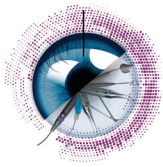
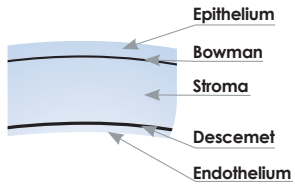
Keratoplasty

A compendium of clinical and laboratory cases

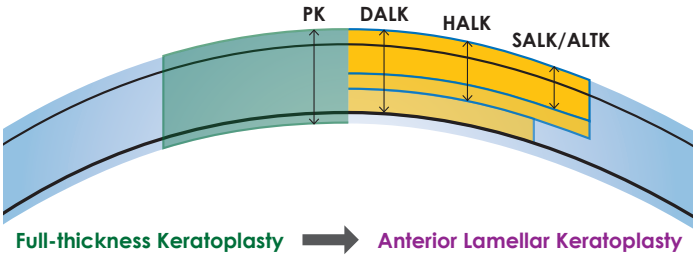
SINCE 1820
200 YEARS
MORIA • OPHTHALMIC INSTRUMENTS

Moria
Ophthalmic Instruments





Anterior Lamellar Keratoplasties



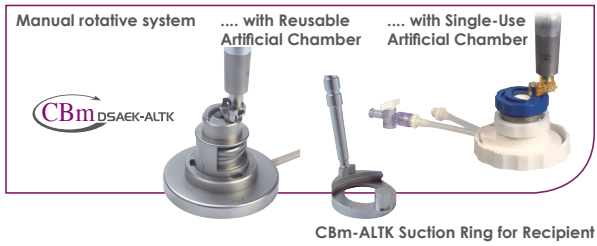
Full-thickness Keratoplasty → Anterior Lamellar Keratoplasty

Microkeratome-assisted SALK-HALK-ALTK:

SALK

ALTK

HALK



Recipient vacuum trephine-assisted DALK & PK:

DALK

PK

Vacuum punch-assisted donor preparation:

SALK

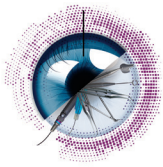
ALTK

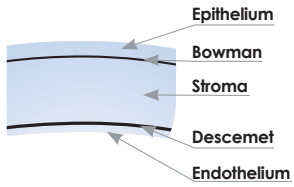
HALK

DALK

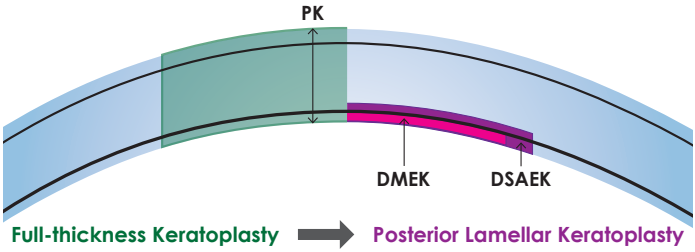
PK

K-Pro





Posterior Lamellar Keratoplasties



Full-thickness Keratoplasty → Posterior Lamellar Keratoplasty

Microkeratome-assisted DSAEK graft preparation:

DSAEK

Automated linear system

One Use-*Plus* Automated DSAEK

.... with Reusable Artificial Chamber

.... with Single-Use Artificial Chamber

Manual linear system

One Use DSAEK

.... with Reusable Artificial Chamber

.... with Single-Use Artificial Chamber

ACP system

Vacuum punch-assisted DSAEK & DMEK graft preparation:

DSAEK

DMEK

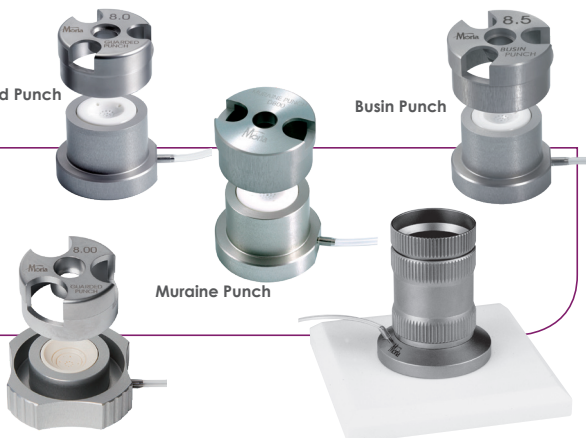
Guarded Punch

Busin Punch

Muraine Punch

Deep Guarded Punch

Reusable Donor Punch



SALK
ALTK

SALK for anterior stromal opacities
ALTK for mid stromal defects

INDICATIONS:

Superficial Anterior Lamellar Keratoplasty (SALK) for the treatment of superficial stromal opacities resulting from:

- previous refractive surgery, infection, degeneration and dystrophy, or trauma[1-2]
- or after penetrating keratoplasty[3].

