

The background of the cover is a blurred, high-angle photograph of a busy city street. In the center, a blue and white tram is moving away from the viewer. The street is lined with trees and buildings, and many pedestrians are walking on the sidewalks. The overall scene is bright and somewhat overexposed, giving it a clean, modern feel.

International
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Abstract Book

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A Novel Artificial Intelligence Model for Diagnosis of Keratoconus Based on Chaos Theory

Authors

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Abstract

Purpose: We aimed to develop a novel model for diagnosing keratoconus based on chaos theory principles.

Materials and Methods: Many processes in nature and even the human body have been shown to exhibit chaotic behavior, meaning that they behave based on the deterministic laws of physical equations, yet are very hard to predict. The same approach can be applied to corneal ectatic diseases (which cornea is/will progress to keratoconus?). In this study, data from the Pentacam Scheimpflug device were used for modeling the cornea based on chaos theory principles. The designed model was implemented in two groups of patients, with a total of 62 males and 51 females. (48 keratoconus, 65 normal eyes). In each group, 70% of the data were used for training and 30% for testing the model.

Results: Group 1 consisted of 33 normal and 26 keratoconus, and group 2 consisted of 32 normal and 22 keratoconus eyes. Our model achieved a very acceptable sensitivity of 88% and 92% and a specificity of 90% and 96% for diagnosing keratoconus in the first and second groups, respectively. ($p = 0.028, 0.025$)

Conclusion: To the best of our knowledge, this is the first attempt to model the cornea based on the principles of chaos theory. Two samples were used, and very similar results regarding sensitivity and specificity were achieved in both cases. We successfully produced a proof of concept for our model. Nevertheless, larger sample sizes can give even greater credibility to this novel model.

Biography - Soheil Adib-Moghaddam

As the youngest Iranian ophthalmologist who has been involved with laser vision correction technology in Iran since the mid-90, he justifies his motivation to provide his patients with premium medical and surgical services.

He performed the first Single step TransPRK in Iran in 2009. For a better understanding and sharing of the results on TransPRK, he founded the "International TransPRK Research Group" in 2009. Since then, he has been presenting the results in the most authentic ophthalmic events. He also has developed and introduced a modified version of TransPRK, known as the (REFINED TransPRK), also the IRAN REGIMEN.

In 2015, he along with Professor Ioannis G. Pallikaris formed the "Universal Council of Ophthalmology", (U.C.O.), a new international platform for interdisciplinary research, education, and scientific activities. With the presence and support of Professor Ioannis G. Pallikaris, Dr. Harilaos Ginis, and Dr. Samuel Arba Mosquera it became a globally driven organization.

A Novel Keratoconus Staging System Based on Optical Coherence Tomography

Authors

Dr. Nanji Lu - ELZA Institute

Prof. Jos Rozema - University of Antwerp

Prof. Carina Koppen - University of Antwerp

Dr. Le-Le Cui - Wenzhou Medical University

Prof. Farhad Hafezi - ELZA Institute

Abstract

Purpose: To establish a numerical spectral-domain optical coherence tomography (SD-OCT)-based keratoconus (KC) staging system and compare it with existing KC staging systems.

Methods: Scheimpflug tomography, air-puff tonometry, and SD-OCT were performed for all eyes. Multiple SD-OCT-derived parameters of the corneal epithelium and stroma were evaluated. For SD-OCT derived parameters, receiver operating characteristic (ROC) curves were performed to determine area under the curve (AUC), sensitivity, and specificity. Principal component analysis and multinomial logistic regression after features selection were conducted in sequence to establish a new staging parameter with diagnostic ability. The novel OCT-based staging system was then compared with existing staging systems.

Results: 223 eyes from 223 normal patients prior to uneventful laser vision correction with at least 3 years of stable follow-up and 334 eyes from 334 KC patients of different stages were included. The highest ranked AUC ROC SD-OCT parameters, derived from stroma and epithelium, were stroma overall minimum thickness and epithelium overall standard deviation. In addition, a new comprehensive parameter entitled P was established. Finally, a numerical SD-OCT staging system including 3 parameters - stroma overall minimum thickness (ST), epithelium overall standard deviation (E), and P, with 5 stages- called STEP were proposed.

Conclusions: Our new SD-OCT-based KC staging system is the first to take the epithelium with its sublayer stroma information into account, showing a well-performing diagnostic ability and strong compatibility to the existing staging systems. This system could be incorporated into daily practice, potentially leading to an overall improvement in KC diagnosis, treatment, and follow-up management.

