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Penetrating Keratoplasty as an Alternative to Deep Anterior Lamellar Keratoplasty

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ABSTRACT:

Background: A corneal transplant, or graft, known as a "penetrating keratoplasty," replaces the whole thickness of the cornea. The inner layers of the cornea are transplanted during traditional posterior lamellar keratoplasty (LK) and the more recent “endothelial keratoplasty (EK) operations. Deep lamellar EK, Descemet's stripping (automated) EK (DSEK or DSAEK), Descemet's membrane EK, and Descemet's membrane automated EK” are examples of these procedures' variations.

Objective: In order to compare “deep anterior lamellar keratoplasty (DALK)” with “penetrating keratoplasty (PK)” for the outcomes of “best spectacle-corrected visual acuity (BSCVA)”, refractive error, immunological graft rejection, and graft survival, it is necessary to evaluate the published literature on DALK.

Methods and Materials: The Cochrane Library and PubMed databases were searched for peer-reviewed literature. The most current search was conducted in May 2009, and the searches were restricted to citations dating back to 1997. 1024 citations in English-language journals were found thanks to the searches. After reviewing the abstracts of these publications, 160 were chosen for likely clinical relevance, of which 53 were found to be pertinent to the assessment aim.

Results: Utilizing “481 DALK eyes and 501 PK eyes, eleven DALK/PK comparison studies (level II and level III evidence)” were found that directly compared the outcomes of the two methods. In nine of the trials that provided vision and refractive data, there was no discernible change in “BSCVA between the two groups”. Although the range of astigmatism was frequently wide for both groups, there was no significant difference in spheroequivalent

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refraction in six of the investigations or in postoperative astigmatism in nine of them. In DALK eyes, “endothelial cell density (ECD)” stabilised six months following surgery. In general, all studies that reported data found that the ECD differences between the DALK and PK groups were substantial at all time points at least 6 months after surgery. At the conclusion of each study, “the endothelial cell density values were higher in the DALK groups”.

Conclusions: Based on level II data from 1 study and level III evidence from 10 trials, DALK is equivalent to PK for the outcome measure of BSCVA, particularly if the surgical approach leaves a small residual host stromal thickness. DALK gives no benefits with regard to the effects of refractive errors. Despite the lack of evidence for improved graft survival in DALK, postoperative results demonstrate that DALK is superior to PK for ECD preservation. Endothelial immune graft rejection cannot occur after DALK, in contrast to PK eyes, which could simplify DALK eyes' long-term therapy. DALK is an excellent alternative for individuals whose endothelium is not damaged when it comes to the visual rehabilitation of corneal illness because it has significant theoretical safety advantages as an extraocular surgery.

INTRODUCTION:

A corneal graft or transplant known as a "penetrating keratoplasty" replaces the entire thickness of the cornea. The inner layers of the cornea are transplanted during traditional posterior “lamellar keratoplasty (LK)” and the more recent “endothelial keratoplasty (EK)” operations. “Deep lamellar EK, Descemet's stripping (automated) EK (DSEK or DSAEK), Descemet's membrane EK, and Descemet's membrane automated EK are examples of these procedures' variations”. [1,2] The key factor in determining whether an anterior or posterior LK operation is necessary is the condition of the corneal endothelium. EK or PK can be used to treat conditions affecting the corneal endothelium, and PK is typically necessary for conditions affecting both the “endothelium and the corneal stroma”. Only a portion of the corneal thickness is replaced after traditional anterior LK.

Zirm carried out the “first successful partial penetrating corneal transplant” on a human being in 1905 using a “spring-driven trephine that von Hippel2 had created in 1888 for partial LK”. The surgical correction of the majority of axial corneal disorders was handled by PK over the course of the final half of the 20th century. Lamellar keratoplasty was typically used to treat less frequent corneal diseases like peripheral ectasias, perforated ulcers, and traumatic tissue loss through tectonic surgery. “The use of lamellar corneal transplant surgery as an alternative to PK for the optical correction of axial corneal diseases with normal corneal endothelium, such as keratoconus, stromal corneal dystrophies, and corneal scars from traumatic injury or infection, has always existed among ophthalmic surgeons, including Paufique,[3] Malbran,[4] Anwar,[5], and others”. The use of lamellar corneal transplants became more popular in the 1970s.[6] However, PK has continued to be the most popular

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corneal transplant surgery for the optical repair of corneal disease due to the technical complexity of the procedure and the often lower postoperative acuity following LK.

Peer-reviewed journal papers, pieces in industry-supported publications, and educational courses offered both privately and at ophthalmological organisation meetings all indicate a rise in interest in more recent anterior lamellar corneal surgeries for vision restoration. The core corneal stroma is removed during one of the most well-known anterior lamellar corneal operations, DALK, while the host corneal endothelium and Descemet's membrane (DM) remain in place. In DALK operations, Descemet's membrane may or may not be exposed.[7] "The absence of potential corneal endothelial cell immune rejection and the anticipated retention of the majority of recipient corneal endothelial cells in DALK surgery, as opposed to the rapid decrease in donor corneal endothelial cell density (ECD) following PK surgery, are the two main theoretical advantages of DALK over PK procedures. The most crucial component of a successful DALK is the removal of all, or nearly all, of the corneal stroma from a lamellar dissection bed". Several surgical procedures have been devised to achieve this goal. This article will provide a succinct summary of DALK methods.