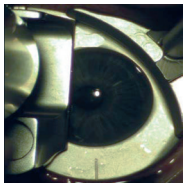
Automated Lamellar Therapeutic Keratoplasty (ALTK) for the treatment of stromal disorders such as: mid scars, moderate keratoconus (central cone), perforations, trauma, trachomatous keratopathy, etc.

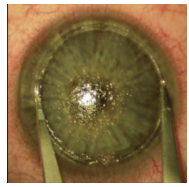
TECHNIQUES:

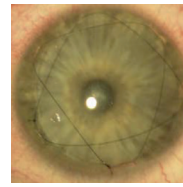
Preparation of the recipient:

1) The recipient bed is prepared similarly to a LASIK free cap with:
- a calibrated CBm-ALTK cutting head:
  - SALK: 110-, 130- or 150-micron heads[1-3]
  - ALTK: 200-, 250-, 300- or 350-micron heads
- a suction ring: to determine the overall flap dimensions.

2) The exposed stromal bed is measured (vertically and horizontally) to determine the dimensions of the donor tissue cut:
  - SALK: same size as the smaller measurement
  - ALTK: 0.25- to 0.50-mm larger than the residual stromal bed.







Preparation of the donor graft:

1) The donor cornea, mounted on an anterior artificial chamber, is prepared similarly to the recipient, using an equivalent CBm-ALTK head to obtain the flap dimensions.
2) The donor graft is laid onto the recipient bed:
- SALK: overlay sutures can be used to secure positioning on the graft, and/or a bandage contact lens may be used.
- ALTK: the lamellar graft is sutured in place under tension with interrupted 10-0 nylon sutures; knots are buried.

CLINICAL OUTCOMES[1-2]:

Final refraction is possible within 1 month from surgery.
In a series of 20 patients:
- SALK successfully managed to clear the central optical zone
- BSCVA improved to > 20/40 as early as 1 month postop
- every single patient experienced a postoperative refractive astigmatism < 4δ
- vision can still improve.

TAKE-HOME MESSAGES[1-3]:
SALK & ALTK share the advantages of a lamellar keratoplasty:
- it is an extraocular procedure,
- it preserves the host endothelium,
- so postop steroidal treatment is minimized.
SALK & ALTK have unique advantages:
the technique is simple, easy to perform (like a LASIK flap), and is standardized; the time necessary for visual rehabilitation is much shorter than usually needed with thicker grafts (DALK & PK).

1. Busin M. *Tech Ophthalmol.* 2006;4(1):1-5
2. Busin M, Arffa RC. SLACK Inc, 2006;Chapter 3:23-30
3. Busin et al. *Cornea* 2012;31(1):101-105

HALK

HALK for irregular anterior to mid stromal scarring

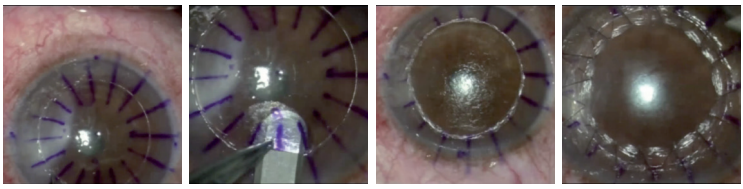
RATIONALE:
In case of marked corneal irregularities, a microkeratome reproduces them on the recipient bed, potentially compromising visual outcomes.

INDICATION[4-5]:
Hemi-Automated Lamellar Keratoplasty (HALK) is a hybrid anterior lamellar keratoplasty in corneas with superficial to mid-stromal scars and topographical irregularities, such as: post-infection scar, post-pterygium removal scar, post-trauma/PRK scar, recurrent corneal dystrophy, etc.

TECHNIQUE[4-5]:
HALK combines both manual and automated steps:

- a manual recipient lamellar dissection using the reusable Hanna or single-use adjustable trephine,
- an automated donor preparation using the CBm-ALTK microkeratome.

Preparation of the recipient:



The recipient cornea is manually dissected using the trephine:

- with a predetermined depth, usually 200 to 300 µm based on localization of the anterior stromal pathology
- with a predetermined diameter: from 7.00 to 10.50 mm.

A crescent knife is used to dissect the anterior lamellae, then corneal scissors to excise the dissected lamellae margins at the edge of trephination.

