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Cross – Infection and Contact Ophthalmic Devices: Clinical Trials of a Disposable Ophthalmic Barrier System

TIGHE BJ (1), FRANKLIN VJ (1), HENLEY CE (1), KERR J (2), GEE H (3), WOLFFSOHN J (4), FLANAGAN J (5)
(1) Biomaterials Research Unit, Aston University, Birmingham
(2) Mayday University Hospital, Croydon
(3) First Water Ramsbury Ltd, Hilldrop Lane, Ramsbury
(4) Optometry & Vision Sciences, Aston University, Birmingham
(5) School of Optometry, University of Waterloo, Waterloo, Canada

Purpose It's generally accepted that there is a potential risk of cross-infection from patient to patient from contact ophthalmic devices such as the Goldmann tonometer, Gonioscope lenses, A-scan ultra sound probes, and ultrasound pachymeters. A Department of Health funded project has developed a four-layer barrier system consists of barrier layer, which is coated with an adhesive hydrogel. The adhesive layer is covered with backing paper until use to maintain the adhesiveness, and the barrier layer is covered with a protective liner until use to maintain a sterile environment.

Methods Clinical trials demonstrated that not only does the prototype developed perform successfully in terms of the functional properties such as ease of use, barrier properties but also the effect on the intra ocular pressure measurements are acceptably accurate in comparison to the Goldman Tonometer.

Results This poster summarises the work completed to date on the development of the novel sterile universal barrier system and the next stages of further design refinement, involving extended clinical consultation in conjunction with professional design input, interlinking the three aspects: materials, fabrication and ease of use in the clinical environment. In this way, an optimized product with demonstrated acceptability to clinical practitioners can be developed.

Conclusion There is a need for an effective disposable ophthalmic barrier system which is clinically acceptable.

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Age-related changes in the corneal thickness profile assessed with Orbscan

JONUSCHEIT S, DOUGHTY MJ, BUTTON NF
Department of Vision Sciences, Glasgow

Purpose To assess the corneal thickness with scanning-slit (Orbscan) pachymetry at central, mid-peripheral, and peripheral sites and to generate a ratio to describe the corneal thickness profile from the centre towards the periphery as a function of age.

Methods Orbscan measurements were performed on 98 right eyes of 98 healthy subjects. Three readings were taken and data was extracted from the pachymetry maps at the geometrical centre, mid-peripheral locations 2.5 mm to either side of the centre, and peripheral locations 4.5 mm from the centre along the horizontal meridian. Nasal and temporal measurements were averaged for each cornea.

Results The mean age of the subjects was 44.9 +/- 14.1 years (+/- SD), range 19 to 82 years. The mean central corneal thickness was 0.584 +/- 0.041 mm. For the mid-periphery and the periphery the readings were 0.635 +/- 0.042 mm and 0.713 +/- 0.047 mm respectively. The mean M/C-ratio (ratio between mid-peripheral and central corneal thickness) was 1.09 +/- 0.03 and the mean P/C-ratio (ratio between peripheral and central corneal thickness) 1.22 +/- 0.06. The M/C-ratio was only weakly correlated to age. However, the P/C-ratio showed a much stronger correlation to age. The results of our study strongly indicate that corneal thinning does occur at peripheral sites but is not as pronounced in the mid-periphery about 2.5 mm from the centre.

Conclusion Age-related changes in the corneal thickness profile (peripheral corneal thinning) predominantly occur at locations outside 2.5 mm from the centre of the cornea.

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Short-term Effects of Contact Lens Corneal Refractive The Short-term Effects of Contact Lens Corneal Refractive Therapy on Corneal Topography

QUEIROS A (1), GONZALEZ-MEIJOME JM (1), VILLA-COLLAR C (2), JORGE J (1), ALMEIDA JB (1), PARAFITA MA (3)
(1) Physics (Optometry) - University of Minho, Braga
(2) Clinica Oftalmológica Novovisión, Madrid
(3) Surgery (Ophthalmology) - University of Santiago de Compostela, Santiago de Compostela

Purpose The goal of the present study was to investigate central corneal pachometric changes within the first 3 hours of lens wear under open-eye conditions and the regression of the effect achieved during the same period time after lens removal.

Methods Fourteen voluntaries where fitted with Paragon CRT® rigid gas permeable contact lenses according to the fitting recommendations of the manufacturer simulating a different treatment effect of -2 and -4 myopic correction in the right and left eye in random order. After the lenses were placed in both eyes, subsequent measurements were obtained at 30, 60 and 180 minutes, and with same intervales after lens removal.

Results Change in apical curvature above -0.50 D is already detected after 30 minutes of lens wear. However, on average changes in apical curvature are greater (-0.27 vs -0.39 D/hr.; $p<0.05$) and faster (-0.53 vs -0.78 D/hr.; $p<0.05$) for the -4.00 targeted eye. Recovery was total 180 minutes after lens removal. Flat Sim'k showed differences between both treatments even within the first 30 minutes, reaching a maximum reduction in power after 180 minutes of -0.67 and -0.82 D for -2 and -4 targets, respectively ($p<0.05$). Changes in steep Sim'k were almost the same for both targets (maximum change at 180 minutes: -0.56 vs -0.63 D; $p>0.05$). Changes in corneal eccentricity were similar for both groups (maximum of -0.17 and -0.19 at 180 minutes of lens wear; $p>0.05$) with a parallel progression over time.

Conclusion Short term changes in apical radius in response to CRT lens wear are very fast, and apical radius can reach total recovery after short periods of lens wear within 3 hours. From the clinical point of view, this work helps us to understand what to expect from the cornea while we are performing the fitting tests.

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Gene therapy promotes corneal graft survival

BARCIA RN, DANA RM, KAZLAUSKAS A
Schepens Eye Research Institute, Harvard Medical School, Boston

Purpose Corneal endothelial cells (CEC) are essential to keep the cornea clear. Loss of CEC is thought to occur in graft failure, particularly in graft failure due to rejection, an immune reaction that targets endothelial cells. We postulate, that CEC loss during graft failure is due to apoptosis. Furthermore, because CEC in vivo are thought to have little regenerative capability, we hypothesize that preventing apoptosis in the donor corneal endothelium will promote cornea graft survival.

Methods Anti-apoptotic genes (Bcl-xL, Bcl-2, p35 and survivin) were cloned into a retroviral plasmid vector. Retroviruses were used to infect CEC. Apoptosis was induced by etoposide or IFNγ and TNFα, and detected by annexin V and Propidium Iodide staining and flow cytometry analysis.For in vivo studies, we used an orthotopic cornea transplant model. BALB/c mice were used as recipients, and C57BL/6 or BALB/c (syngeneic) corneas were used as donors. For transduction of the endothelium, excised corneas were teated with eGFP, or IZsGreen or IzsGreen-Bcl-xL lentivirus. Apoptosis in the graft's endothelium was detected by TUNEL staining and confocal microscopy.

Results Apoptosis of the graft endothelium occured in rejecting corneas as early as 2 weeks. We found that Bcl-xL, but not other genes, protects CEC from apoptosis. Lentiviral-delivery of Bcl-xL to the corneal endothelium of donor corneas significantly improved the survival of low risk allografts.

Conclusion Graft failure is accompanied by apoptosis of the endothelium. Bcl-xL protects CEC from apoptosis in vitro and promotes allograft survival.