Deep anterior lamellar keratoplasty, or DLK, is the term Sugita and Kondo7 used when they initially introduced their method for treating DM. In this study, the abbreviation DALK is used to refer to deep anterior LK procedures generally because that word eventually came to be extensively used to describe the diffuse lamellar keratitis linked to LASIK surgery. The phrase "maximum depth anterior lamellar keratoplasty" was proposed by Anwar and Teichmann8 to describe the baring of DM. The words "DALK" and "maximum depth DALK (MDDALK)" are used in this study. "The literature frequently fails to distinguish between situations where enough deep corneal stroma was left in the surgical bed to count as a DALK but not an MD-DALK and situations where DM baring was planned (i.e., MDDALK) but was not completed due to perforation, operator caution, and many more. [8] Although DM exposure is occasionally attained, DM exposure is not the intended outcome of the DALK in other approaches that are mentioned, and this distinction is typically not made".

"Depending on the host corneal diameter and the corneal disease being treated, the perimeter of the DALK bed is often set using a trephine diameter of 7 to 8.5 mm to partially cut through the anterior stromal fibres but not deep enough to penetrate the anterior chamber. This partial-thickness trephination may be carried out initially, as in the hydrodelamination technique of Sugita and Kondo [7] or the big-bubble technique of Anwar and Teichmann [9]. After expansion of the corneal stroma with air, as in the air injection technique of Archila10 as modified by Morris et al.11 and Coombes et al. [12]; or following the limbal dissection of a deep lamella [13] The anterior two thirds of the corneal stroma are removed using Sugita and Kondo's7 method of direct dissection following partial trephination, which is followed by fluid injection into the remaining stromal bed and spatula delamination to remove the deeper stromal layers. Following this, there is hydrodelamination and DM exposure in the middle 5 mm of the trephine bed". The direct dissection technique developed by Rostron entails

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trephination followed by direct dissection to remove the stroma that is immediately above the cornea. In the event that DM separates during the air injection, the entire stroma will be eliminated.[10] Anwar begins with a partial-depth trephine cut, just like Sugita and Kondo do, but then violently injects air deep in the stromal bed to separate DM, creating a 'huge bubble' that makes it much easier to remove all of the stroma in the trephine bed. The DM is frequently exposed when employing the direct dissection DALK procedures with air or fluid. "The big-bubble approach, when effective, results in the separation of DM from the deep corneal stroma, whereas Sugita and Kondo's procedure needs peeling off the final thin layer of deep stroma, at least in the middle 5 mm or so. If not, layer-by-layer deep dissection using air, fluid, or an OVD may be necessary in order to try DM exposure. The Melles procedure relies on the surgeon's visual assessment of the depth of the lamellar dissection and calls for a limbal approach. Lamellar dissection is used to make a full-corneal diameter pre-DM pocket, which is then filled with an OVD and trephinated to eliminate the anterior stromal button. The surgeon's capacity to determine visually how close the lamellar dissection blade can approach DM without puncturing it determines the thickness of the remaining stromal bed".

In contrast to Sugita and Kondo's7 earlier attempts, which used cryolathed lenticules, Rostron's DALK techniques typically use full-thickness, lyophilized donor lenticules. Corneal tissue that has been cryopreserved in glycerin has also been accepted. [14] One study specifically evaluated donor corneas implanted in lyophilized or Optisol GS (Bausch & Lomb, Inc., Rochester, NY) eyes and found no statistically significant differences between the 2 preservation techniques. [15] The majority of surgeons employ organ culture medium or full-thickness donor lenticules, as is typical in Europe, which are derived from corneal sclera rims kept in intermediate storage media (for example, Optisol GS). To remove the donor endothelium, use a dry surgical sponge. But many surgeons also perform DM removal. In either scenario, the smooth bed of the exposed (bared) host DM will be juxtaposed to the smooth posterior face of the donor transplant. Removing the endothelium cells also reduces the donor's antigenic load. The interface will not be as regular in DALK procedures if some residual stroma is present, and it is likely to be even less regular if the donor lenticule was also obtained through surgical dissection, as described by Tsubota et al.16 and Panda et al. [13]

METHODS AND MATERIALS:

On December 14, 2006, and October 1, 2007, the PubMed database was searched for peer-reviewed English-language literature, and on December 18, 2006, and October 1, 2007, the Cochrane Library database was searched for citations beginning in 1997. Deep anterior lamellar keratoplasty, also known as DALK, deep lamellar keratoplasty, Descemet's membrane baring, and maximum depth anterior lamellar keratoplasty, were used as search terms together with the MeSH heading corneal transplantation. The 236 citations that came up in the electronic searches were evaluated by the authors, and they chose 88 of them that either certainly or potentially matched the inclusion criteria.