Accuracy of MS39 Corneal Topography in the Diagnosis of Keratoconus

Authors

Dr. Yasser Rifay - Dr Rifay Ophthalmology Center

Abstract

Purpose: To determine the normative and the cut-off values of various indices available in the MS 39 Anterior Segment Optical Coherence Tomography (MS-39 AS-OCT) for keratoconus (KC) diagnosis and detect the accuracy (sensitivity and specificity) of the variable available parameters.

Methods: This cross-sectional observational study was conducted at Dr Rifay Ophthalmology Center, Rabat, Morocco, on 231 eyes with KC (group 1) and 307 eyes of healthy controls (group 2). Participants were screened using MS-39 AS-OCT (CSO, Firenze, Italy), software Phoenix version 3.7. The investigated indices included: keratometric (curvature) indices, pachymetric indices, elevation indices, Keratoconus Summary Indices (KSI), aberration indices, and epithelial mapping evaluation.

Results: All the studied indices were significantly different between the two groups (P value <0.001). Fifteen indices had Area Under the Receiver Operating Curve (AUROC) values >0.950, nine of which were from the KSI. The indices with the highest AUROC values were Keratoconus Vertex Front "KVF" index (AUROC=0.995, and best cut-off >7.98 μm with sensitivity of 98.25% and specificity of 96.04%), and the index of vector summation for the Baiocchi Calossi Versaci (BCV) aberration-based index for both front (BCVf) and back (BCVb) corneal surfaces (AUROC=0.995, and best cut-off >0.45 μm with sensitivity of 97.82% and specificity of 98.02%).

Conclusions: This study to presents the mean and the cut-off values for a plethora of parameters available in the MS-39 AS-OCT. The MS-39 AS-OCT is a valuable equipment for diagnosing keratoconic corneas, with a high accuracy detected for many parameters.

Biography - Yasser Rifay

Ophthalmologist , Keratoconus, and refractive surgery specialist.

Assessing the Impact of Riboflavin Rinsing and Replenishment on Corneal Cross-Linking Effectiveness

Authors

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Prof. David P.S. O'Brart - St Thomas' Hospital

Prof. Andrew J. Quantock - Cardiff University

Prof. Keith M. Meek - Cardiff University

Dr. Sally Hayes - Cardiff University

Abstract

Purpose: To assess the impact of riboflavin rinsing and replenishment during corneal cross-linking (CXL).

Methods: 80 porcine eyes were assigned to 6 groups. Group 1 remained untreated. Groups 2-5 received a 16-minute application of 0.1% riboflavin/HPMC. Group 2 was then exposed to 9 mW/cm² UVA for 10 minutes. Groups 3-5 received a corneal surface rinse with 0.25ml, 1ml or 10ml BSS followed by UVA exposure (9 mW/10 minutes). Group 6 received a 0.25ml BSS rinse followed by UVA exposure (9 mW/10 minutes) with a mid-UVA riboflavin replenishment. Central corneal thickness (CCT) was recorded at each stage. Trephined 8.0 mm central corneal buttons were subjected to 0.3% collagenase digestion at 37°C and monitored at 1-hour intervals to determine the time required for complete digestion.

Results: A 16-minute application of riboflavin/HPMC eye drops to the de-epithelialized cornea led to a significant increase in CCT. Except for Group 6, CCT decreased during UVA exposure. All CXL-treated corneas displayed a 2-4-fold increase in resistance to collagenase digestion compared to non-irradiated untreated corneas. However, there was a trend for the resistance to be reduced when higher rinse volumes were used (Group 5) and increased when a brief pre-UVA rinse and mid-UVA replenishment of riboflavin was incorporated into the CXL protocol (Group 6).

Conclusions: All CXL protocols were effective at enhancing the resistance of the cornea to collagenase digestion. The inclusion of a 0.25ml pre-UVA rinse and mid-UVA replenishment of riboflavin increased CXL effectiveness and helped maintain the thickness of the tissue during UVA exposure.

Biography - Siân R. Morgan

Dr Siân Morgan obtained a BSc Honours degree in Biochemistry with Molecular Biology (Cardiff University, 2006) before completing an MSc in Biomedical Sciences Research (University of Bristol, 2009), a Postgraduate Certificate in Education (PGCE) in Secondary Science (Swansea Metropolitan University, 2010) and a PhD in Vision Science (Cardiff University, 2014). Siân is currently a Research Associate working within the Structural Biophysics Group in the School of Optometry and Vision Sciences, Cardiff University. Her current research is focused on the development of new technologies and techniques to better understand the function of the cornea and other collagen rich tissues, and the development of therapeutic strategies for the treatment of connective tissue disorders including developmental abnormalities, disease, and abnormal healing processes. Siân is also a Science, Technology, Engineering and Mathematics

(STEM) ambassador and can often be found inspiring audiences of all ages at public engagement and outreach events.

