

Scientific session: Cornea – sclera

422-01

Retention of the Boston keratoprosthesis

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Purpose: To elucidate the retention and stability of a late-model Boston Keratoprosthesis.

Methods: The surgical results of 104 consecutive Boston Keratoprosthesis Type I Rev C (with locking ring to prevent loosening of the back plate) performed in non-autoimmune cases over the last 2 years have been reviewed. Thus the follow-up has been for 1–24 months. The data for corneal melt, aqueous leak, need for surgical repair and overall retention have been analyzed.

Results: Of the 104 Boston Keratoprosthesis cases examined, none has so far required any surgical revision or replacement. No tissue melt or aqueous leak has occurred.

Conclusion: Stability and retention are the most fundamental requirements of a Keratoprosthesis. On a medium-term basis, in non-autoimmune diseases, the late-model Boston Keratoprosthesis (Rev C) has shown excellent retention.

422-02

Engineering of multilayered polarized corneal epithelial grafts from explant culture

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Purpose: To investigate polarization and surface morphology of bio-engineered corneal grafts for transplantation purposes in treating severe corneal epithelial conditions.

Methods: Human amniotic membranes were stitched onto permeable membranes of culture plate inserts to enhance the provision of nutrients to the cultures. Human limbal explants were positioned with either the epithelium or the stromal side facing the amniotic membrane and cultured for 16 days. The morphology of the epithelial outgrowth was examined by the means of scanning electron microscopy, light microscopy and transmission electron microscopy.

Results: The morphological analysis did not show any major difference between the two groups of explant orientations. A surface consisting of closely apposed, flattened epithelial cells covered with microplicae and microvilli was revealed by the means of scanning electron microscopy. Light microscopy demonstrated a squamous epithelium which was up to six cells in thickness. Transmission electron microscopy uncovered a polarized well-differentiated epithelium with desmosomes, hemidesmosomes and deep basal interdigitations.

Conclusion: Multilayered polarized epithelium may be engineered *ex vivo* independent of limbal explant orientation.

422-03

DSAEK: a new posterior corneal graft technique

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Purpose: To describe a new surgical technique of posterior lamellar corneal graft (DSAEK: Descemet Stripping Automated Endothelial Keratoplasty) and to give results of the first cases.

Methods: The first step consists to remove an anterior lamellar from the posterior portion using the Moria CBm microkeratome with a

300-µm head. The residual posterior tissue is then punched. In the second step, the Descemet's membrane of the patient is stripped off. In the last step, the donor is folded, before to be inserted in the anterior chamber through a 5-mm scleral incision. An air bubble is injected to press the donor tissue against the patient's cornea. The anatomic and visual results of our 3 first cases are analyzed.

Results: The adhesion of the posterior lamellar graft was obtained in two cases. In the other one, a second air injection was performed at J1 with success. The best corrected visual acuity at 1 month was superior to 0.25 in all cases, and superior to 0.3 at 3 months. The pachymetry at 3 months was 703 µm +/- 32 µm.

Conclusion: DSAEK offers the possibility to replace corneal endothelium through a 5-mm scleral incision. The corneal form and innervation is then preserved. Rapid visual recovery can be obtained. Long term studies are necessary to confirm the interest of this new corneal graft technique.

422-04

One cornea, two patients

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Purpose: To illustrate the usefulness of the Moria ALTK system in preparing tissue for both anterior lamellar keratoplasty (LKP) and Descemet's stripping automated endothelial keratoplasty (DSAEK).

Methods: Anterior lamellar keratoplasty for the correction of keratoconus and stromal scars using the technique of Malbran will be discussed. Donor tissue preparation for this procedure is facilitated by the Moria microkeratome/artificial chamber system. This system also assists in the preparation of donor tissue for DSAEK which can be utilized for patients with Fuchs dystrophy and pseudophakic keratopathy.

Results: One year postoperative results for LKP and DSAEK will be discussed. The use of a single donor cornea to treat two different patients with these techniques will be addressed.

Conclusion: Lamellar keratoplasty represents a safer alternative to penetrating keratoplasty for patients requiring corneal transplantation and in the case of DSAEK visual rehabilitation is greatly accelerated.

422-05

Topography-guided LASIK in eyes with symptomatic corneal irregularities

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Purpose: Patients with corneal irregularities may have visual disturbances, such as reduced best corrected visual acuity, monocular diplopia, and night vision complaints. The purpose of the present study was to examine the effectiveness of topography-guided LASIK with the Wavelight platform (T-CAT), in patients with visual complaints caused by corneal irregularities.

Methods: The eyes included in the study, had corneal irregularities following penetrating keratoplasties (PK) (7 eyes), previous refractive surgeries (10 eyes), and corneal injuries (2 eyes). Two eyes of one patient had constitutional irregular corneas. The corneal topographies were obtained and analyzed with the 'Allegro Topolyzer'. The examinations were transferred to the excimer laser. Corneal flaps were cut with Moria M2 microkeratome. Corneal high order aberrations were corrected with 'Allegretto Eye-Q' excimer laser.

Results: Significant improvements of corneal aberrations were obtained in 95% (20/21 eyes). One operation was aborted (PK case) due to button hole in the corneal flap. Remaining patients reported significant improvement of visual quality. None of the eyes lost best spectacle corrected visual acuity. The refractive results following T-CAT

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were unpredictable. Refractive errors were corrected with excellent results, using wavefront optimized re-treatments in 80% (16/20 eyes).