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For further analysis, the writers obtained the whole versions of these 88 publications. The study outcomes or publishing information was not hidden from the reviewers. These articles' full texts were examined by the writers to see whether they fit the selection criteria and should be included. A review of an article reference list revealed one more article. The writers chose 42 papers for methodological review and another 19 for the lead author to use as a guide while drafting the first draught. These 19 papers did not undergo methodological review because they were review articles, single-case reports of problems, or single-case reports of methodology. Each of the chosen articles received ratings from the methodologist based on the strength of the evidence. Well-designed and well-conducted randomised clinical trials received a level I rating; similarly, well-designed case control and cohort studies and subpar randomised clinical trials received a level II rating; and case series, case reports, and subpar case-control or cohort studies received a level III rating. Two studies, both randomised controlled trials, were given level II evidence rating due to their low statistical power, lack of masking, and shoddy randomization procedures. [15]

All other papers, which were classified as level III evidence, were case reports, prospective and retrospective case series, or comparative and noncomparative case series. On May 28, 2009, an updated search was undertaken with the addition of the search term ‘penetrating keratoplasty’ (MeSH and text). This search yielded 788 citations, of which an additional 73 potentially pertinent papers were found and examined. 13 of these were deemed to be pertinent. Additionally, periodic reviews of the literature revealed more recent papers that were pertinent. These extra studies received a level III evidence rating.

RESULTS:

The Appendix (found at http://aaojournal.org) contains comprehensive summaries of the findings from the included investigations. The operational and postoperative outcomes of DALK and PK procedures were directly compared in eleven published studies. Only one study [12] received a level II grade; the other ten received level III ratings. All of the trials were conducted at a single institution, frequently with a single operating surgeon, and efforts were made to account for common variables like diagnosis or age. “Comparing the visual, refractive, early postoperative ECD results, and surgical complications of the two operations is made very helpful by these 11 studies”. Table 1 (which is accessible at http://aaojournal.org) presents these statistics. Part of the findings from those 41 investigations are presented (found at http://aaojournal.org). “Data on a total of 481 eyes with DALK and 501 eyes with PK are included in the 11 clinical comparative DALK/PK trials that have been identified. There were 26 eyes in each group in eight trials,135 DALK and 76 PK eyes in one study, 25 135 DALK and 76 PK eyes in another, and 150 eyes in one study”. Only patients with keratoconus were included in seven of the studies [9–14], only patients with lattice or macular corneal dystrophy were included in one research (15), and other corneal stromal disorders were included in the other three studies. [12]

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Of the 11 comparative studies, there were 6 studies where there was no discernible difference in the postoperative BSCVA between the DALK and PK groups (16), one study where there was a better BSCVA in the DALK group, and 4 studies where there was a better BSCVA in the PK group. [11–16] The biggest number of eyes in each group (150/150) were used in the one study that claimed the DALK group had superior postoperative vision. Overall, there was no discernible difference between the DALK and PK groups in terms of astigmatism or spherical refractive error. Of the additional 31 studies reported in (found at http://aaojournal.org),17 of them provided information on the astigmatism, refractive correction, and postoperative visual acuity of DALK eyes. "Although there was a trend for worse postoperative visual acuity in DALK eyes where DM was not borne and residual stroma in the bed exceeded 10% of total stromal thickness, there was no appreciable difference between DALK or PK eyes as a group". Epithelial, stromal, endothelial, or a combination of these can describe immune-mediated donor-graft rejection. Donor endothelial immune-medicated rejection cannot take place in DALK as it can in PK because the corneal endothelium is not replaced. Following DALK and PK, stromal graft rejection is also possible in the postoperative phase. For the 1843 DALK eyes reported (found at http:// aaojournal.org), there were 18 immunological rejections noted (1.0%). "In one study 28, 2 of the 7 patients who experienced graft rejection after receiving DALK for keratoconus also experienced increasing vascularization of the graft interface with opacification. One recent study29 of 129 consecutive eyes of 121 patients with DALK for keratoconus found 14.9% of episodes of subepithelial graft rejection and 3.1% of episodes of stromal graft rejection, both of which were successfully treated with a 3- to 6-week course of topical corticosteroids (not included. The majority of graft rejection episodes (n = 13) occurred during the first year following surgery and were more common (66.3%) in patients who had previously experienced vernal keratoconjunctivitis. Inactive vernal keratoconjunctivitis had previously affected 18 of the 129 eyes at the time of surgery. The postoperative ECD of the host corneal endothelium for the DALK groups and the donor graft endothelium for the PK groups were assessed in six of the 11 studies in the DALK/PK comparison group (accessible at http://aaojournal.org). At 12 months postoperatively in 2 investigations, at 24 months in 1, at 3 years in 1, and at all time points up to 5 years in 1, all showed significantly increased ECD in the DALK groups. 26 According to the ECD statistics for the DALK/PK comparison trials, there are clear differences between these surgical approaches (available at http://aaojournal.org), with post-DALK eyes consistently having higher ECD than post-PK eyes".