Assessment of Efficacy of a Novel Crosslinking Protocol with Intracameral Oxygen (Bubble-CXL) in Increasing the Corneal Stiffness Using Atomic Force Microscopy

Authors

Dr. Ammar Alkhalde - Klinikum Wels

Abstract

Purpose: The environmental oxygen level plays a critical role in corneal crosslinking (CXL), a treatment method to increase corneal biomechanical stability.

Materials & Methods: In this study, we introduce a new CXL method (Bubble-CXL), in which intracameral oxygen serves as an additional oxygen source during eye treatment. The efficiency of this new method was compared with the efficiency of the standard CXL method.

Results: Three fresh porcine eye pairs were included in this study. One eye of each pair was treated with standard CXL, whereas in the partner eye, intracameral oxygen was injected prior to CXL and removed at the end of the procedure. The Young's modulus of each cornea was measured using atomic force microscopy. All analyzed corneas treated with intracameral oxygen showed significantly higher Young's modulus and thus an increased stiffness compared to the cornea of the partner eye treated with the standard protocol.

Conclusion: Using intracameral oxygen in CXL therapy may increase crosslinking efficiency and improve biomechanical corneal properties.

Biography - Ammar Alkhalde

Ophthalmologist in Wels Hospital, Austria

Specialty Cataract Surgery, Intraocular lenses, Dry Eye/Pterygium, Cornea Transplantation, Refractive Surgery/LASIK

Assessment of the In-vivo Corneal Biomechanics Effect of Intracorneal Ring Segments in Keratoconus: Long Term Results.

Authors

Dr. Riccardo Vinciguerra - Humanitas San Pio X

Abstract

Purpose: The aim of the study is to evaluate the long-term effect of the implantation of Intracorneal Ring Segments (ICRS) in keratoconus (KC) on the Dynamic Corneal Response Parameters (DCRs) obtained with the Corvis.

Methods: In this prospective clinical study, we included patients who underwent ICRS implantation for KC over a period of one year. On the day of the surgery and at 1 year after ICRS implantation, the following measurements were made: Distance corrected and uncorrected visual acuity (DCVA and UCVA), corneal tomography indices with the Pentacam (Oculus, Wetzlar, Germany), biomechanically corrected intraocular pressure (bIOP) and the Corvis DCRs (Integrated Inverse Concave Radius (1/R), Deformation Amplitude ratio (DA ratio), Stiffness Parameter at first applanation (SP-A1), Stress-Strain Index (SSI) and Highest Concavity Radius (HRC)).

Results: Thirty eyes were included with a mean follow-up time of 15 months. Statistical analysis showed that ICRS implantation induces significant improvement of corneal biomechanics measurements in the long term as demonstrated by a significant increase in SSI ($p = 0.004$).

Conclusions: Patients implanted with ICRS alone for KC showed significant stiffening compared to preoperative values showing no deterioration of corneal biomechanics

Biography - Riccardo Vinciguerra

Dr Riccardo Vinciguerra is currently working as an Ophthalmologist and Scientific responsible at the Humanitas San Pio X Hospital, Milan, as well as a research collaborator at Biomechanical Engineering Group, University of Liverpool, UK. Despite his young age (36 years old), he is a very well-known international researcher with various peer-reviewed publications mainly in the field of corneal biomechanics, refractive surgery, corneal collagen cross-linking and corneal transplants.

Dr. Vinciguerra is the author of 95 original scientific articles in peer-reviewed journals and received 5 prizes and awards. His work has been cited more than 2200 times with an h-index of 22.

Binocular Visual Function Changes After Corneal Collagen Cross-Linking in Keratoconus Patients

Authors

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Prof. Stanislao Rizzo - Fondazione Policlinico Universitario Agostino Gemelli IRCCS Rome

Abstract

Purpose High order aberrations have been demonstrated to profoundly affect both visual acuity and stereoacuity in keratoconus patients. Corneal collagen crosslinking (CXL) has been proven to significantly lower HOAs in keratoconus. Yet, to the present date, no evaluation of the effect of the procedure on stereopsis has been performed. The purpose of the study is to assess differences in binocular visual performance in keratoconus patients before and after CXL.

Materials and Methods Keratoconus patients undergoing standard Dresden protocol epi-off CXL in Ophthalmology department of Policlinico Universitario Agostino Gemelli Hospital received slit-lamp examination, UDVA and CDVA assessment, corneal tomography, Lang stereotest, TNO stereoacuity assessment, distance and near Cover test and Irvine test before surgery and 6 months after CXL.

