

Lamelläre Keratoplastik
Eine neue Dimension in der Hornhautchirurgie

F.E. Kruse



Universitäts-Augenklinik Erlangen
Direktor: Prof. Dr. F.E. Kruse

Perforierende Keratoplastik

Eine erfolgreiche totale Keratoplastik.
Von
Dr. Eduard Zirm
in Olmütz.
Mit Taf. XXI und XXII und einer Figur im Text.




Zirm, Graefes Archiv 64:580, 1906

Vorteile der lamellären Keratoplastik

- **Arbeiten im geschlossenen System**
→ reduziertes Risiko expulsiver Blutungen
(gefährdete Altersklasse)
- **Schnellere visuelle Rehabilitation**
→ Wochen statt Monate
→ Keine Refraktionsänderungen bei
Fadenentfernung
- **Kürzere Nachsorge**

Vorteile der lamellären Keratoplastik

- **Geringerer postoperativer Astigmatismus**

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- **Größerer Durchmesser: 8-9 mm**

Vorteile der lamellären Keratoplastik

- **Geringerer postoperativer Astigmatismus**
- **Größerer Durchmesser: 8-9 mm**
- **Erhalt des Patientenendothels
oder**
- **Erhalt des Patientenstromas**

Terminologie

DALK

Terminologie

DALK

DSAEK

Terminologie

DALK
(Deep anterior lamellar keratoplasty)

DSAEK

Terminologie

DALK
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DSAEK
(Descemet stripping automated endothelial keratoplasty)

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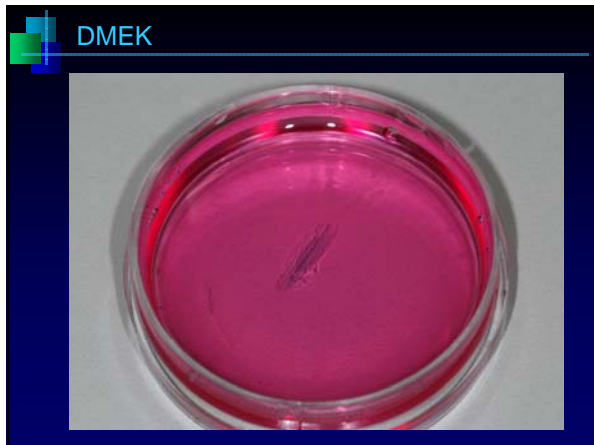
DALK
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DSEK – DSAEK – DMEK
(Descemet stripping endothelial keratoplasty)
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Terminologie

DALK
(Deep anterior lamellar keratoplasty)

DSEK – DSAEK – DMEK
(Descemet stripping endothelial keratoplasty)
(Descemet stripping automated endothelial keratoplasty)
(Descemet membrane endothelial keratoplasty)



Erkrankungen des Hornhautendothels

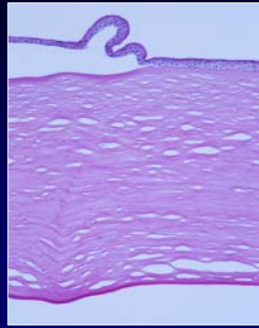
37% aller Keratoplastiken

Cursiefen et al. Changing indications for penetrating keratoplasty: histopathology of 1,250 corneal buttons. 1998;17:468-70

Erkrankungen des Hornhautendothels

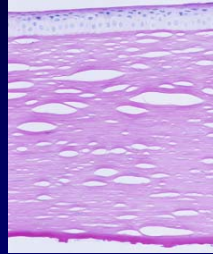


Pathologie im Endothel
- Fuchs Endotheldystrophie
- Pseudophake bullöse KP
- PEX-Keratopathie



Kpl. bei Endothelproblem - Übertherapie

Perforierende KPL



Posteriore lamelläre KPL



Pathologie



DSAEK

- technisch anspruchsvoll
- längere Lernkurve
- initial mehr Komplikationen
- teures Instrumentarium und Verbrauchsmaterial
- endgültiger Visus möglicherweise geringer als nach perforierender (Excimerlaser) Keratoplastik

DSAEK - Methode

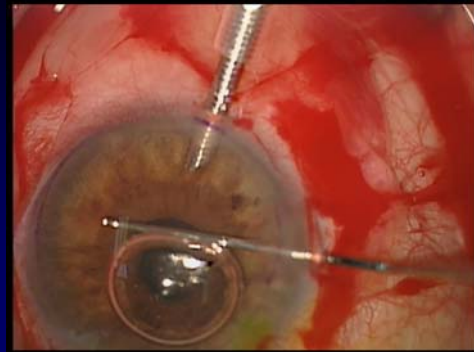
- Vorderkammerbank
- Moria-Keratome 350 µm
- Endotheliale Trepanation des tiefen lamellären Scheibchens 8-9 mm