DISCUSSION:

DALK has the following benefits over PK surgery: The corneal endothelium cannot be immunely rejected. It is an extraocular procedure, not an intraocular one. With DALK, topical corticosteroids can typically be stopped sooner. There is a slight reduction of ECD. DALK may be more resistant to globe rupture following forceful trauma than PK. DALK

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allows for quicker suture removal. The host corneal endothelium is not vulnerable to immunological rejection in DALK, which is its most obvious benefit. “If the goal is to completely remove ectatic tissue from keratoconus patients, larger grafts that approach the limbus may be used in conjunction with DALK. Even though continuing a daily topical corticosteroid drop for an additional 6 months provided additional protection against immunologic rejection in a significant, prospective randomised interventional trial of 406 eyes, normal-risk patients undergoing PK who are phakic are typically tapered off of topical corticosteroids in 6 months.[10] Although keratoconus is the most frequent indication for DALK, this benefit of DALK over PK is not as significant as one might anticipate because immunological rejection following PK for keratoconus is less prevalent. The primary long-term benefit of DALK surgery over PK is the sustained preservation of host corneal endothelial cells, as determined by specular microscopy and reported as ECD. Some patients, such as those with keratoconus and concurrent Fuchs' endothelial dystrophy, require PK. Patients with weakened corneal endothelium who have corneal scarring from illnesses like herpes simplex virus, varicella zoster virus, microbiological corneal ulcers, or macular corneal dystrophy should have PK surgery. A distinct benefit of DALK, particularly if the patient is a corticosteroid responder or is phakic, is that it does not require the use of long-term topical, periocular, or systemic immunosuppressive medications to control the graft in the presence of a generally normal host corneal endothelium. Deep anterior lamellar keratoplasty omits the intraocular, open-sky portion of the PK treatment. Through the use of DALK, complications like positive pressure, iris prolapse, and choroidal effusion/hemorrhage are fully avoided. Theoretically, only keratitis rather than endophthalmitis should be transmissible bacterial infections from donor to recipient. Deep anterior lamellar keratoplasty can lessen ECD, particularly if microperforations happen. This is also true if gas injections into the anterior chamber are necessary to treat DM detachments or double anterior chambers. [11–14] Pupilary block angle closure during anterior chamber gas injection or the air bubble itself can damage the corneal endothelium”. After DALK surgery, ECD loss does not appear to continue or accelerate as it does after PK, with the exception of these rare cases. After the initial postoperative period, endothelial cell density reduction is anticipated to resemble the steady ECD decline of a normal cornea.

There is a decreased frequency of corticosteroid-associated intraocular pressure (IOP) increase since topical corticosteroids can typically be stopped 3 to 4 months following DALK. With DALK, there is a lower risk of cataract advancement and less weakened local ocular surface immunity compared to the PK wound, which is subjected to the extended administration of topical corticosteroids to avoid immunological rejection. Traumatic rupture of PK wounds is a potential complication [35] that can be fatal months to decades after surgery. Theoretically, DALK wounds are superior to PK wounds, and clinical accounts of the traumatic dehiscence of DALK wounds indicate that the injuries are less severe than may be predicted for PK eyes. [16] Because there are currently fewer DALK eyes available and there is a shorter postoperative follow-up period, it is challenging to demonstrate this claim.

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However, in a series of 1962 successive keratoplasties (PK, 1776 eyes; DALK, 186 eyes) between 1998 and 2006, a 1.8% incidence of globe rupture (36/1962), of which 35 received PK (2.0%) and one was a DALK eye (0.5%), was recorded (PK, 1776 eyes; DALK, 186 eyes). [15] On DALK eyes, sutures can be taken out earlier. PK eyes do not have a stable refraction until all sutures have been removed, which in some circumstances may not happen for several years following surgery if permanent sutures are not utilised.

Due to the lower burden of corticosteroid use and improved wound anatomy, early studies revealed that sutures might be removed from DALK eyes as early as 3 months after surgery. However, 6 to 12 months seems to be more typical. However, once the sutures are taken out, other refractive procedures can be carried out sooner and conceivably with less risk of wound rupture in DALK eyes. According to one study, DALK eyes react considerably differently from PK eyes when astigmatic keratotomy incisions are made. 37 When performing refractive procedures like LASIK, wound strength is always a concern due to the wound-stressing effects of the IOP-increasing suction ring necessary for surgery. Penetrating keratoplasty eyes frequently do not maintain a stable refraction for years following surgery. The following are some advantages of PK over DALK: For example, “Fuchs' endothelial corneal dystrophy, pseudophakic and aphakic corneal edoema, posterior polymorphous corneal dystrophy, and congenital hereditary corneal endothelial dystrophies can all be treated with penetrating keratoplasty, albeit EK (DSEK or DSAEK) may currently be preferred”. Especially if there is corneal tissue loss, penetrating keratoplasty can treat penetrating corneal injuries. If there is scarring below the level of DM, such as from postacute hydrops in keratoconus, ancient penetrating central corneal injuries, or severe postinfectious corneal ulcers, penetrating keratoplasty may be employed. The non-DM-baring DALK approaches may be employed instead of PK if there is a sufficient ECD. If the DM is not exposed in the visual axis, penetrating keratoplasty may be employed, and PK patients may have better vision. Most corneal surgeons are more accustomed to performing penetrating keratoplasty. Although there are regional and sociological variations in the causes of corneal surgery, many corneal disorders are linked to weakened corneal endothelium, hence PK or EK will be responsible for the majority of requests for donated corneal tissue made to any given eye bank. “The big-bubble approach for DALK will typically fail in keratoconus eyes that have previously experienced hydrops, traumatic penetrating lesions to the central cornea, or severe microbial infections with residual scarring down to DM. Although the final vision might not be as good as following PK, other direct dissection DALK procedures, which leave some residual cornea, can be taken into consideration in these situations. Pressure-dependent stromal edoema has been reported following surgery if corneal hydrops aggravating keratoconus has developed and DALK without DM exposure is performed”. This edoema dissipated over time and with IOP-lowering medicine in these cases. [13]