Preparation of the donor graft:

1) The donor cornea, mounted on an anterior artificial chamber, is prepared using the CBm-ALTK microkeratome.
   The CBm-ALTK calibrated head is selected to obtain a postoperative total corneal thickness of 550-600 µm.
2) The created anterior cap is placed on the donor punch to produce:

- a straight-edged donor anterior lamellar graft,
- customized to match the recipient trephination diameter or 0.25 mm oversized.

3) The anterior graft is sutured onto the recipient bed using a 10/0 nylon single or an eight-bite double continuous antitorque suturing technique.

CLINICAL OUTCOMES[5]:

- 35 eyes of 35 patients with heterogeneous causes of anterior stromal scarring: contact lens associated infectious keratitis (29%), scars (26%), dystrophies (14%), other (31%).
- Almost 7 years of follow-up from the date of surgery.
- No intraoperative complication occurred.
- No postoperative graft rejections occurred.
- Visual acuity: UCVA and BSCVA improved significantly in 93.5% patients, due to stromal interface remodeling.
- Refraction: stabilization of refractive astigmatism.
- Kaplan-Meier estimated survival for all HALK cases was 90.6 months with a survival probability of 96% at 12 months, and 92% at 3, 5 and 7 years of follow-up.

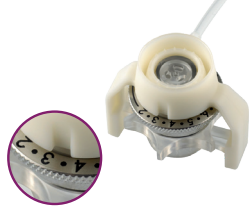
TAKE-HOME MESSAGES [4-5]:
HALK combines a smooth microkeratome lamellar interface with a sharp accurate recipient manual dissection.
HALK is a safe and effective procedure with:

- **excellent graft survival in primary cases or with prior keratoplasty,**
- **significant improvement in visual acuity ,**
- **low complication rates.**

Furthermore: HALK allows use of poor quality endothelial tissue.

4. Tan et al. *British J Ophthalmol*. 2011;95(11):1513-1518
5. Mehta et al. *Clin Exp Ophthalmol*. 2018;46(9):1017-1027

DALK



From wet-lab effectiveness…

BACKGROUND:

The Moria single-use adjustable depth trephine (#17202Dxxx) has unique features that allow to select and target a trephination depth for a DALK surgery.

STUDY DESIGN[6]:

Design:

Wet-lab study on cadaveric human eyes.

Purpose:

To evaluate the 8.0-mm Moria adjustable trephine (#17202D800) in terms of:

- accuracy of trephination depth
- angle of trephination
- compared to competitive Hessburg-Barron® trephine (Katena)
- when set at 80% of corneal thickness.

Materials:

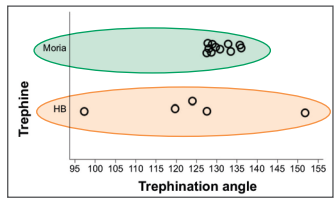
- Recipient single-use trephines:
  - Moria: 8.0-mm Moria adjustable trephine (#17202D800)
  - Katena: 8.0-mm Hessburg-Barron® trephine
- Light microscopy to image antero-posterior cross-sections of each corneal specimen.
- Digital protractor software to evaluate the trephination angle, depth and length.

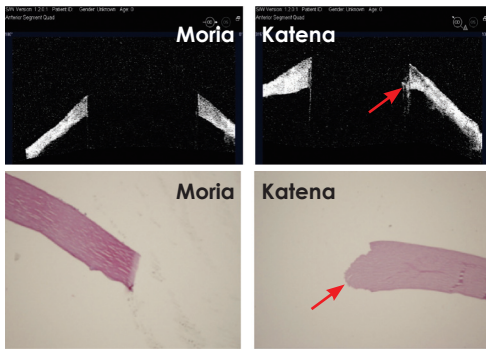
Participants:

- Wet-lab study on 11 fresh human cadaveric eyes
- Trephination depth was set to 80% of average corneal pachymetry in the peripheral 7–10 mm range previously obtained using anterior-segment OCT imaging.

RESULTS[6]:

- Trephination depth obtained with Moria trephine (% of corneal thickness):
  - mean: 83.7% ± 6.5 [71.3 - 95.3]
  - 95% confidence interval: [79.8 - 87.6] %
- Trephination angle obtained:
  - Moria: 130.2 ± 3.6° [126° - 135.5°]
  - Katena: 123.8 ± 20° [97° - 153°]





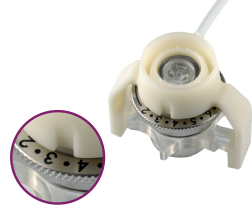
Top: AS-OCT images of corneal recipient rims created by Moria (left) and Katena (right)
Bottom: light microscopy of corneal recipient rims created by Moria (left) and Katena (right)
Red arrows: remnant corneal tissue due to irregular cuts with Katena trephine

CONCLUSION[6]:

The Moria adjustable vacuum trephine is an accurate method of trephination when a specific depth is desired.

