DALK (fluid dissection) in Keratoconus

Islam M. Hamdi FRCS (Glasg.), PhD

Consultant of Ophthalmology
Head Refractive Surgery and Cornea Unit,
Magrabi Eye and Ear Center,
Jeddah

Assistant Professor
Ophthalmology Dept.
Faculty of Medicine
Ain Shams University, Cairo

ESOIRS, May 31st 2012
Introduction

KERATOCONUS

- Corneal stromal ectatic disease.

- Conservative treatment (*Optical*)
  - Spectacles
  - Hard contact lenses

- Interventional treatment (*Surgical*)
  - Corneal Collagen Cross-linking
  - Intracorneal ring Segments
  - *Keratoplasty*
Introduction

KERATOPLASTY

• Classic surgery is "Penetrating" (PKP)
• The healthy endothelium is replaced altogether.
• Higher risk of rejection.
• Early models of lamellar graft (Epikeratoplasty) failed to achieve a smooth interface.
Keratoplasty

Penetrating

Lamellar
Introduction

DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK)

- Deep dissection as deep as the Descemet’s membrane.
- Corneal endothelium is preserved.
- Epithelium of the patient grows and replaces the donor’s epithelium.
- Only the weak stroma is replaced by a new healthy one.
Anterior Lamellar Keratoplasty

Deep

Superficial
Introduction

ADVANTAGES OF DALK

- Overcomes previous disadvantages:
  - Rejection and survival (PKP).
  - Ocular penetration (PKP).
  - Smooth interface (Epikeratoplasty)
Introduction

DISADVANTAGES OF DALK

• Lengthy procedure.
• Steep curve of learning
• Long visual rehabilitation. (?)
• If perforated, should be converted into PKP.
Techniques of DALK

- Intrastromal Air Injection (Archila, 1984).
- Hydrdolamination (Sugita, 1997).
- Air Bubble in AC (Melles, 1999).
- Intrastromal Fluid Injection (Amayem, 2000)
- The big bubble technique (Anwar, 2002).
DALK Fluid Dissection
ISRS Multimedia Library
DALK (Fluid Dissection) vs. PKP

• To assess the effect of the residual interface on the visual outcome.

• 1st Study:
Visual Acuity and Refraction
(Retrospective longitudinal)

• 2nd Study:
Optical Quality (Retrospective Cross-Sectional)
Conclusions: Long-term BCVA, manifest refraction spherical equivalent and manifest refractive cylinder after DALK with hydrodissection were similar to those after PKP.
1st Study (accepted for publication)

- Vision (Best Spectacle Corrected Visual Acuity- BSCVA)

- Refraction (Mean Refractive Spherical Equivalent- MRSE + Mean Refractive Cylinder – MRC).

- Comparison at 6- 12 -24 months (1 year after suture removal)
BSCVA (Log.MAR)

$P > 0.05$
Results

P<0.05
Results

$P>0.05$
2nd Study

- Vision (UCVA – BSCVA)
- Refraction (MRSE – MRC – RMS @ 3&5mm)
- Keratometry (Sim K1 – K2 – Kcyl)
- Aberrometry (RMS – PSF – MTF of HO Aberreations + RMS of major aberrations for both: Corneal and Global measurements)
Patients and Methods

• Retrospective comparative study between 2 matched groups.

• 36 Keratoconus eyes

Group A-PKP: 12 cases
Group B-DALK: 24 cases

• Comparison after removal of sutures
Visual Acuity

P > 0.05
Refraction

\( P > 0.05 \)
Keratometry

P > 0.05
RMS of OPD

P > 0.05
Global Aberrations

$P > 0.05$

$P < 0.05$

<table>
<thead>
<tr>
<th>Microns</th>
<th>PKP</th>
<th>DALK</th>
</tr>
</thead>
<tbody>
<tr>
<td>HO</td>
<td>2.73</td>
<td>1.59</td>
</tr>
<tr>
<td>Sph.</td>
<td>0.55</td>
<td>0.52</td>
</tr>
<tr>
<td>Coma</td>
<td>1.35</td>
<td>0.91</td>
</tr>
<tr>
<td>Tri</td>
<td>1.86</td>
<td>0.97</td>
</tr>
<tr>
<td>Tetra</td>
<td>0.44</td>
<td>0.41</td>
</tr>
<tr>
<td>HO Ast.</td>
<td>0.33</td>
<td>0.26</td>
</tr>
</tbody>
</table>
Corneal Aberrations

$P > 0.05$

$P < 0.05$

Microns

<table>
<thead>
<tr>
<th></th>
<th>PKP</th>
<th>DALK</th>
</tr>
</thead>
<tbody>
<tr>
<td>HO</td>
<td>3.24</td>
<td>2.26</td>
</tr>
<tr>
<td>Sph.</td>
<td>1.04</td>
<td>0.90</td>
</tr>
<tr>
<td>Coma</td>
<td>1.98</td>
<td>1.37</td>
</tr>
<tr>
<td>Tri</td>
<td>1.73</td>
<td>1.07</td>
</tr>
<tr>
<td>Tetra</td>
<td>0.51</td>
<td>0.58</td>
</tr>
<tr>
<td>HO Ast.</td>
<td>0.45</td>
<td>0.36</td>
</tr>
</tbody>
</table>

PKP: Penetrating Keratoplasty
DALK: Deep Anterior Lamellar Keratoplasty

International Society of Refractive Surgery
A Fellow of the American Academy of Ophthalmology
$P > 0.05$

**PSF**

**Strehl ratio (1E-3)**

- **Global**
  - PKP: 4.08
  - DALK: 2.84

- **Corneal**
  - PKP: 3.16
  - DALK: 5.16
MTF

P > 0.05

A/D

Global

Corneal

PKP

DALK
Conclusion

- Visual results and topography are equal
- Preservation of Descemet’s pushes the graft into a more myopic position after suture removal
- DALK by fluid dissection provides an optical quality comparable to PKP
- Sometimes even better (?????)
Summary

- Preserving the Descemet’s membrane + a thin layer of stroma did not sacrifice results
- DALK shows medical and clinical superiority
- DALK is the technique of first choice when posterior corneal layers are healthy.
Summary

PKP is indicated whenever DALK (fluid dissection) is not possible:
- Post-hydrops.
- Intra-operative Descemet’s membrane perforation (macro perforations only).