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However, MD-DALK has been documented in a case of a patient whose keratoconus had previously been complicated by hydrops. [11] Visual acuity for DALK and PK is comparable when DM is exposed in the visual axis and there are no DM folds in the visual axis. Visual acuity in DALK eyes may be harmed if a sizable amount of pre-stroma Descemet's is left in the recipient bed. [15,12,16] In these circumstances, removing the DALK graft, followed by excimer laser photoablation or the big-bubble procedure to remove the residual stromal tissue and replacing the DALK graft, can improve visual acuity and avoid the need for a later PK. Alio 40 used the Melles approach to treat four eyes with poor vision following DALK, elevated the donor graft for up to two years after the procedure, and exposed the DM using the big-bubble technique, resulting in 6-month BSCVA improvements of 20/25 in three patients and 20/32 in one patient. However, many surgeons may opt to employ PK as the main technique when DM cannot be exposed or if there is extensive scarring of the deep corneal stroma.

Despite the fact that most corneal surgeons already have the requisite training for PK surgery, there is a distinct learning curve for both PK and DALK surgeries. Due to the extensive suturing of the DALK or PK donor graft, the operating time for DALK is often longer than for PK, and both procedures take longer than DSEK surgery.

The following are the specific DALK complications: Large lamellar splits in DM. Ruptures of DM. DM micro-perforations It has two anterior chambers. Endothelial cell loss brought on by synthetic gas or air.

Interface haze or irregularity if all stroma in the visible axis is not eliminated. Debris at the interface, bleeding, vascularization, microbiological infections, and epithelial ingrowth. DM wrinkles or the leftover layer of stroma and DM. OVD that is confined to the interface. Mydriasis from air block glaucoma typically makes it more difficult to treat DM detachment with anterior chamber gas injection. stromal corneal dystrophy reappearing in the residual bed. Problems with re-epithelialization on occasion. The most frequent problem is when DM is punctured with macroperforations, which typically result in a quick surgical conversion to PK, or minor holes of 1 mm or less. Micro or macro DM perforation through direct dissection using a surgical blade with or without the injection of fluid, air, or OVD injection can also result in this. These big-bubble procedures use air, OVD, or fluid injection. Unless the perforation is tiny, conversion to a normal PK may be advised.

The danger of DM perforation is increased by lamellar splits in DM with stromal pressure dissection utilising air, fluid, or OVD, despite the fact that these splits are infrequent and the operating surgeon may not be aware of them. If a perforation occurs but a DALK is finished, placing air or another gas in the anterior chamber to tamponade the perforation may cause further ECD loss, a gas pupillary block with a fixed dilated pupil [11,12] or eventually fail the DALK graft and necessitate a delayed conversion to PK. Although perforations occur often (11.7%), intraoperative PK conversions of 2.0% and delayed PK conversions of 0.4%

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indicate that the majority of DALK patients will go according to schedule. Remaining stroma may be left and the donor graft may be applied on top if a DM perforation happens before DM has been exposed in the central optical zone of about 5 mm. In this case, residual stroma may cause diminished visual acuity. Although there is a chance of postoperative DM detachment and the development of a pseudo double anterior chamber, DM microperforations that do not preclude a lamellar onlay graft can occur during DALK.

Double anterior chambers are typically caused by DM perforations, however they have sometimes been observed without perforations that can be verified. Furthermore, if the donor graft's endothelium has not been eliminated, this could persist, complicating any subsequent cataract surgery including DM separation. [13] Endothelial cell loss caused by air or synthetic gas, as well as postoperative duplicate anterior chambers, may occur after anterior chamber injection to alleviate intraoperative DM tears. [14] Interface haze is rarely an issue with DM-baring techniques, and if DM has been exposed throughout the recipient bed, occasionally even seasoned observers struggle to tell the difference between a PK and a DALK eye. Glare or reduced optical acuity may result from interface haze. A few uncommon consequences include interface debris, interface vascularization, haemorrhage from host stromal vascularization, microbiological infections, and interface epithelial ingrowth. [12,15,16] In keratoconus eyes with advanced cones, DM wrinkles are more prevalent; this is likely because the donor graft compressed the cone. [13] Additionally, wrinkles could make it harder to see or cause glare. If wrinkles are present at the time of surgery, they may be moved out of the visual axis and lessen the impact they have on vision by adjusting the donor graft.