6. Moshirfar et al. *Clin Ophthalmol*. 2014;8:2391-2396

DALK



… to proven surgical benefits

STUDY DESIGN[7]:

Design:

Retrospective, non comparative, interventional case series.

Purpose:

To evaluate safety & efficacy of deep trephination DALK with peripheral air injection employing the 9.0-mm Moria adjustable trephine intended to a depth within 100 µm from the patient's endothelium.

Material:

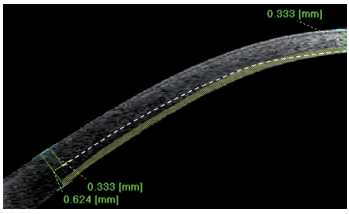
- 9.0-mm Moria single-use adjustable trephine: #17202D900

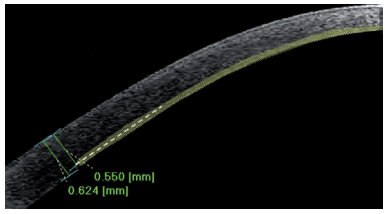
Participants:

- 88 eyes of 88 patients scheduled for DALK
- Deep trephination was set to a depth within 100 µm from the patient's endothelium in the peripheral 9.0 mm range, previously obtained using anterior-segment OCT imaging

RESULTS[7]:

- pneumatic dissection success: 85%
- suction loss during trephination: n=2 (2.3%)
- perforation: n=4 (4.6%)
- DALK converted to full-thickness PK: n=1 case (1.1%)





AS-OCT images illustrating:
- *left: the conventional DALK approach*
- *right: the deep trephination DALK technique with peripheral air injection*

SUCCESS RATE INDEPENDENT OF SURGEON'S EXPERIENCE[8]:

Group	1	2	3
Surgeon experience	Low: <10 cases	Moderate: [10 – 100]	High: >100 cases
Nb of surgeons	4	2	2
Nb of patients	4 x 10	2 x 10	2 x 10
Success rate	**77.5%**	**95%**	**90%**

CONCLUSIONS[7-8]:

Setting the 9.0-mm Moria adjustable trephine to a depth within 100 µm from the endothelial surface:
- **eliminates the need for reaching the central cornea for successful pneumatic dissection,**
- **substantially flattens the learning curve of DALK,**
- **while achieving a constant success rate above 80% and minimizing complications[7].**

With such standardized technique, surgeons are equally successful in achieving pneumatic dissection independent of their surgical experience[8].

7. Busin et al. *American J Ophthalmol*. 2016;164(4):6-13
8. Busin et al. *Cornea* 2019;38(5):645-647

DSAEK

Surgeons' nomograms to constantly prepare thin DSAEK grafts

BACKGROUND:

The latest generation of linear microkeratomes by Moria offers the convenience to safely and accurately prepare thin DSAEK grafts.

STUDY DESIGNS[9-10-11]:

Purpose:

To compare the results of One Use turbine-assisted Ultra-Thin DSAEK using nomograms developed by surgeons for a single-pass technique.

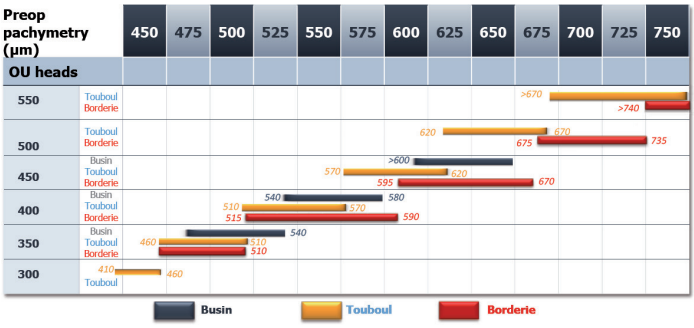
Material:

- One Use turbine by Moria (#19155)
- One Use Large-Cut heads by Moria (#19184/xxx) in different sizes
- Graft thicknesses measured by anterior segment OCT imaging

Methods:

Author	Nb of eyes	Intracameral pressure	Cutting process
Busin et al.[9]	42	90 mmHg	~5 seconds
Touboul et al.[10]	49	90 mmHg	~5-6 seconds
Borderie et al.[11]	112	90 mmHg	as slow as possible

RESULTS[9-10-11]:



- Busin et al.[9]: central graft thickness at 3 months postop:
  - **63 ± 29 µm**
  - <130 µm: 97% of grafts
  - <100 µm: 90% of grafts.

