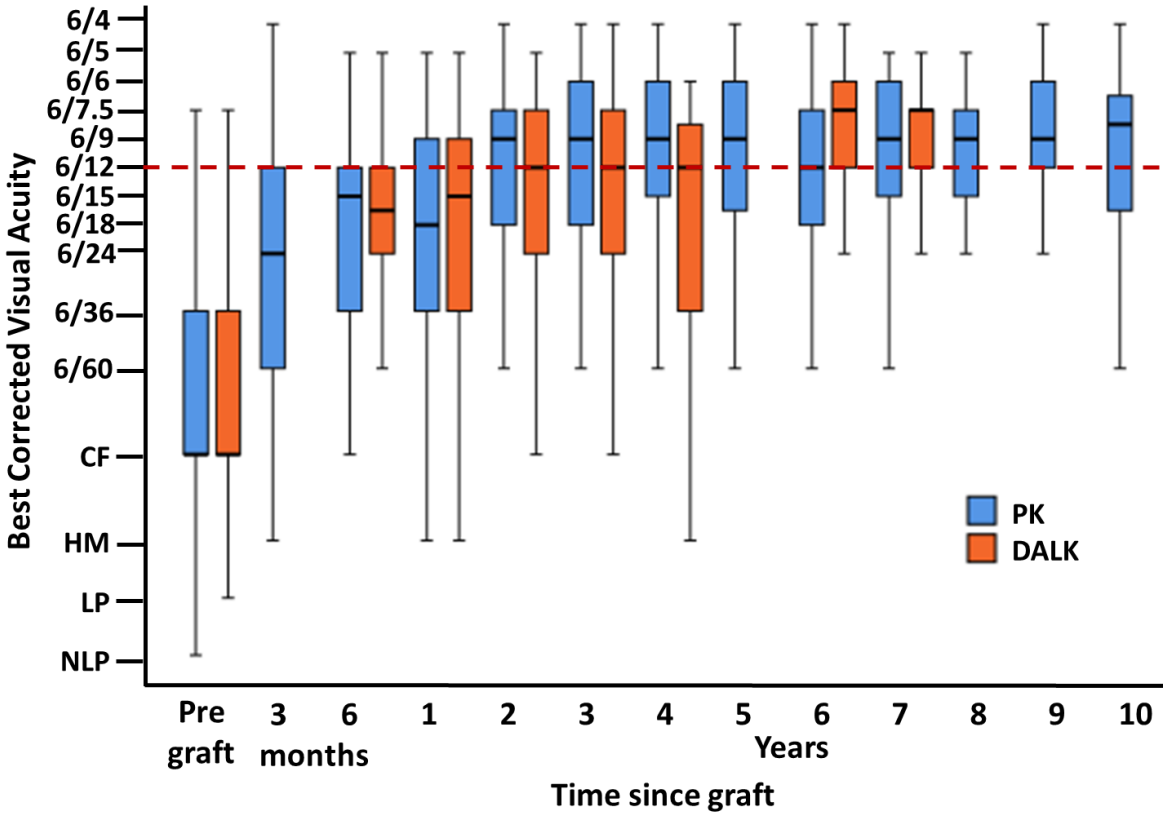
Figure 13 BCVA at various time points pre- and post-graft, in surviving grafts performed for Fuchs' endothelial dystrophy from 2008 to 2022, stratified by type of graft



	Pre graft	3 months	6 months	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
PK	321	5	5	19	38	20	16	10	19	14	10	5	6
DS(A)EK	3178	147	190	297	245	197	118	113	91	74	47	27	25
DMEK	2610	139	134	277	137	93	40	32	16	7	1	1	1

For FED, the pre-graft BCVA varied significantly across graft types, with DMEK performed in eyes with significantly better vision than either PK or DS(A)EK, and DS(A)EK in eyes with better vision than PK (all p<0.001). The median BCVA for eyes undergoing PK had not reached a functional level of 6/12 at either 2-years or 3-years post-graft. The vision in these eyes were significantly poorer than both EK groups at each of these times. There were insufficient data to analyse outcomes for PK at any other time points. Functional vision was achieved in a majority of eyes with surviving grafts at 3-months for both EK groups. There was a drop to a median BCVA of 6/15 in DS(A)EK surviving at 6-months, however from that point median BCVA was 6/12 or better in surviving grafts, at yearly intervals up to 5-years post graft for DMEK and 10-years for DS(A)EK. Post-graft BCVA in eyes undergoing DMEK was significantly better than that in those undergoing DS(A)EK, up to 5-years post-graft.

Figure 14 BCVA at various time points pre- and post-graft, in surviving grafts performed for keratoconus from 2008 to 2022, stratified by type of graft



	Pre graft	3 Months	6 Months	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
PK	2369	53	38	257	187	125	86	79	52	43	20	32	20
DALK	1432	17	48	130	87	53	31	17	24	25	7	7	4

Pre-graft visual acuity was significantly poorer in eyes that underwent PK (p<0.001). Median post-graft BCVA achievement reached functional vision by 2-years post-graft for both PK and DALK performed for keratoconus. This was maintained to 10-years for PK and 7-years for DALK. The post-graft BCVA was significantly better following PK compared to DALK at 2-years, and 4-years post graft (p=0.024, p=0.027).