Results The analysis included 30 patients (mean age 24.63 ± 3.49 years). Lang test improved significantly after treatment ($p = 0.027$), with 6/30 patients (20%) showing a positive Lang test before CXL compared to 16/30 patients (53.3%) after treatment. Moreover, TNO stereoacuity significantly increased after treatment ($p = 0.043$) and 14/30 patients (46.7%) manifested an improvement of at least 250" at TNO test after CXL. In this subgroup of patients, total RMS values statistically significantly decreased after treatment ($p < 0.01$) while patients that didn't manifest clinically significant improvement in stereoacuity didn't show a statistically significant reduction in total RMS after CXL ($p = 0.11$). The results of Cover test and Irvine test didn't vary significantly after CXL.

Conclusions Keratoconus patients showing reduction of HOAs after CXL also manifest significant improvement in stereoacuity after the treatment.

Biography - Romina Fasciani

MD, since 1996, Ophthalmologist since 2002, PhD in 2008, Ophthalmology Consultant in Eye clinic c/o Fondazione Policlinico Gemelli IRCCC Rome since 2005. Expertise fields are corneal and ocular surface pathologies and surgeries, anterior segment surgeries, corneal transplants, refractive surgery, dry eye, keratoconus, and cross linking. My personal surgical practice counts more than 5000 procedures.

Biomarker Enabled Specific Targeted Therapy: A New Insight into Keratoconus Disease Management

Authors

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Dr. Rohit Shetty - Narayana Nethralaya

Dr. Pooja Khamar - Narayana Nethralaya, Bengaluru, India

Abstract

Purpose: To evaluate the role of tear biomarkers in personalized Keratoconus Disease Management and predicting crosslinking outcomes using an ELISA based lab on chip.

Methods: 3,500 keratoconus were recruited in this study. Selected biomarkers in tears (MMP-9, IL-6, IL-1b, I-CAM-1, IL-10a, IL-17a, TNF-a, VEGF-a) were analyzed using an ELISA based biomarker kit. Tears using Schirmer's strip from KC patients (treatment naïve-not on any ocular medications) and controls were collected. Based on normative database, targeted therapy was instituted and reassessed at 6 months. Results: 60% eyes had high MMP-9, of which 30% had 3-fold rise compared to controls. Patients were randomized and further divided into 2 groups. Group 1 received preservative free artificial tears. Group 2 Eyes with single-fold rise received immunomodulators. Those with > 2-fold rise, received trehalose containing eyedrops + immunomodulators. Patients with 3-fold rise received vector pulsation+ IPL therapy + immunomodulators. 20% had high TNF-a and IL-17a, treated with steroids and lubricants.

Results: Post-treatment group 2 eyes had significant reduction in targeted biomarkers, drug response time, progression of ectasia, crosslinking treatment failure rate in comparison to group 1 who received only preservative free artificial tears.

Conclusion: Biomarkers enabled personalized management in keratoconus and crosslinking will herald a paradigm shift with a potential to enhance treatment outcomes and reduce the treatment failure rates.

Biography - Divya Trivedi

Keen interest in corneal ectatic disorders, refractive surgery, cataract, and optics.

Biomechanics of Cross-Linked Porcine-Derived Corneal Lenticules for the Treatment of Advanced Keratoconus

Authors

Dr. Abby Wilson - University College London

Prof. John Marshall - University College London

Abstract

Purpose: Corneal transplantation is the main treatment for advanced keratoconus. However, transplantation has many associated risks, with supply falling short of demand due to a worldwide shortage of human donor corneas. To address this, lenticular implants from porcine corneas are under development (Xenia[®], Gebauer Medizintechnik GmbH.). They are formed from tissue from the central anterior porcine cornea, subjected to a 4-stage proprietary process, involving, washing, decellularization, compression and cross-linking producing a final acellular, collagen-based lenticule of <50µm thickness with enhanced stiffness relative to normal corneal tissue. In ongoing clinical trials (up to 80 patients, max. 3yr follow-up) lenticular implants have achieved up to 10 diopters reduction in advanced Keratoconus.

Development, to improve lenticular properties, in terms of transparency, refractive properties, biocompatibility, standardization and personalization is on-going. Here we evaluate the biomechanical properties and discuss current challenges in lenticule development.

Material and Methods: The stiffness of baseline tissue from which the lenticules are formed was compared with the processed material using laser speckle interferometry to map surface deformation whilst subjecting lenticules to physiological-scale pressure variations.

Results: All lenticules showed enhanced stiffness relative to baseline material from which they were manufactured. Variability in the stiffness of the lenticules increased after processing suggesting differences in the response of the tissue to processing procedures.