- Touboul et al.[10]:
  - central graft thickness at 1 month postop: **102.8 ± 35.9 µm**
  - central graft thickness at 6 months postop: 89.4 ± 26.2 µm
  - endothelial cell loss at 6 months postop: -28 ± 15%.

- Borderie et al.[11]: central graft thickness was **74 ± 49 µm** at 32 ± 29 months postoperatively.

CONCLUSIONS[9-10-11]:

Nomograms developed at different institutions allow:

- **reliable single-pass dissection of donor tissue,**
- **creating consistently thin and symmetric grafts[9-10-11].**

Results compare favorably with those reported in the past for double-pass microkeratome-assisted dissection of Ultra-Thin DSAEK[12].

9. Busin et al. *Cornea* 2015;34(11):1362-1364
10. Touboul et al. *French J Ophthalmol*. 2016;39(9):780-785
11. Borderie et al. *British J Ophthalmol*. 2020;104(9):1317-1323
12. Busin et al. *Ophthalmology* 2013;120(6):1186-1194

DSAEK

From wet-lab validation…

BACKGROUND:

Maintain of intracameral pressure during DSAEK graft preparation erases one variable for an even tighter predictability of calibrated cutting heads.

STUDY DESIGN[13]:

Design:

Wet-lab study on 30 human research corneas.

Purpose:

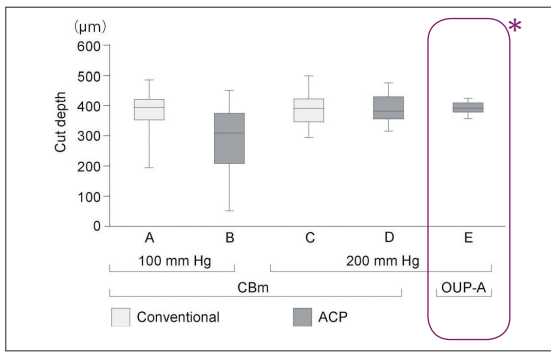
To highlight benefits of using ACP in combination with One Use-*Plus* (OUP) microkeratome.

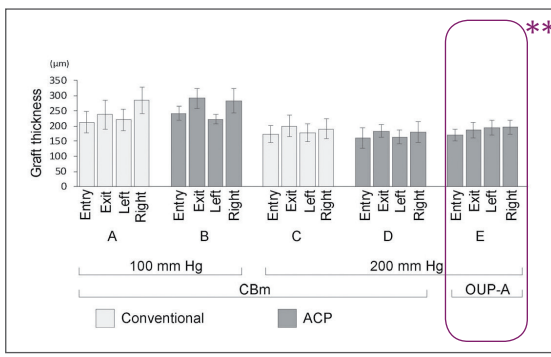
Materials:

- One Use-*Plus* and CBm microkeratomes by Moria
- ACP system to pressurize artificial chamber at 100 vs 200 mmHg

RESULTS[13]:

- Head performances*: the smallest variation in mean cut depth was observed when combining the OUP microkeratome with ACP at 200 mmHg & open system.
- Uniformity of DSAEK grafts** up to 3 mm from the center: again, more uniform-shaped DSAEK grafts were obtained when combining OUP microkeratome with ACP at 200 mmHg & open system.
- Endothelial cell loss: changes in endothelial cell density before and after the cuts were from -5.6 to +2.2%, without statistically significant differences among all the groups.
- Stromal surface: SEM (Scanning Electron Microscopy) analysis showed that combining the OUP microkeratome with ACP at 200 mmHg & open system didn't compromise smoothness of the residual stromal bed.





CONCLUSION[13]:

An intracameral pressure of 200 mmHg in combination with the One Use-*Plus* microkeratome is the best setting for UT-DSAEK grafts with high predictability of cut depth and uniformity of graft thickness with limited endothelial cell damage.

13. Shimazaki et al. *Trans Vis Sci Tech*. 2018;7(6):11

DSAEK

… to added-value eye banking practice

STUDY DESIGN[14]:

Design:

Retrospective study.

Purpose:

To compare the reliability of One Use-*Plus* (OUP) microkeratome with ACP system versus conventional pressurization for Ultra-Thin DSAEK graft preparation.

Objective:

To obtain a central DSAEK graft thickness ≤ 100 µm.