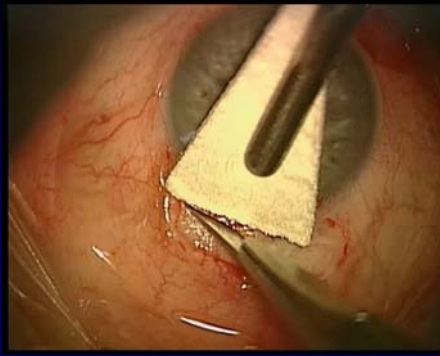
DSAEK - Methode

- Vorderkammer-maintainer
- sklerokorneraler Zugang mit 8 mm Tunnel
- Descemet Stripping mit Price Haken
- Einbringen des Transplantates mittels Pinzette/Gleitschiene ohne Falten
- mittelgrosse Luftblase

DSAEK - Methode



DSAEK - Methode

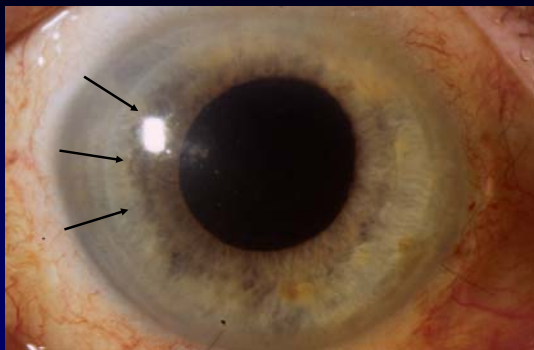


DSAEK – Erlanger Ergebnisse

n = 120, maximale Nachbeobachtung 24 Monate

- 88/120 reine lamelläre Keratoplastik
- 32/120 TRIPLE-Prozedur
- Indikationen:
 - Fuchs Dystrophie
 - Pseudophake bullöse KP
- 93/120 primäre komplette Transplantatadhärenz

