

Supplementary Online Content

Lass JH, Benetz BA, Patel SV, et al; for the Cornea Preservation Time Study Group. Donor, recipient, and operative factors associated with increased endothelial cell loss in the Cornea Preservation Time Study. *JAMA Ophthalmol*. Published October 26, 2018.
doi:10.1001/jamaophthalmol.2018.5669

eTable 1. Factors Not Associated with 3-year Endothelial Cell Density in the Cornea Preservation Time Study

eTable 2. Mean Endothelial Cell Density Over Time by Select Recipient, Donor, and Operative Factors in the Cornea Preservation Time Study

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Factors Not Associated with 3-year Endothelial Cell Density in the Cornea Preservation Time Study

		Base Model ^a	
	N=913	Mean 3 Yr ECD (99% CI) (cells/mm ²)	p-value
Donor/ Recipient Factors			
Donor Gender			0.38
Female	323	1534 (1399, 1670)	
Male	590	1503 (1377, 1630)	
Recipient Gender			0.91
Female	559	1513 (1385, 1641)	
Male	354	1517 (1381, 1653)	
Recipient and Donor Gender Mismatch Groups			0.46
F Donor/F Recipient	192	1510 (1363, 1657)	
M Donor/M Recipient	223	1487 (1343, 1631)	
F Donor/M Recipient	131	1575 (1410, 1739)	
M Donor/F Recipient	367	1517 (1383, 1651)	
Donor Race/Ethnicity			0.94
Black/AA	48	1491 (1272, 1710)	
White	827	1516 (1392, 1640)	
Other	38	1522 (1275, 1768)	
Recipient Race/Ethnicity			0.84
Black/AA	23	1523 (1216, 1829)	
White	847	1517 (1393, 1641)	
Other	43	1466 (1221, 1712)	
Donor Cause of Death			0.49
Cancer	164	1536 (1382, 1690)	
Cardiovascular Disease	363	1492 (1358, 1625)	
Cerebrovascular accident	106	1452 (1279, 1624)	
Pulmonary/ Respiratory	104	1560 (1389, 1731)	
Accident	129	1552 (1388, 1716)	
Other	47	1542 (1318, 1766)	
Dissection to Surgery Time (hours)^b			0.11
Surgeon Dissected Tissue (hours=0)	269	1651 (1457, 1846)	
<24	349	1496 (1364, 1627)	
≥24	291	1507 (1369, 1644)	
Death to Refrigeration Time (hours)			0.37
<2	219	1526 (1381, 1670)	
2 - <3	241	1555 (1410, 1699)	
3 - <4	176	1454 (1300, 1608)	
≥4	185	1502 (1351, 1653)	
Not Refrigerated	92	1511 (1330, 1693)	
Refrigeration to Preservation Time (hours)			0.87
<5	204	1485 (1337, 1632)	
5 - <8	230	1538 (1395, 1681)	
8 - <12	224	1520 (1374, 1665)	
≥12	163	1513 (1359, 1666)	
Not Refrigerated	92	1514 (1334, 1695)	
Death to Preservation Time (hours)			0.76

<7	221	1508 (1364, 1653)	
7 - <10	238	1543 (1398, 1688)	
10 - <14	229	1519 (1377, 1662)	
≥14	225	1490 (1345, 1635)	
Glaucoma Medications at Enrollment			0.25
No	855	1521 (1398, 1645)	
Yes	58	1439 (1229, 1649)	
Prior Glaucoma Surgery			0.45
No	894	1516 (1393, 1640)	
Yes	19	1424 (1092, 1757)	
Diabetic Recipient			0.63
No	773	1519 (1394, 1643)	
Yes	140	1494 (1331, 1658)	
Current Cigarette Smoker			0.55
No	867	1512 (1388, 1635)	
Yes	46	1561 (1325, 1796)	
Operative Factors			
Resident or Fellow Involved			0.55
No	812	1506 (1379, 1634)	
Yes	101	1550 (1354, 1746)	
Insertion Method			0.45
Busin Glide	94	1676 (1397, 1956)	
Direct Forceps	328	1478 (1289, 1667)	
Glide Pull	21	1355 (968, 1742)	
Injector	275	1534 (1320, 1747)	
Pull Through	92	1581 (1261, 1901)	
Sheets Glide/Shovel	103	1415 (1129, 1702)	
Insertion with Protection^c			0.10
No	547	1471 (1330, 1611)	
Yes	366	1602 (1418, 1785)	
Incision Location (Temporal)^d			0.14
Not temporal	92	1420 (1213, 1627)	
Temporal	821	1539 (1412, 1666)	
Incision Site			0.83
Cornea	697	1508 (1366, 1651)	
Scleral Tunnel	216	1526 (1334, 1719)	
Incision Size (mm)			0.66
3.0 ± 0.2	24	1332 (816, 1848)	
3.5 ± 0.2	72	1506 (1175, 1838)	
4.0 ± 0.2	308	1462 (1263, 1660)	
4.5 ± 0.2	114	1614 (1390, 1838)	
5.0 ± 0.2	313	1502 (1330, 1675)	
>5.2	82	1544 (1300, 1789)	
Graft Diameter (mm)			0.47
<8	15	1289 (928, 1650)	
8 - <8.5	508	1520 (1381, 1660)	
8.5 - <9	378	1527 (1383, 1671)	
≥9	12	1363 (919, 1806)	
AC Maintainer			0.35
No	670	1490 (1351, 1630)	
Yes	243	1559 (1385, 1734)	
# Venting Incisions			0.85
0	456	1524 (1369, 1679)	