The Melles or limbal pocket procedures, which use an OVD to extend the limbal entrance pocket dissection to enable safe trephination, can be complicated by retained OVD.

[48] In big-bubble procedures, OVD is frequently employed to extend the collapsed air bubble before removing the remaining stroma. To prevent probable donor graft edoema or donor failure, the surgeon must be cautious in gently irrigation OVD from the lamellar bed before putting the donor graft.

The need to inject air or another gas into the anterior chamber to tamponade the tear results from postoperative DM detachment or a double anterior chamber, which impairs vision due to an edematous graft. Larger or inferior tears may need suture reattachment or delayed conversion to PK since they are harder to tamponade with gas. Large gas bubbles in the anterior chamber can cause endothelial cell loss, air block glaucoma, which in its most severe form can cause permanent pupillary mydriasis from iris ischemia, iris peripheral anterior synechiae, and glaucomflecken from anterior lens epithelial/lens cortical infarcts (a group of complications known as "Urrets-Zavalia syndrome"),[14] and, rarely. The length of the IOP increase is probably connected to these issues, which are caused by elevated IOP. These problems can frequently be avoided with prompt identification of pupillary block glaucoma and treatment with pupil dilation or paracentesis to lessen the size of the gas bubble, deepen

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the anterior chamber, and remove the pupillary block. For PK or DALK, it is envisaged that the corneal stromal dystrophies will recur in the anterior region of a corneal graft. Recurrence in the interface, though, has an eye issue with LASIK surgery and can happen with DALK. Recurrence of a stromal dystrophy, such as lattice dystrophy in the deep lamellar bed, is thought to be caused by host stroma that has been maintained and is rare using DM-baring procedures. Re-epithelialization can occasionally cause issues if cryolathed or lyophilized donor lamellar tissue is used, but it can also make PK more challenging because the epithelium is frequently no longer viable after prolonged corneal donor storage times. The following complications are specific to PK: Immune rejection of donor corneal endothelium.

In rare circumstances, prolonged topical corticosteroid usage is required. Bacteremic endophthalmitis. Trephine side effects (DM retention, crystalline lens damage, and iris damage). Issues with the open eye (positive vitreous pressure, expulsive choroidal haemorrhage, and iris or lens damage).● problems from penetrating wounds, including poor vertical wound apposition, iris synechiae, and flat anterior chamber from wound leak. Elevated IOP due to OVD retention. Ingrowth of the anterior chamber epithelium. Endothelial failure in primary donor grafts. Donor graft endothelial cell loss that is accelerated (donor endothelium damaged by instruments, endothelium damaged during surgery due to iris or lens contact, and postoperative biphasic accelerated loss). Immune corneal endothelial rejection, which frequently involves considerable corneal stromal vascularization, inflammation, and anterior segment abnormalities, can be a serious issue for high-risk corneal transplant recipients. In cases of ocular surface chemical injuries, ocular mucous membrane pemphigoid, Stevens-Johnson syndrome, inactive interstitial keratitis with corneal scarring from varicella zoster or herpes simplex virus, and vascularized corneas following treatment for microbial keratitis, these eyes are sporadic candidates for DALK if the host endothelium is normal. If ocular surface issues can be treated, deep anterior lamellar keratoplasty or even a therapeutic LK would be the recommended technique. Immunological rejection, however, is not a significant issue in keratoconus because, with quick and proper treatment, immune endothelial rejection seldom causes a graft to fail. It is yet unknown if subclinical immunological endothelial rejection or other factors are to blame for the faster long-term loss of ECD in PK. In some situations with recurrent immunologic graft responses, prolonged topical corticosteroid treatment may be necessary.

Corticosteroid-induced IOP rises may need to be controlled surgically or with topical glaucoma medicines. Secondary glaucoma may cause vision loss, and the patient may not be able to wear contact lenses when the ocular surface is being significantly immunosuppressed with topical corticosteroids due to the elevated risk of infectious keratitis. Prolonged usage of glaucoma drugs or topical corticosteroids is also related with higher costs. Epithelial downgrowth, expulsive choroidal haemorrhage, and microbial endophthalmitis are a few of the catastrophic PK-specific consequences. Fortunately, these serious side effects are quite uncommon, especially with phakic PK surgery, which is typically an option to DALK

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surgery because most phakic eyes have keratoconus, nonpenetrating corneal scars, herpes simplex virus, corneal scars, and other conditions. In skilled hands, complications connected to the PK surgery's anterior chamber penetrating nature are similarly rare, however they can occasionally lead to poor visual outcomes.

The following are issues that PK and DALK frequently experience: Ametropias, severe astigmatism, irregular astigmatism, and suture-related issues (sterile inflammation, microbiological abscess, epithelialization issues, early loosening, induced astigmatism, delayed absorption, and unpredictable breakage) are all examples of astigmatism.● Epithelial and stromal rejection in immune donors. Corneal dystrophies recurring. Recurrent keratoconus of the graft's corneal ectasia, progressive host ectasia in keratoconus eyes. Donor endothelial cell loss in PK and loss of host endothelial cell density in DALK, particularly with DM perforations or injection of air or gas into the anterior chamber.