DSAEK – Eigene Ergebnisse



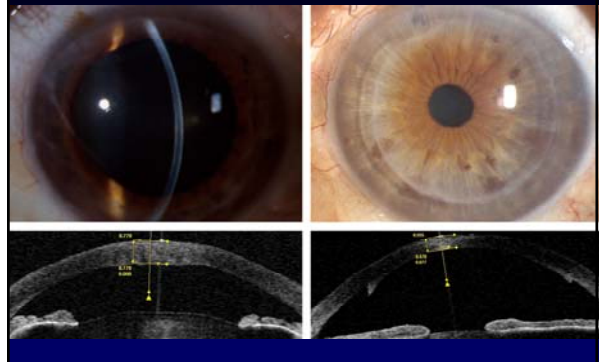
DSAEK – Eigene Ergebnisse



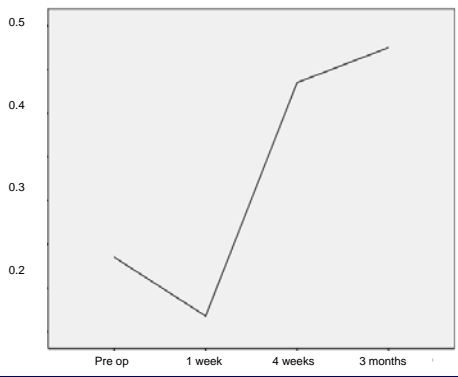
DSAEK – Eigene Ergebnisse



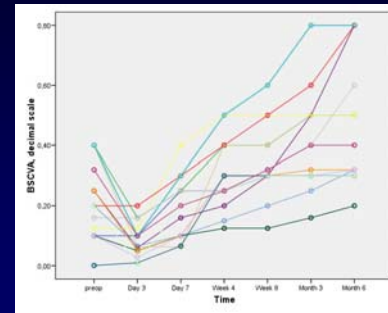
DSAEK – Erlanger Ergebnisse



DSAEK – Ergebnisse: Visus Frühphase

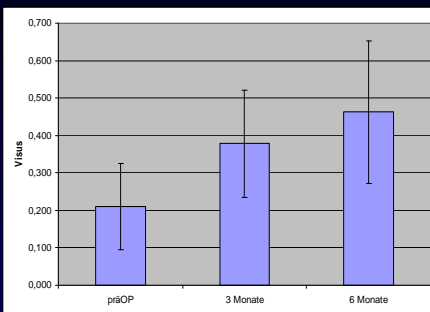


Visus nach DSAEK



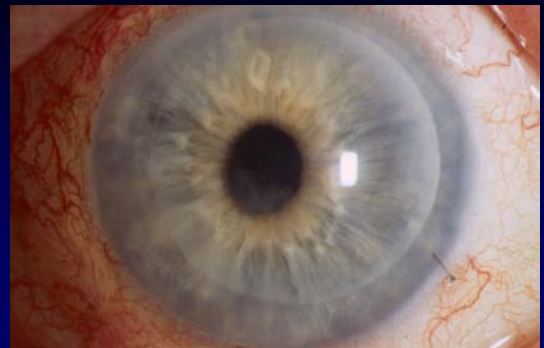
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Erlangen
Augenklinik mit Poliklinik

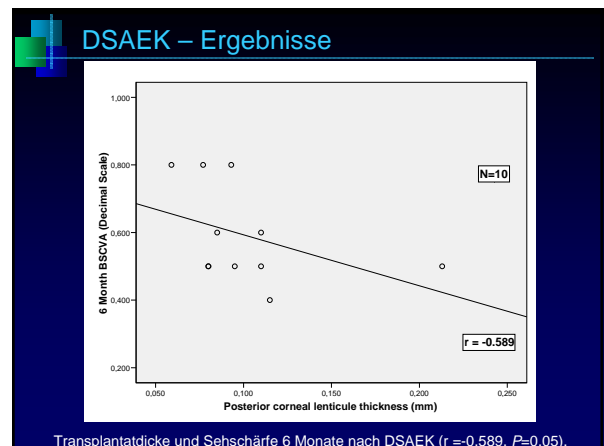
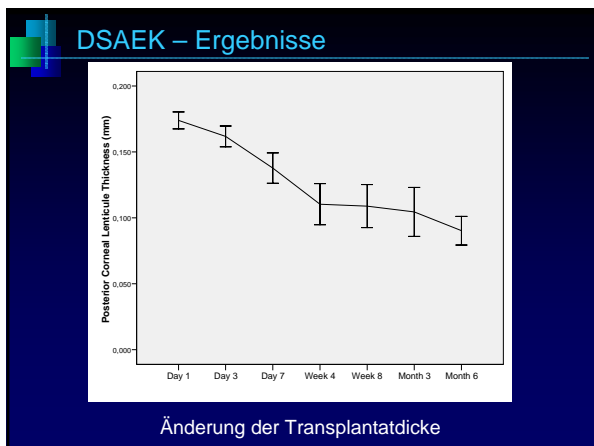
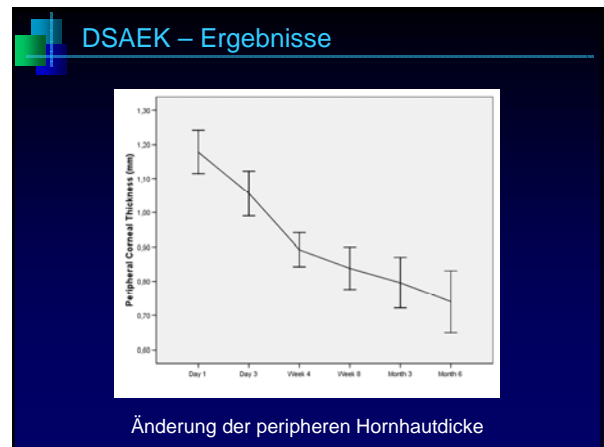
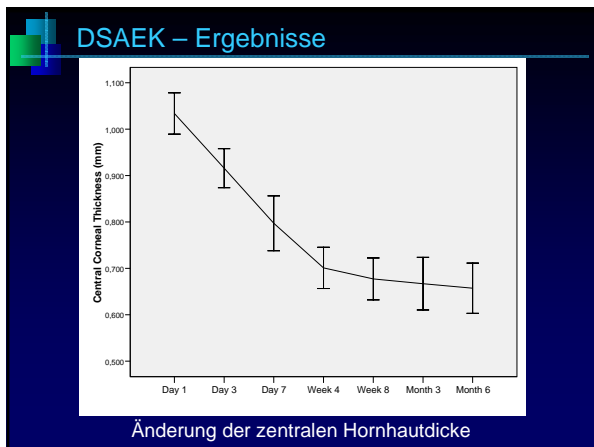
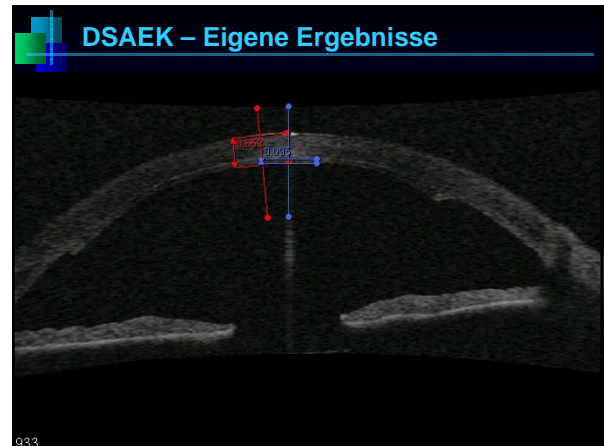
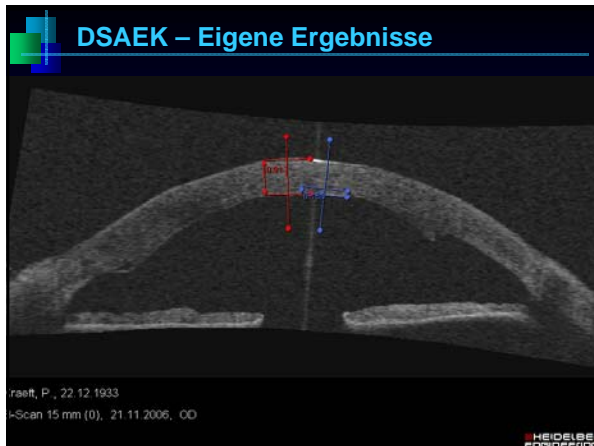
Visus nach DSAEK