Conclusion: Topography-guided LASIK is an effective method to improve visual disturbances caused by corneal irregularities. The refractive result of the treatment is unpredictable. Accordingly, the treatment should be planned as a two-step procedure.

422-06

Kerating procedure with femtosecond laser in keratoconus results in Euroeyes clinics

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Purpose: Kerating procedure with femtosecondlaser in keratoconus ectasia. Purpose to evaluate the outcome and safety of treating patients with keratoconus by insertion of a kerating with a femtosecondlaser. Setting: Euroeyes Clinic group (Copenhagen, Hamburg, Stuttgart, Berlin).

Methods: Kerating-Procedure in 12 eyes of 10 patients with keratoconus (8 primary and 2 post-LASIK). The size of the Kerating was chosen after the nomogram of Albertazzi. The cut of the Kerating tunnel was performed with a femtosecondlaser (Intralase FS2). The inner and outer diameter of the cut were set by 5 and 5.6 or 5.7 mm, the depth was chosen at 80% of the corneal thickness (400 µ). The entry cut was done in the steepest topographic meridian of the upper half with a cut length of 1.1 mm. The ring was then manually inserted. Patients evaluated preoperatively and after 1, 3, 6 and 12 months. BUCVA, BCVA, mean topographic power and mean spherical equivalent and complications.

Results: The mean spherical equivalent decreased from preoperatively -9.6 D to -3.9 D at 1 month, -3.8 D + -2.6 D at 3 months and -0.875 D + -3 D after 6 months. The mean BUCVA increased at 1 month 1.5 lines, 3 month 1.5 lines and after 6 months 3.5 lines. The mean BCVA increased at 1 month 0.5 lines, at 3 months 0.5 lines and after six 2.5 lines. The mean topographic power decreased from preoperatively 48.1 D + -3 D to 43.9 D + -1.7 D at 1 month, to 41 D + -0.8 D after 3 months and 41.1 D + -0.5 D after 6 months (one year results will be presented).

Conclusion: The treatment of keratoconus with Keratings is effective in reducing the mean topographic power and spherical equivalent, thus increasing the BUCVA and BCVA over time. In some cases allowing the use of simple contact lens or refractive surgery correction restoring a useful vision and postponing a corneal transplant. The use of the Femtosecondlaser for the preparation of the tunnel facilitates the procedure and adds to the safety of the surgery.

422-07

A model for corneal endothelium morphometry by diffraction

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Purpose: To develop a mathematical model for the relationship between corneal endothelial cell density and coefficient of variation for cell size (CV) and variables in the diffraction pattern of corneal

endothelial cells. The long term goal of the project is to do morphometry of the corneal endothelium with diffraction.

Methods: The Fraunhofer diffraction pattern of the corneal endothelium holds average morphometric information. As a first step, a mathematical model for specularly imaged corneal endothelial cells was developed. The model was used to simulate corneal endothelial cells. The software allows variation of the endothelial cell density and CV. The simulated endothelial cells were Fourier transformed numerically. Relevant characteristics of the diffraction pattern were detected. The simulation was repeated while successively varying mean endothelial cell size and CV within a relevant interval. The functional dependence of selected properties of the diffraction pattern and mean endothelial cell size and CV was determined.

Results: The simulation generated clinically relevant endothelial cell structure with variable morphometric parameters. A first degree linear relationship between the mean cell size and the radius of the first order diffraction maximum was found. A second order linear relationship between endothelial CV and diffraction pattern properties was also found. Modulation of the second order relationship rendered a direct relation between the diffraction pattern samples and the CV.

Conclusion: The mean endothelial cell size and the CV, respectively, are related to characteristics of the diffraction pattern of endothelial cells. In order to obtain absolute measurements of mean endothelial cell size and CV, from the diffraction image, the parameters for the dependence has to be empirically determined by in vivo calibration.

422-08

The expression of the focal adhesion protein PINCH in normal and alkali injured corneas and the role of PMNs

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Purpose: To evaluate the role of particularly interesting new cystein-histidin-rich protein (PINCH), in corneal wound healing and early neovascularization and to assess the influence of granulocytes on the expression.

Methods: A standardized rabbit corneal alkali wound was inflicted in general anesthesia to the right eye of 14 New Zealand White rabbits. 7 of the rabbits received i.v.1.5 ml 5% fucoidin every 2 hours to block granulocytes from entering the wound area. After 36 hours the rabbits were sacrificed, the corneas excised, fixed in 4% formaldehyde and embedded in paraffin. The sections were double stained with antibodies against PINCH and hematoxyline-eosin.

Results: In the normal cornea and limbus, PINCH was not expressed except in a wedge of the conjunctival stroma. In the wounded corneas, PINCH expression was seen in the frontline of repopulation cells, and in the keratocytes from the limbus to the wound. The vascular endothelium and the granulocytes expressed PINCH as did the conjunctival epithelium. In the fucoidin treated rabbits, PINCH expression was markedly reduced. The vascular endothelial cells and the few granulocytes seen did not express PINCH in these rabbits.

Conclusion: PINCH is not expressed in the normal cornea. A corneal wound induces expression in the invading, repopulating cells, in the vascular endothelial cells of the limbus, in the limbal epithelium and in the granulocytes. Exclusion of granulocytes reduces the expression of PINCH and in the vascular endothelium there is no expression at all. The pattern of expression resembles that of VEGF in the same model, but there are also distinct dissimilarities.