Lessening of the ability of the eyeball tunic's transplant wound to rupture when subjected to harsh ocular trauma. Ocular surface illness Infection transmission from donor to host. In DALK procedures, sutures can be removed significantly earlier than in PK, which may result in fewer suture-related issues after DALK. Because all keratocytes and epithelial cells are destroyed during the processing of the donor tissue, stromal and epithelial immune rejection cannot take place in DALK operations when cryolathed or lyophilized donor corneal tissue has been used to prepare the lamellar donor tissue. However, the majority of surgeons use corneal tissue preserved in short- or intermediate-term corneal preservation media, which typically maintains donor corneal epithelium and stromal keratocytes to varying degrees. Rejections of stromal grafts, which are already rare, become even more rare as postoperative time lengthens. In general, topical corticosteroids are often taken off in low-risk PK eyes with a diagnosis like keratoconus six months following surgery, and corticosteroid-related glaucoma is rarely a significant management issue. The necessary use of corticosteroids for immunosuppression, however, can cause corticosteroid-induced glaucoma and posterior subcapsular cataract development in a small number of individuals with repeated immunological graft rejections. After six months following surgery, it is unusual for DALK eyes to require topical corticosteroids. Even if topical corticosteroids are necessary to treat subepithelial infiltrates or stromal graft rejection in DALK eyes, they are rarely needed for extended periods of time if there is no other source of inflammation. The anterior portion of the graft is typically where corneal dystrophies recur after PK, thus it makes sense that they would do the same following anterior lamellar corneal operations like DALK. Late postoperative corneal ectasia after DALK has been reported.[15] In a schizophrenic patient with frequent eye rubbing, an apparent cause of recurrent keratoconus, there was a real keratoconus recurrence in a DALK cornea from lyophilized donor tissue, and a follow-up DALK was successful.

Additionally, PK in keratoconus eyes has been linked to late-onset keratoconus. Even though true keratoconus as a side effect of PK has been documented,[17] the majority of cases

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described as late-onset keratoconus are likely caused by continued ectasia of a portion of the residual host cornea, typically inferiorly, and are not true keratoconus where the graft itself experiences central thinning and ectasia. It is still unknown if keratoconus following a PK or a DALK transplant is brought on by unrecognised keratoconus in the donor cornea, patient variables such biochemical anomalies of the host epithelium, stromal keratocytes, or habits like contact lens use and eye rubbing. The host cornea's ongoing thinning, which is the more frequent cause of so-called recurrent keratoconus, is difficult to treat, but occasionally resecting an ectatic crescent in the host cornea can bring astigmatism down to manageable levels. After PK for keratoconus, late ectasia of the graft-host connection, particularly inferiorly, is not unusual. This may indicate that not all of the ectatic tissue was removed during PK. The ability to employ larger grafts that approach the limbus to potentially prevent this late problem is one theoretical benefit of DALK. If the initial diameter of 7.75 mm is successful, a two-step, two-diameter approach has been reported to produce DALK sizes of 9.5 to 11.0 mm. [16]

Both procedures can cause ocular surface diseases, such as dry eye, neurotrophic, neuroparalytic, epithelial stem-cell dysfunction, or other conditions. However, LK procedures are typically easier to manage because immune endothelial rejection is not a concern and anti-rejection medication is typically less important.

CONCLUSIONS:

This review's goal was to assess the effectiveness of DALK against PK for BSCVA, refractive error, rejection, and graft survival. Level III data and one level II trial show that BSCVA and refractive error results for DALK and PK are comparable. A better visual prognosis in DALK appears to be connected with exposure of DM or minimization of residual stromaIf the amount of remaining stroma in the surgical bed is small (25–65m), vision between the groups can be comparable: “Vision in the DALK eyes as a whole may be reduced if residual stroma is thicker, or if DM wrinkles or haze is present, but not by less than 1 line of Snellen visual acuity on average. For both PK and DALK, astigmatism and ametropia continue to be issues. With either method, epithelial and stromal immune rejection reactions of the donor tissue can occur, although they are typically treatable with topical corticosteroids. Immune rejection reactions against donor graft endothelium, however, cannot happen with DALK surgery, but they are a known concern for PK and can happen at any point during the transplant's lifetime”.

Every donor endothelial rejection reaction has the potential to reduce ECD or cause the transplant to fail. “Immune rejection reactions themselves, immunosuppressive therapies for acute rejection reactions, or the prevention of rejection, may cause corticosteroid-associated IOP elevation in vulnerable patients, cataract changes to occur more quickly, wound healing to be less effective, and local immunity to be compromised, giving DALK an advantage over

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PK. Before even being able to draw a firm conclusion on enhanced graft survival after DALK in comparison to after PK, sufficient data must yet be acquired.