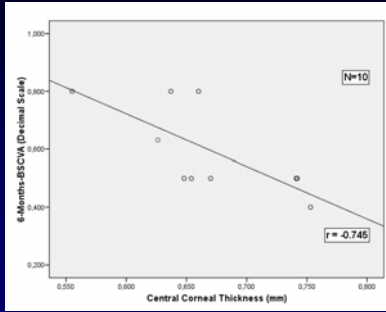
n = 100

DSAEK – Eigene Ergebnisse



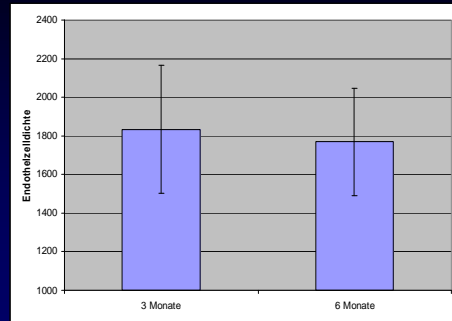


DSAEK – Ergebnisse



Transplantatdicke und Sehschärfe 6 Monate nach DSAEK ($r = -0.589$, $P=0.05$).

Endothelzellichte

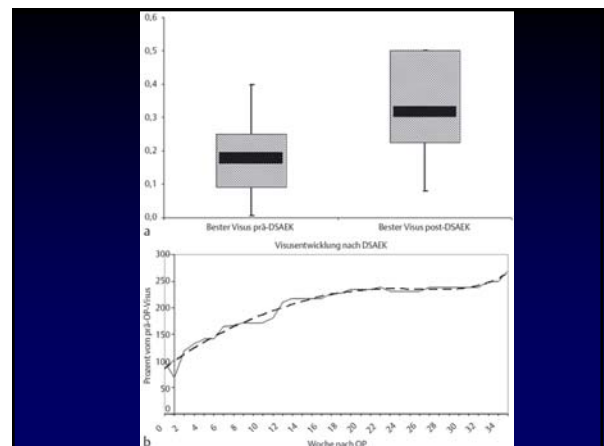
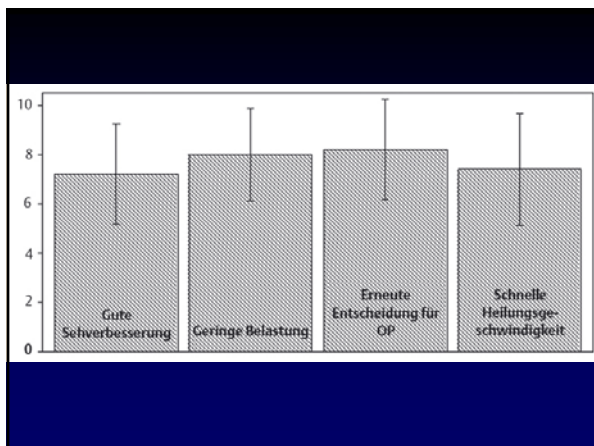
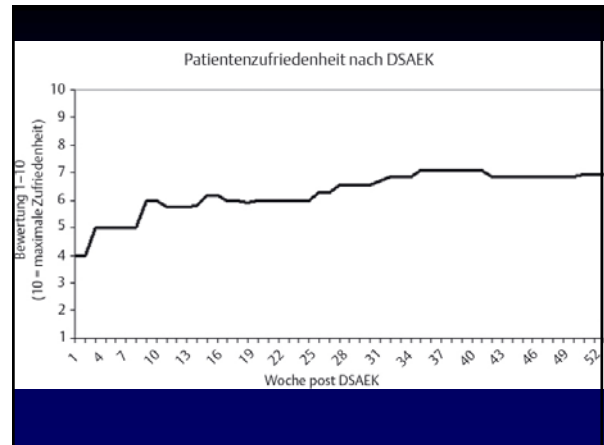


