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SERUM DRAMATICALLY ENHANCES ORIENTATION AND MIGRATION OF CULTURED BOVINE CORNEAL EPITHELIAL CELLS IN AN APPLIED ELECTRIC FIELD (EF)

ZHAO M[1], AGIUS-FERNANDEZ A[2], FORRESTER J[2], McCAIG C[1]

[1]Department of Biomedical Sciences, Marischal College, [2]Department of Ophthalmology, University of Aberdeen, Aberdeen AB9 1AS, Scotland(UK)

Purpose Wounded epithelia generate small dc electric fields, whilst many cell types, including rabbit corneal epithelial cells reorient and migrate directionally when cultured in a dc field. We have studied the effects of an externally applied dc field on cultured bovine corneal epithelial cells.

Methods Primary culture of bovine corneal epithelial cells were exposed to a dc field for 5h. Media were exchanged into the cultures immediately prior to field application. Serial photographs were taken and analyzed.

Results In media containing 10% FCS, cells showed marked galvanotropic response. At 100mV/mm, cells reoriented perpendicularly after about 20–30 min in EF, whilst at 150mV/mm migration towards the cathode at a mean rate of 13.3±2.6um/h (n=40) was evident. Cell sheets (about 3–30 cells together) also migrated cathodally at a slightly higher rate of 17.0±1.9um/h for the leading edge and 17.4±1.9um/h for the trailing edge (n=15). Much larger sheets also migrated cathodally. For both the dissociated cells and cell sheets, ruffled membranes and lamellipodia were abundant at the leading edges, and cell processes underwent retraction at the trailing edges. The directional migration of the cell and cell sheets showed no marked increase beyond 150mV/mm to 250mV/mm. Addition of 25ng/ml EGF in the serum containing media had no obvious influence on the cell response to EF. By contrast, in serum free medium, we found cell reorientation at 200 mV/mm, but no obvious directional movement at field strengths up to 250mV/mm.

Conclusions The results demonstrate a much lower threshold for galvanotropic and galvanotaxic response of cultured corneal epithelial cells when serum is present in the medium. Thus element(s) within serum promote electric field directed migration of corneal epithelial cells. In combination, electric fields and serum components may enhance corneal wound healing. (supported by the Wellcome Trust)

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AUTOMATED TECHOLOGY OF CLINICAL STUDY OF EYE BIOMECHANICS AND DIAGNOSIS ACCORDING TO CORNEA PHOTOELASTICITY

V.DANILICHEFF, A.JOURAVLEV

Clinic & Department of Ophthalmology, Medical Military Academy, St.-Petersburg, (Russia)

Purpose
Creating a technology for clinical studies of cornea photoelasticity and mechanical tensions on the eyeball for the purpose of practical diagnostics and scientific research.

Methods
Cornea experiences a stress-strain state and shows an optical anisotropya. The method of photoelasticity based on the effect of induced birefringence allows one to vizualize inner tensions. The pattern obtained from the cornea with the help of polariscope is entered into computer for image processing.

Results
It was revealed that the field of tensions in the cornea is determined by specific eye biomechanics. The interference pattern arising in polarized light (isochromatic and isoclinic fringes) is an integral indicator of the state of the biomechanical system of an eye at the moment of studies. A correlative connection between features of interference pattern and factors causing changes in the stress-strain state of cornea is an instrument for diagnostic decision making. The phenomenological models for interference pathological states of an eye are outlined. Image processing made it possible to derive the most informative diagnostic features. According to results of studies a database is formed and used in diagnostics.

Conclusions
New technology proved to be highly valuable for practical ophtalmology as well as for scientific research. Technology is realized in the screening and differential assessment operation modes.

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Videokeratoscopic study of central corneal topography in a population of myopes

Mehel E., Stork L.,Lignereux F., Weber M.,Pechereau A
Clinique Ophtalmologique, Hôtel Dieu, C.H.U. Nantes (France)

Purpose : The configuration of the central cornea in a population of myopes was analysed stastistically using a computerized videokeratoscope. The variables which can affect mean corneal refractive poower were analysed.
Methods : The study was carried out on 80 eyes in 49 myopic subjects. Analysis was carried out at 16 points situated between two concentric circles with a radius of 0,32 and 1,32 millimetres, respectively, identified by their distance from the centre (in millimetres) and the coordonates (in degrees). The correlation between the corneal refactive power of two opposing semi-meridians was found. Then, the influence of age and spherical equivalent on corneal refractive power was studied .
Results : The correllation existing between two opposing semi-meridians are excellent (r=0,90). However, 22,5% of corneas demonstrate significant asymetry between two opposing semi-meridians. This asymetry was not demonstrated by standard keratometry. The influence of age and spherical equivalent was found to be not significant. Mean corneal refractive power is greater in the center than in the periphery on every ring and every semi-meridians. The percentage of corneas with positive or negative asphericity varies, depending on the distance from the center : 91,25% of corneas have a positive asphericity on the ninth ring. Only 43,75 % of corneas have a positive asphericity on the third ring.
Conclusions . This study allowed us to demonstrate the wide variation in refractive power of the normal cornea. This phenomenon cannot be demonstrated by standard keratometry.

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COMPARISON OF VIDEOKERATOSCOPES FOR THE DIAGNOSIS OF CENTRAL ISLANDS

J. Moossavi, M. Assouline, M. Muller-Steinwachs, A. Galand, Ch. Hartman, Y. Pouliquen
CHU Hôtel-Dieu de Paris (France), CHU Liège (Belgium), U. Köln (Germany), U. Hosp Charité Berlin (Germany).

Purpose: To investigate the ability of various videokeratoscopes to identify and characterize central islands (CI) following photorefractive keratectomy
Methods: 10 spherical PMMA contact lenses presenting true (not artifactual) CI following experimental photoablation were analyzed by videokeratoscopy using both TMS-1 (Tomey, France) and CAS 2000 (EyeSys Technology, France) systems.
Results: Mean largest diameter analyzed by TMS and CAS, in the absence of face contour related shadows, was not significatively different (7.84±0.68 mm vs 7.93±0.61 mm respectively). Mean largest diameter of ablated area was not significatively different from actual ablation zone size (107±10 % vs 100±11 % for TMS and CAS respectively). However, although CI were detected in all samples by TMS, only 4 CI in 10 were identified on the CAS color coded maps at the same resolution level (0.5 diopters steps). Mean largest CI diameter was 2.23±0.85 mm (TMS) vs 0.63±0.85 mm (CAS). Mean steepest refractive power of CI, relative to the flattest refractive power of the ablated zone was 6.36±2.72 D (TMS) vs 2.86±2.56 D (CAS).
Conclusion: These results suggest that the reported rates and characteristics of CI following PRK may largely depend upon specific videokeratoscope design. The topographical significance of CI may therefore reflect both actual surface deformation and measurement biases.