Materials:

- One Use-*Plus* microkeratome and ACP system by Moria
- Series of 265 consecutive human corneas processed for surgical purposes as per following:

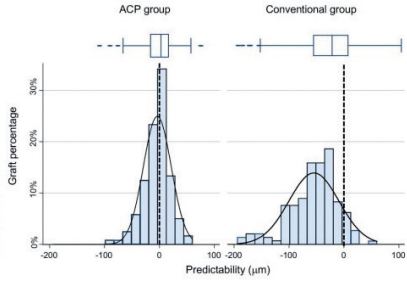
Group study	Nb of corneas	Pressurization method	Intracameral pressure	System open/closed
Group A	120	ACP	240 mmHg	open
Group B	145	Infusion line	200 mmHg	closed

- Corneal & graft thicknesses were measured by anterior segment OCT:
  - before and immediately after the cut,
  - centrally: corneal thickness (CCT) & graft thickness (CGT)
  - peripherally:
    - along 2 meridians: horizontal and vertical to the microkeratome pass line,
    - up to 9.0 mm diameter: ±0, 1, 3, 4 and 4.5 mm from the corneal center.

RESULTS[14]:

There was a statistical gain of accuracy and predictability with ACP:

Group	ACP	Infusion line
Nb of corneas	120	145
CCT (µm)	522.6 ± 52.5	538.6 ± 69.8
CGT (µm)	89.5 **± 16.7**	94.6 ± 23.6
CGT ≤ 130µm	**100%**	97.2%
CGT ≤ 100µm	**72.5%**	58.6%
Predictability (µm)	**-3.9 ± 2.3**	-54.6 ± 3.7



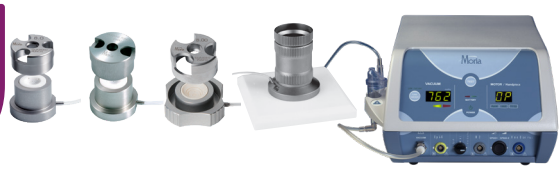
CONCLUSION[14]:

ACP system at 240 mmHg improved single-pass OUP-assisted preparation reliability of Ultra-Thin DSAEK grafts:

- **achieving central graft thickness ≤ 100 µm**
- **with significantly higher frequency**
- **and predictability compared to conventional pressurization.**

14. Quaranta et al. *Cornea* 2021;40(6):755-763

DMEK



Different approaches & techniques: dedicated donor punchs

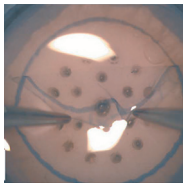
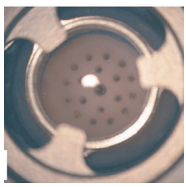
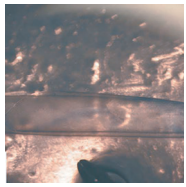
BACKGROUND:

Since introduction of DMEK by Dr Melles in 2006[15], different iterations have been proposed requiring the use of dedicated donor punchs. Here we'll briefly review main DMEK graft harvesting techniques using 3 different types of donor punches by Moria.

I) "SCUBA" PEELING TECHNIQUES[16-23]:

a) Vacuum-assisted Hanna donor punch[16-22]:

Kruse et al. (Erlangen, Germany)[16-19] then Seitz et al. (Homburg, Germany)[20-22] have both standardized their bi-manual underwater technique by positioning corneoscleral buttons onto the Hanna donor punch connected to the Evolution 3E console for an ~730 mmHg vacuum.
A 8.0- & 7.5-mm disposable Hanna blade is respectively used to superficially mark borders of the future DMEK grafts, followed by peeling off the Descemet Membrane (DM) with forceps, then DM is completely trephined with the same Hanna blade.

b) Guarded blade technology to find DM cleavage plan[23]:

Team from Rocky Mountain Lions Eye Bank (Denver, CO, USA) is routinely using:

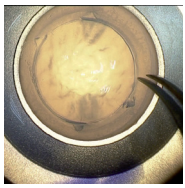
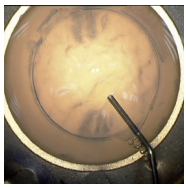
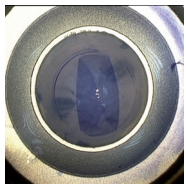
- a 9.5-mm guarded donor punch (#17207D950) to find a proper cleavage plan to peel the DM off
- until approximately 90% of the DM disc is separated,
- then a regular 8.0-mm full-thickness Busin donor punch (#17200D800) is used to finalize the DMEK graft diameter.

Their results of acceptable endothelial cell loss confirms that complete DMEK graft preparation can be conducted in an eye bank setting without compromising graft viability.