Klinische Studie 577

Patientenzufriedenheit nach posteriorer lamellärer Keratoplastik (DSAEK)

Patient Satisfaction after Posterior Lamellar Keratoplasty (DSAEK)

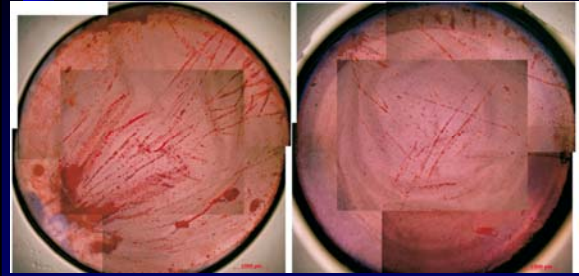
Autoren: B. O. Bachmann, P. Fegorikow, F. E. Kruse, C. Cornelsen
Institut: Augenklinik mit Poliklinik, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen



DSAEK - Visus

- Price et Price, Ophthalmology 2006:
- N=330, Nachbeobachtung: 6 Monate
- **Zylinder manifest:** 1.5±1 Dioptrien
- **Sphärisches Äquivalent:** -0.19±1.6 Dioptrien
- **Visus bestkorrigiert (6 Monate):** 0.5±0.1 (70%>0.5)
- **1% Flapdislokation**
- **Endothel:** 1650 (6M), 1560 (12M), 1500 (24M) – (Melles, Cornea 2006)

DSAEK – Schnittgröße zählt

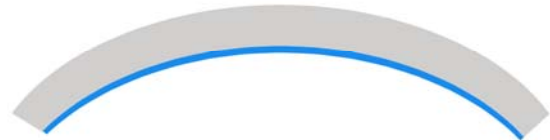


Kuo et al. Am J Ophthalmol 2008;145:91

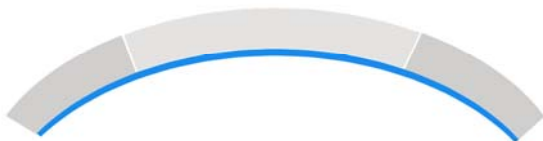
DALK - Vordere lamelläre Keratoplastik



DALK - Vordere lamelläre Keratoplastik



DALK - Vordere lamelläre Keratoplastik



DALK – Big bubble

techniques J Cat Refract Surg 2002;28:398

Big-bubble technique to bare Descemet's membrane in anterior lamellar keratoplasty

Muhammad Anwar, FRCS, Klaus D. Tschmann, MD

In anterior lamellar keratoplasty (ALK) was developed more than 150 years ago.¹ The first attempt to dissect Descemet's membrane was by Hallstrom's.² "Anwar" and Achizi³ were the first to describe complete lifting of Descemet's membrane in the recipient cornea. This technique proved to result in less interface opacity and hence improved visual acuity postoperatively, yielding vision comparable to that resulting from penetrating keratoplasty (PKP). However, the surgeons continued pursuing this goal^{4,5} because the rate of intraoperative perforation was high (38.2%)⁶ when one attempted to remove all corneal stroma. In addition, failure to bare Descemet's membrane was the outcome