If ECD is used as a proximate for graft survival, there is strong evidence from level III studies and a level II study that DALK eyes have higher ECD than PK eyes at any point after surgery. The preservation of endothelial cells in DALK surgery may offer a significant advantage that will only become apparent within time frames more relevant to these patients, that is, decades, as keratoconus is the disease that is most frequently treated using one of these two procedures and keratoconus recipients tend to be young and healthy with a long-life expectancy. Data on ECD and graft survival can be compared with existing data on populations with PK as the number of DALK surgeries rises and extended follow-up becomes accessible".

It is necessary to conduct randomised clinical trials to compare DALK and PK, but doing so is challenging and expensive. A randomised clinical trial is being done as part of the Dutch Lamellar Corneal Transplantation Study to compare posterior LK with PK and DALK with PK, including 28 patients in each arm. [18] "The discard rate of donor corneas serves as the primary outcome indicator, with visual acuity, astigmatism, stray-light assessment, contrast sensitivity, endothelial cell loss, incidence of endothelial rejection, vision-related quality of life, and patient satisfaction serving as secondary indexes". A randomised prospective study comparing the two procedures might not be acceptable in the eyes of surgeons or patients who think that while the visual and refractive outcomes of PK and DALK are similar, the rate of endothelial cell loss over time is noticeably different. It might be challenging to enrol patients in such a study. It is challenging to carry out a trial that is big enough to assess the aforementioned secondary outcome indicators. It might be easier to conduct an observational study with uniform outcome evaluation. In order to better understand the connection between BSCVA and residual corneal stroma, any future DALK trials should use imaging methods to measure any residual posterior cornea stroma in the donor bed.

REFERENCES:

1. Paufique L. Les greffes corneennes lamellaires therapeutiques. Bull Mem Soc Fr Ophtalmol 1949;62:210 –3.
2. Malbran ES. Corneal dystrophies: a clinical, pathological, and surgical approach. 28 Edward Jackson Memorial Lecture. Am J Ophthalmol 1972;74:771– 809.
3. Anwar M. Technique in lamellar keratoplasty. Trans Ophthalmol Soc U K 1974;94:163–71.
4. Sugita J, Kondo J. Deep lamellar keratoplasty with complete removal of pathological stroma for vision improvement. Br J Ophthalmol 1997;81:184–8.
5. Archila EA. Deep lamellar keratoplasty dissection of host tissue with intrastromal air injection. Cornea 1984-1985;3: 217–8.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022**

6. Chen W, Lin Y, Zhang X, et al. Comparison of fresh corneal tissue versus glycerin-cryopreserved corneal tissue in deep anterior lamellar keratoplasty. Invest Ophthalmol Vis Sci 2010;51:775– 81.
7. Farias R, Barbosa L, Lima A, et al. Deep anterior lamellar transplant using lyophilized and Optisol corneas in patients with keratoconus. Cornea 2008;27:1030–6.
8. Bahar I, Kaiserman I, Srinivasan S, et al. Comparison of three different techniques of corneal transplantation for keratoconus. Am J Ophthalmol 2008;146:905–12.
9. Han DC, Mehta JS, Por YM, et al. Comparison of outcomes of lamellar keratoplasty and penetrating keratoplasty in keratoconus.Am J Ophthalmol 2009;148:744 –51.
10. Silva CA, Schweitzer de Oliveira E, Souza de Sena Junior MP, Barbosa de Sousa L. Contrast sensitivity in deep anterior lamellar keratoplasty versus penetrating keratoplasty. Clinics (Sao Paulo) 2007;62:705– 8.
11. Watson SL, Ramsay A, Dart JK, et al. Comparison of deep lamellar keratoplasty and penetrating keratoplasty in patients with keratoconus. Ophthalmology 2004;111:1676–82.
12. Krumeich JH, Knülle A, Krumeich BM. Deep anterior lamellar (DALK) vs. penetrating keratoplasty (PKP): a clinical and statistical analysis [in German]. Klin Monbl Augenheilkd 2008;225:637– 48.
13. Kawashima M, Kawakita T, Shimmura S, et al. Characteristics of traumatic globe rupture after keratoplasty. Ophthalmology 2009;116:2072– 6.
14. Lee WB, Mathys KC. Traumatic wound dehiscence after deep anterior lamellar keratoplasty. J Cataract Refract Surg 2009; 35:1129 –31.
15. Alió JL. Visual improvement after late debridement of residual stroma after anterior lamellar keratoplasty. Cornea 2008; 27:871–3.
16. Minasian M, Ayliffe W. Fixed dilated pupil following deep lamellar keratoplasty (Urrets-Zavalia syndrome) [letter]. Br J Ophthalmol 2002;86:115– 6.
17. Kanavi MR, Foroutan AR, Kamel MR, et al. Candida interface keratitis after deep anterior lamellar keratoplasty: clinical, microbiologic, histopathologic, and confocal microscopic reports. Cornea 2007;26:913– 6.
18. Fontana L, Parente G, Di Pede B, Tassinari G. Candida albicans interface infection after deep anterior lamellar keratoplasty. Cornea 2007;26:883–5.