II) HYDRODISSECTION TECHNIQUE WITH REVERSED CORNEA[24]:

Muraine et al. (Rouen, France) reported an innovative and efficient hydrodissection harvesting technique[24]:

- by generating two access endothelial flaps (uncut hinges) on opposite sides of the cornea thanks to the 8.0-mm Muraine donor punch (#17209D800),
- then reversing the donor cornea, endothelium up, onto an artificial chamber,
- then hydrodissection is performed using a 27G Rycroft cannula filled with corneal storage medium or BSS,
- allowing DM to be folded in a "burrito" shape similar to a DSAEK graft with the endothelium inside the burrito.

TAKE-HOME MESSAGE:
The Descemet Membrane being delicate and prone to tears, a critical step in DMEK surgery is preparation of the donor endothelial graft.
Moria developed a wide range of donor punches to accompany every harvesting technique in order to:

- **maximize preservation of the endothelial cell density**
- **secure long-term graft survival**
- **reduce loss of precious donor tissue.**

K-Pro

Punch adapter for paired concentric donor trephination

BACKGROUND:

Difficulties in achieving concentric double punches of the donor tissue have been reported as regards the type 1 Boston K-Pro keratoprosthesis[25-27].
The Moria punch adapter (#17211) used with the Busin punch, is a simple and cost-effective device to standardize such crucial step:

STUDY DESIGN[28]:

Design:

1:1:1 three-arm wet-lab study.

Purpose:

To assess gain of centration accuracy when using the Moria punch adapter (#17211) in combination with the Busin punch.

Materials:

- 30 human corneas not suitable for transplantation
- 8.0-mm Busin single-use vacuum-assisted donor punch: #17200D800
- Reusable punch adapter: #17211

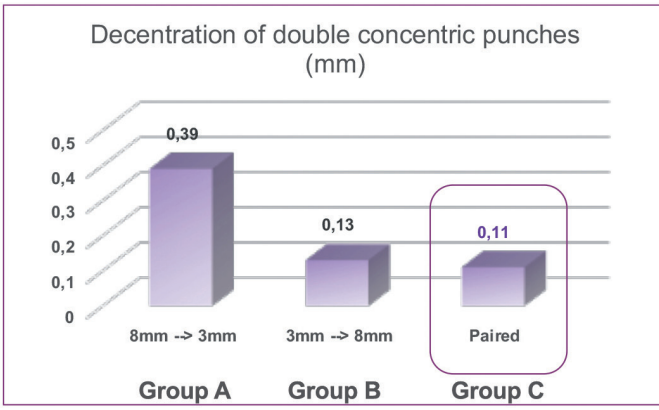
Method:

Group study	Nb of corneas	1st punch	2nd punch
Group A	10	8-mm	3-mm
Group B	10	3-mm	8-mm
Group C	10	Paired 3- & 8-mm simultaneous punches using punch adapter	

Centration of the two punches were measured using PhotoShop® (Adobe, USA) by a masked examiner.

RESULTS[28]:

Mean decentration was statistically lower when simultaneously pairing the two punches rather than consecutively.



CONCLUSION[28]:

Pairing the two punches on the donor cornea with the use of punch adapter by Moria leads to increased predictability and ease of trephination for Boston K-Pro preparation.
This may be an ideal and cost-effective method to prepare the donor corneal rim for surgery.

25. Moshirfar et al. *Clin Ophthalmol*. 2010;4:931-933
26. John T. *Tech Ophthalmol*. 2009;7(4):127-130
27. Moshirfar et al. *Clin Ophthalmol*. 2011;5:1017-1020
28. Baig et al. ESCRS Fall 2014, Sept 16th, London, UK

REFERENCES & DISCLOSURE

SALK-ALTK: with CBm-ALTK system

1. **Busin M.** Microkeratome-assisted superficial anterior lamellar keratoplasty. *Tech Ophthalmol.* 2006;4(1):1-5
2. **Busin M, Arffa RC.** Atlas of microkeratome-assisted superficial anterior lamellar keratoplasty. *SLACK Incorporated,* 2006;Chapter 3:23-30
3. **Busin et al.** Microkeratome-assisted superficial anterior lamellar keratoplasty for anterior stromal corneal opacities after penetrating keratoplasty. *Cornea* 2012;31(1):101-105

HALK: with CBm-ALTK system & Reusable Donor Punch

4. **Tan et al.** Hemi-automated lamellar keratoplasty (HALK). *British J Ophthalmol*. 2011;95(11):1513-1518
5. **Mehta et al.** Long-term outcomes of HALK. *Clin Exp Ophthalmol.* 2018;46(9):1017-1027