1	7	1174 (544, 1804)	
2	10	1240 (677, 1803)	
3	72	1406 (1089, 1723)	
4	368	1581 (1367, 1794)	
Peripheral Host Stroma Scraping			0.48
No	295	1544 (1380, 1707)	
Yes	618	1494 (1350, 1638)	
Air Remaining after Surgery (mm)^e			0.36
<3	23	1426 (965, 1887)	
3-5	225	1452 (1281, 1624)	
6-8	434	1506 (1362, 1649)	
>8	223	1596 (1412, 1779)	

Abbreviations: PACE = Pseudophakic/aphakic corneal edema; FECD = Fuchs' endothelial corneal dystrophy; IOP = intraocular pressure; ECD = endothelial cell density; DSAEK = Descemet stripping automated endothelial keratoplasty; IOP = intraocular pressure; CIARC = Cornea Image Analysis Reading Center

- a. Model based means adjusted for recipient and surgeon (random effects) and preoperative endothelial cell density (as determined by CIARC) and preservation time group (fixed effects).
- b. There are 4 eyes for which dissection to surgery hours is missing.
- c. Insertion Method with protection includes "Injector – EndoSerter", "Injector - Neusidl Corneal", and "Injector - Tan Endo Glide", and "Injector - Busin Glide"; insertion method without protection includes "Direct Forceps", "Glide Pull", "Pull Through", "Sheets Glide", "Shovel", "Injector – Endoshield", and other.
- d. Temporal insertion location includes inferotemporal, superotemporal, and temporal.
- e. There are 8 eyes for which air remaining is missing.

eTable 2. Mean Endothelial Cell Density Over Time^a by Select Recipient, Donor, and Operative Factors in the Cornea Preservation Time Study

Number of Eyes (Mean ECD, Cells/mm ²) ^a					
Baseline Factor	Baseline	6 mo	1 y	2 y	3 y
Overall	913 (2756)	852 (1930)	866 (1873)	857 (1709)	913 (1516)
Donor Factors					
Diabetes					
No	674 (2773)	623 (1972)	640 (1914)	636 (1745)	674 (1552)
Yes	239 (2707)	229 (1816)	226 (1756)	221 (1603)	239 (1410)
Age (y)					
≤30	52 (3011)	50 (2204)	50 (2228)	50 (2040)	52 (1843)
31-50	144 (2821)	129 (2023)	138 (1969)	134 (1788)	144 (1592)
51-60	232 (2726)	217 (1963)	215 (1879)	215 (1709)	232 (1507)
61-70	352 (2733)	328 (1854)	332 (1784)	331 (1621)	352 (1445)
71-75	133 (2699)	128 (1867)	131 (1870)	127 (1733)	133 (1514)
Storage Solution					
Life 4°C	35 (2821)	33 (1630)	33 (1647)	34 (1470)	35 (1214)
Optisol GS	878 (2753)	819 (1946)	833 (1885)	823 (1723)	878 (1532)
Change in Solution^b					
Original	256 (2733)	236 (2054)	243 (2024)	243 (1824)	256 (1598)
Fresh	388 (2786)	359 (1871)	360 (1803)	356 (1644)	388 (1458)
Surgeon Dissected	269 (2734)	257 (1980)	263 (1922)	258 (1792)	269 (1635)
DSAEK lenticule thickness (μm)					
<100	138 (2657)	124 (1836)	125 (1782)	127 (1651)	138 (1416)
100 - <125	266 (2763)	245 (1948)	247 (1913)	245 (1725)	266 (1554)
125 - <150	244 (2783)	232 (1961)	233 (1892)	229 (1744)	244 (1528)
≥150	231 (2785)	219 (1891)	228 (1837)	224 (1654)	231 (1491)
Any Eye Bank Observations^c					
No	522 (2761)	485 (1941)	496 (1876)	486 (1712)	522 (1505)
Yes	122 (2784)	110 (1837)	107 (1806)	113 (1619)	122 (1460)
Surgeon Dissected Tissue	269 (2734)	257 (1988)	263 (1932)	258 (1802)	269 (1641)
Recipient Factors					
Preservation Time					
0-7 Days	470 (2745)	440 (1964)	448 (1899)	438 (1747)	470 (1555)
8-14 Days	443 (2768)	412 (1895)	418 (1847)	419 (1672)	443 (1476)
Diagnosis					
PACE (without FECD)	36 (2794)	33 (1956)	36 (1761)	35 (1502)	36 (1313)
FECD	877 (2754)	819 (1928)	830 (1882)	822 (1724)	877 (1530)
Age (y)					
42-65	254 (2752)	237 (1956)	239 (1909)	238 (1719)	254 (1553)
66-75	405 (2752)	377 (1948)	385 (1897)	383 (1719)	405 (1530)
76-91	254 (2766)	238 (1879)	242 (1808)	236 (1687)	254 (1461)
Gender					
Female	559 (2762)	527 (1935)	533 (1875)	527 (1711)	559 (1517)
Male	354 (2747)	325 (1921)	333 (1871)	330 (1706)	354 (1514)
Race/Ethnicity					
Black/AA	23 (2740)	21 (1862)	22 (1747)	18 (1652)	23 (1520)