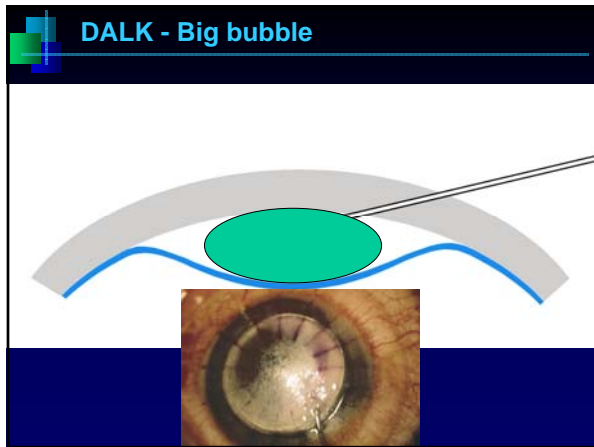
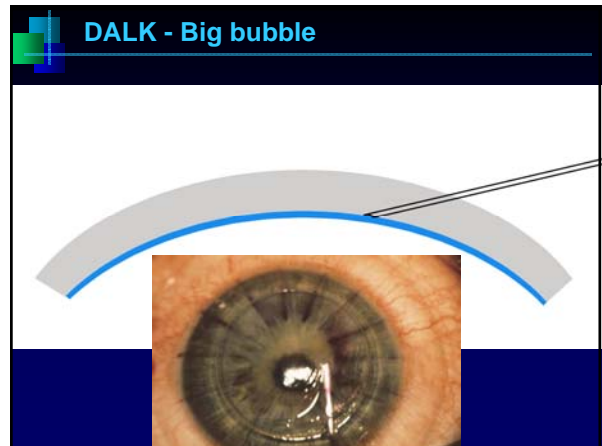
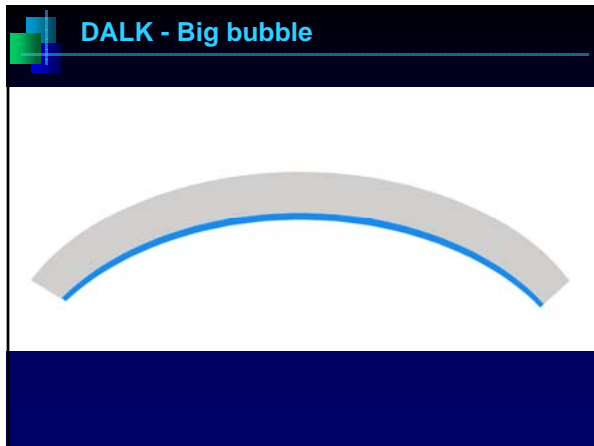
in a high proportion of cases.^{7,8,9} The crucial step, namely gaining access to the tissue plane immediately anterior to Descemet's membrane (the pre-Descemet's anatomy and potential surgical plane), prevented the major difficulty in preparing an extremely deep lamellar flap¹⁰ and thus in performing maximum-depth anterior ALK.¹¹

We present a technique that facilitates exposure of Descemet's membrane, considerably shortens the duration of the operation, lowers the risk of perforation, and has the potential to make maximum-depth ALK a popular procedure.

Surgical Technique

Partial-thickness transplantation of the cornea is performed to a depth between 50% and 90% using a cell-based grafting system (Keratograph, Rhein-Modell) that can be set to any depth. The Hatanaka suction ring (Moria) is also accurate but can be set in 100-µm steps only. The Heidelberg Retina scanner (Heidelberg Engineering) is also accurate but can be set in 100-µm steps only. The Heidelberg Retina scanner (Heidelberg Engineering) is also accurate but can be set in 100-µm steps only.

Accepted for publication September 11, 2002.
From the Hospital Eye of the Hospital, Jeddah (Anwar) and King Abdul Aziz Specialist Hospital, Riyadh (Tschmann), Saudi Arabia.
Reprints requests for this article or permission to reproduce in any form should be addressed to Dr. Klaus D. Tschmann, MD, Chief of Refractive Services, King Abdul Aziz Specialist Hospital, PO Box 7251, Riyadh 11462, Saudi Arabia. E-mail: ktschmann@aol.com.
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DALK - Big bubble – Small bubble

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1369

SURGICAL TECHNIQUES

Use of a "small-bubble technique" to increase the success of Anwar's "big-bubble technique" for deep lamellar keratoplasty with complete baring of Descemet's membrane