DALK: with Single-Use Vacuum-Assisted Adjustable Recipient Trephine

6. **Moshirfar et al.** Accuracy of corneal trephination depth using the Moria single-use adjustable depth vacuum trephine system. *Clin Ophthalmol*. 2014;8:2391-2396
7. **Busin et al.** Outcomes of air injection within 2 mm inside a deep trephination for DALK in eyes with keratoconus. *American J Ophthalmol.* 2016;164(4):6-13
8. **Busin et al.** Deep trephination allows high rates of successful pneumatic dissection for DALK independent of surgical experience. *Cornea* 2019;38(5):645-647

DSAEK:

With One Use manually-driven turbine:

9. **Busin et al.** Postoperative graft thickness obtained with single-pass microkeratome-assisted UT DSAEK. *Cornea* 2015;34(11):1362-1364
10. **Touboul et al.** Reproducibility of single-pass donor DSAEK tissue preparation with the Moria single-use microkeratome. *French J Ophthalmol*. 2016;39(9):780-785
11. **Borderie et al.** Influence of graft thickness and regularity on vision recovery after endothelial keratoplasty. *British J Ophthalmol*. 2020;104(9):1317-1323
12. **Busin et al.** UT-DSAEK with the microkeratome double-pass technique: two-year outcomes. *Ophthalmology* 2013;120(6):1186-1194

With One Use-*Plus* automated microkeratome & ACP system:

13. **Shimazaki et al.** Comparison of artificial anterior chamber internal pressures and cutting systems for DSAEK. *Trans Vis Sci Tech*. 2018;7(6):11
14. **Quaranta et al.** Single-pass microkeratome and ACP for the Ultra-Thin DSAEK graft preparation. *Cornea* 2021;40(6):755-763

DMEK:

With Reusable Vacuum-Assisted Hanna Donor Punch & Evolution 3E Console:

15. **Melles et al.** Descemet Membrane Endothelial Keratoplasty (DMEK). *Cornea* 2006;25(8):987-990
16. **Kruse et al.** A stepwise approach to donor preparation and insertion increases safety and outcome of DMEK. *Cornea* 2011;30(5):580-587
17. **Kruse et al.** Characterization of the cleavage plane in DMEK. *Ophthalmology* 2011;118(10):1950-1957
18. **Kruse et al.** Reproducibility of graft preparations in DMEK. *Ophthalmology* 2013;120(9):1769-1777
19. **Kruse et al.** Long-term clinical outcome after DMEK. *American J Ophthalmol*. 2016;169:218-226
20. **Seitz et al.** Anatomy-based DMEK wetlab in Homburg/Saar: novel aspects of donor preparation and host maneuvers to teach DMEK. *Clin Anatomy*. 2018;31(1):16-27
21. **Seitz et al.** DMEK - Spender und empfänger schritt für schritt. *Ophthalmologe* 2020;117(8):811-828
22. **Seitz et al.** Reproducibility of non-invasive endothelial cell loss assessment of the prestripped DMEK roll after preparation and storage. *American J Ophthalmol*. 2021;221(1):17-26

With Single-Use Vacuum-Assisted Guarded Donor Punch:

23. **Eghrari et al.** Viability of DMEK grafts folded in the eye bank. *Cornea* 2018;37(11):1474-1477

With Single-Use Vacuum-Assisted Muraine Guarded Donor Punch:

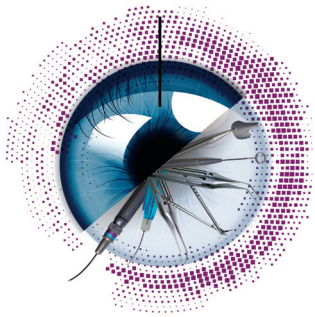
24. **Muraine et al.** Novel technique for the preparation of corneal grafts for DMEK. *American J Ophthalmol*. 2013;156(5):851-859

KERATOPROSTHESIS: with Reusable Punch Adapter

25. **Moshirfar et al.** Improved centration of the type 1 Boston keratoprosthesis in donor carrier tissue. *Clin Ophthalmol*. 2010;4:931-933
26. **John T.** Use of trypan blue corneal staining and centration ring in Boston keratoprosthesis surgery. *Tech Ophthalmol*. 2009;7(4):127-130
27. **Moshirfar et al.** Femtosecond-assisted preparation of donor tissue for Boston type 1 keratoprosthesis. *Clin Ophthalmol*. 2011;5:1017-1020
28. **Baig et al.** New device for preparation of donor corneal tissue during Boston keratoprosthesis (KPro) surgery. Paper presented during: ESCRS Fall 2014 annual congress, Sept 16th, London, UK

FINANCIAL DISCLOSURE

Massimo Busin, MD, PhP (Forlí, Italy) is a paid consultant for Moria.
None of the other authors has financial interest in Moria products or is a paid consultant for Moria.



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