White	847 (2754)	789 (1936)	801 (1881)	800 (1713)	847 (1519)
Other	43 (2800)	42 (1889)	43 (1840)	39 (1679)	43 (1467)
Baseline IOP					
8-19	839 (2759)	780 (1923)	795 (1866)	787 (1700)	839 (1505)
20-27	74 (2719)	72 (2011)	71 (1968)	70 (1831)	74 (1659)
Diabetes					
No	773 (2752)	732 (1930)	737 (1875)	732 (1713)	773 (1518)
Yes	140 (2775)	120 (1931)	129 (1864)	125 (1692)	140 (1507)
Current Cigarette Smoker					
No	867 (2758)	811 (1928)	823 (1872)	812 (1712)	867 (1515)
Yes	46 (2714)	41 (1973)	43 (1898)	45 (1667)	46 (1524)
Glaucoma Medications at Enrollment					
No	855 (2757)	798 (1932)	812 (1874)	806 (1712)	855 (1522)
Yes	58 (2745)	54 (1905)	54 (1868)	51 (1678)	58 (1442)
Prior Glaucoma Surgery					
No	894 (2757)	834 (1927)	847 (1874)	841 (1710)	894 (1519)
Yes	19 (2704)	18 (2052)	19 (1851)	16 (1698)	19 (1384)
Operative Complications^d					
No	867 (2752)	808 (1947)	820 (1896)	815 (1730)	867 (1536)
Yes	46 (2833)	44 (1696)	46 (1575)	42 (1410)	46 (1226)
Graft Diameter (mm)					
<8	15 (2626)	15 (1658)	15 (1593)	15 (1443)	15 (1230)
8 - <8.5	508 (2771)	477 (1967)	488 (1902)	472 (1732)	508 (1533)
8.5 - <9	378 (2743)	350 (1919)	351 (1864)	358 (1710)	378 (1521)
≥9	12 (2673)	10 (1665)	12 (1760)	12 (1508)	12 (1322)
Complete Air Fill Duration (min)					
<10	23 (2741)	23 (2046)	23 (2010)	22 (1808)	23 (1627)
10 - <20	667 (2771)	636 (1941)	644 (1868)	632 (1739)	667 (1543)
≥20	218 (2704)	188 (1888)	194 (1851)	198 (1629)	218 (1459)
Injection of Viscoelastic					
No	143 (2776)	132 (1919)	138 (1801)	132 (1623)	143 (1399)
Yes	770 (2752)	720 (1934)	728 (1897)	725 (1736)	770 (1554)
Concomitant Cataract Surgery					
No	416 (2784)	384 (1905)	396 (1843)	387 (1687)	416 (1482)
Yes	497 (2733)	468 (1956)	470 (1906)	470 (1733)	497 (1551)

Abbreviations: PACE = Pseudophakic/aphakic corneal edema; FECD = Fuchs' endothelial corneal dystrophy; IOP = intraocular pressure; ECD = endothelial cell density; DSAEK = Descemet stripping automated endothelial keratoplasty; IOP = intraocular pressure; CIARC = Cornea Image Analysis Reading Center

- a. All post-baseline ECD values are adjusted for recipient and surgeon (random effects).
- b. Corneas dissected by the eye bank were either kept in the original solution the entire time until surgery or they were placed in fresh solution before surgery.
- c. Eye bank observations include significant increase in degree of stromal folds, significant increase of stress lines, decrease in posterior stroma clarity, posterior stromal edema, Descemet membrane tear or perforation, stromal cap not clear or not centered (within 1 mm of center), stromal cap not adhered to

stromal bed, gross variation in graft thickness, chatter or irregularities noticed within cut, observed touches of endothelium during mounting or removal from artificial chamber, air bubbles noted at the interface, other observations during or after cutting which could affect surgical technique, and other write-ins.

d. Operative complications include vitreous loss (unplanned), posterior capsule rupture, suprachoroidal hemorrhage, significant hyphema, inverted donor tissue, difficult unfolding and positioning without use of positioning hook, difficult unfolding and positioning with use of positioning hook, difficult air fill and retention in positioning, reinsertion of donor after extrusion, and other write-ins.