Anand Parthasarathy, Yong Ming Por, Donald T H Tan

Abstract

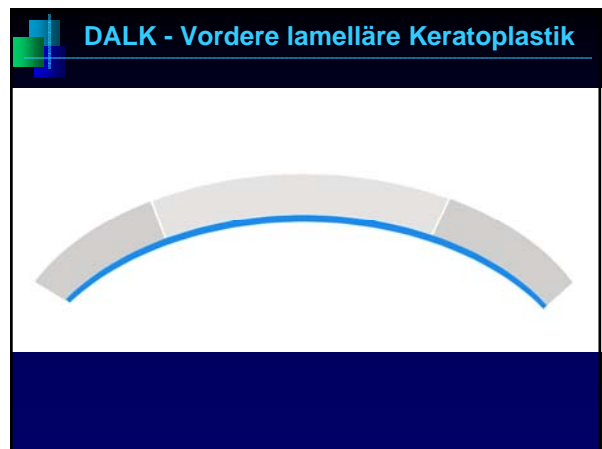
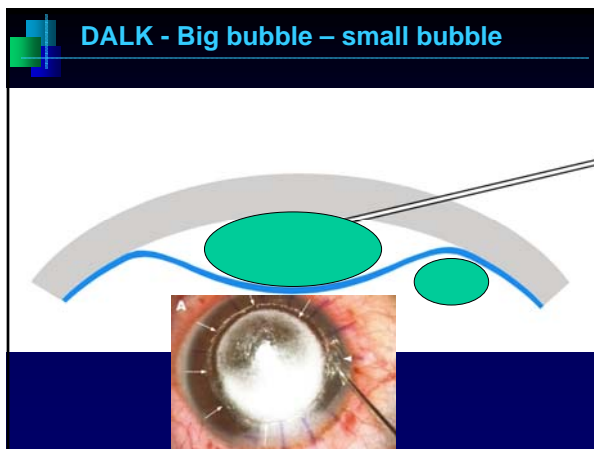
Anterior lamellar keratoplasty involves heterotopic lamellar replacement of the anterior layers of the cornea while retaining the posterior layers of the recipient's eye, including the posterior stroma, DM and the endothelial layer. A major disadvantage of lamellar keratoplasty as opposed to penetrating keratoplasty (PKP) for optical reasons is the irregularity of the corneal stromal bed, which occurs following manual lamellar dissection techniques, and this problem limits the final best visual acuity. Different approaches have been devised to overcome this problem, including the use of microkeratomes¹ to achieve smoother lamellar dissections and transplanting full thickness stroma onto bare DM.² To completely obviate this problem, a variety of surgical techniques have been described for performing "maximum depth" DALK, in which complete stromal removal with baring of DM is attempted, at least in the central visual axis.^{3,4} These include

Methods

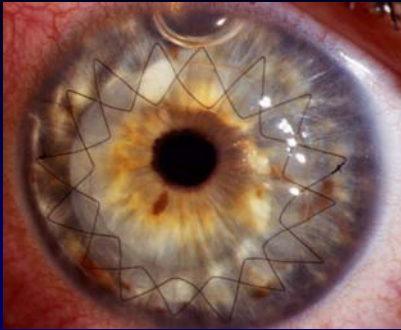
Patients

Out of a total of 41 patients who underwent the DALK procedure by the Anwar method in our centre, three patients required the small-bubble technique to help confirm the presence of the big bubble. The presence of the big bubble could not be ascertained in these cases because of either the presence of intrastromal air after injection (in patient number 1) or the primary pathology (in patients 2 and 3), which precluded a view of the big bubble.

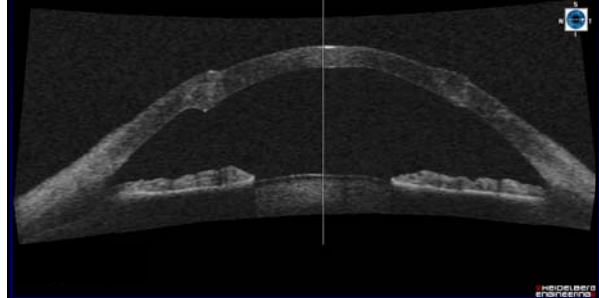
Br J Ophthalmol 2007;91:1369-1373. doi: 10.1136/bjo.2006.113357



DALK – 1. postoperativer Tag



DALK – 1. postoperativer Tag



DALK - Operation



www.augenklinik.uk-erlangen.de

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Anfahrt
Stellenausschreibung

Neue, schonende Methode bei Hornhauttransplantation an der Universitätsaugenklinik in Erlangen: Posteriore lamellare Keratoplastik (DALK)

Die Hornhaut, auch Cornea genannt, ist ein klares Scheibchen am vorderen Teil des Auges und wird wegen ihrer Schutzfunktion auch als die „Windschutzscheibe des Auges“ bezeichnet. Bei Erkrankungen der Hornhaut wird diese oftmals trüb und schwillt an. Einzige Heilungsmöglichkeit besteht in vielen Fällen nur eine Hornhauttransplantation. An der Universitäts-Augenklinik in Erlangen werden pro Jahr bis zu 200 dieser Transplantationen vorgenommen, bei denen das kranke Gewebe der Hornhaut durch gesundes Spendergewebe ausgetauscht wird. Dadurch kann Patienten, die an Hornhauterkrankungen erblindet sind, das Sehen wieder ermöglicht werden.

DALK – Ergebnisse (n = 12, 5 Monate)

TABLE 1. Comparison of Pre- and Postoperative Best-Corrected Visual Acuity (BCVA) After Deep Lamellar Keratoplasty for Keratoconus

BCVA	Preoperative, n (%)	Postoperative (Last Follow-up), n (%)
20/20	0	4 (30.7)
20/25–20/30	0	7 (53.8)
20/40	0	1 (7.6)
20/50	0	1 (7.6)
20/60	3 (23)	0
20/80 or worse	10 (77)	0

Folga et Padmanabhan Am J Ophthalmol 2006; 141:254

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20/60	3 (23)	0
20/80 or worse	10 (77)	0

Folga et Padmanabhan Am J Ophthalmol 2006; 141:254

DALK – Ergebnisse (n = 78, 2 Jahre)

Snellen Visual Acuity of DALK Big-bubble Technique in Patients With Keratoconus

3 months	6 months	12 months	18 months	24 months
0.255 ± 0.183 (0.02; 0.63)	0.313 ± 0.2 (0.05; 0.735)	0.381 ± 0.2 (0.057; 0.785)	0.383 ± 0.238 (0.039; 0.8)	0.351 ± 0.229 (0.036; 0.7)
0.564 ± 0.22 (0.2; 1)	0.651 ± 0.217 (0.3; 1)	0.736 ± 0.182 (0.4; 1)	0.784 ± 0.182 (0.355; 1)	0.766 ± 0.197 (0.32; 1)

uity; DALK = deep anterior lamellar keratoplasty; UCVA = uncorrected visual acuity, d deviation) (fifth; 95th percentiles).

Fontana et al. Am J Ophthalmol 2007; 141:254

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0.564 ± 0.22 (0.2; 1)	0.651 ± 0.217 (0.3; 1)	0.736 ± 0.182 (0.4; 1)	0.784 ± 0.182 (0.355; 1)	0.766 ± 0.197 (0.32; 1)

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Fontana et al. Am J Ophthalmol 2007; 141:254

Zusammenfassung

DALK

Big bubble Operation als Methode der Wahl bei stromalen HH Erkrankungen

- Keratokonus
- Hornhautdystrophien
- Narben

Neues Konzept der HH-Chirurgie

DALK

Big bubble Operation als Methode der Wahl bei stromalen HH Erkrankungen

- Keratokonus
- Hornhautdystrophien/Narben

DSAEK

Methode der Wahl bei endothelialen HH Erkrankungen

- Fuchs' Dystrophie/Pseudophake bullöse Keratopathie

DMEK in Zukunft (?)

Kontakt

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- **Hornhautsprechstunde**
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augen-termin@uk-erlangen.de
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claus.cirsiefen@uk-erlangen.de
- **Stammzell-Labor**
09131 853 44 33 (Prof. Schlötzer Schrehardt)
ursula.schloetzer-schrehardt@uk-erlangen.de

DSAEK - Nachsorge

→ engmaschige Kontrollen des Flaps

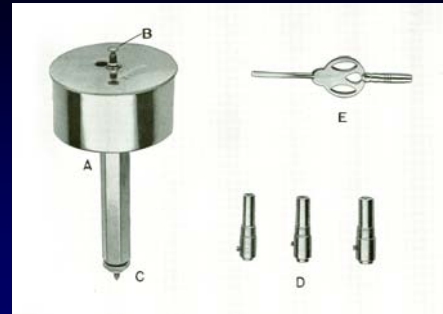
- Inflanefran forte AT 5x/d** jeweils monatlich um einen Tropfen reduzieren und bei 1x/d bleiben >= 1 Jahr (endotheliale Immunreaktion!)
- Adsorbonac AT 5x/d** (2 Wochen)
- Floaxal AT 3x/d** für 1 Woche
- Benetzende Tropfen**
- Bindehautnaht nach 2 Wochen entfernen.



Posteriore lamelläre Keratoplastik

- Barraquer 1960
- Busin 1996 (AAO-Poster)
- Melles 1998
 - Nahtfreie Fixation der posterioren Lamelle –
- Melles 2003
 - Falten des Transplantates –
- Price, Terry 2005
 - größere Serien –
- Gorovoy 2005
 - DSAEK –

Lamelläre Keratoplastik



v. Hippel, 1886