Conclusion: Porcine derived lenticules offer a promising treatment for advanced Keratoconus. Due to the biological nature of the material used and the complexity of the processing methods, further research is required to facilitate the manufacturer of lenticules with specified properties.

Biography - Abby Wilson

Abby is a mechanical engineer. She completed her PhD with Prof. John Marshall in 2017 which was concerned with optical imaging of corneal biomechanics. Since this time, she has focused on applications of engineering in medicine, undertaking a post-doc at the University of Cambridge in 2017 where she worked optical devices to improve cancer detection. She was recently awarded a prestigious Royal Academy of Engineering fellowship, currently based at University College London, to advance her work on corneal biomechanics and optical imaging of the cornea.

Clinical Outcomes of Transepithelial Corneal Cross-Linking with Oxygen Enhancement for Progressive Keratoconus; 1-Year Results

Authors

Dr. Alaa Eldanasoury - Magrabi Hospital

Abstract

Purpose: To assess safety and efficacy of trans-epithelial crosslinking (TECXL) with oxygen boost for progressive keratoconus.

Methods: Prospective study on 30 eyes of 30 consecutive patients. All eyes had TECXL with oxygen boost. Riboflavin 0.1% and an ultraviolet A delivery system were used. Irradiation time was 11 minutes in pulsed mode with average power of 30W/cm² and total energy dose of 7.2 J/cm². Oxygen concentration above 90% was maintained during irradiation. Scheimpflug and Anterior segment OCT were performed at all examinations.

Results: Mean age was 29.1 yrs. At 1 year, the follow up rate was 90%, there was no statistically significant change in uncorrected and corrected visual acuity, spherical equivalent refraction, high order aberrations, maximum keratometry and central epithelial thickness ($p < 0.05$). Demarcation line was documented at 1 month in 67% eyes at a mean depth of 273±40 µm. Corneal densitometry increased significantly only at 1-month postoperatively ($p < 0.05$).

Conclusion:

Accelerated TECXL with oxygen boost is effective at halting the progression of keratoconus for at least 1 year and can be a refractive neutral procedure.

Biography - Alaa Eldanasoury

Dr. Alaa Eldanasoury currently serves as Chief Medical Officer and Director of Cornea & Refractive Surgery Units of the Magrabi Hospitals & Centers; a chain of 21 Hospitals & Centers and is the largest in the Middle East.

Dr. Eldanasoury was among the very first surgeons to perform excimer laser surgery in the world and was the first to introduce many ophthalmic procedures to the Middle East including LASIK, Phakic IOLs, Intracorneal ring segments, Conductive Keratoplasty, Crosslinking, Corneal inlays, Premium IOLs and Femtosecond cataract laser surgery.

Dr. Eldanasoury served as President of the ISRS in 2009-2010. In 2011 he was elected to serve as a member of the AAO Board of Trustees. He is a member of the International Intraocular Implant Club (IIIC) and is currently a board member of the ICO.

Combining Crosslinking and Refractive Laser Ablation in Progressive Keratoconus: Systematic Review and Meta-Analysis

Authors

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Dr. Uri Elbaz - Sackler School of Medicine, Tel Aviv University, Tel Aviv.

Dr. Oriel Spierer - Sackler School of Medicine, Tel Aviv University, Tel Aviv.

Abstract

Purpose: Corneal collagen cross-linking (CXL) is an effective treatment to arrest keratoconus (KC) progression. Recently, several studies demonstrated that simultaneous laser ablation and CXL treatment resulted in improved visual acuity and flatter keratometry values compared to CXL alone. Since published studies have no standardized laser protocol, we performed a systematic review and meta-analysis to assess the effect of combined CXL and refractive techniques on visual acuity,

Methods: We identified 15 studies that fulfilled our inclusion and exclusion criteria. We calculated and compared the standardized mean difference (SMD) between CXL alone and CXL plus laser ablation for uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), refractive manifest spherical equivalent, sphere, and cylinder, K1, K2 and central corneal thickness (CCT).

Results: The CXL plus laser ablation group showed improvement in UCVA LogMAR (SMD: -0.35 [95%CI: -0.67, -0.04; p=0.029]), BCVA logMAR (SMD: -0.17 [95%CI: -0.30, -0.03; p=0.014]), spherical equivalent manifest refraction (SMD:-0.28 [95%CI: 0.06, 0.50, p=0.013]), and change in Kmax (SMD: -0.41 [95%CI: -0.69, -0.13; p=0.004) compared to CXL alone. However, CCT decreased further among patients who underwent CXL plus laser ablation (SMD: -0.37 [95%CI: -0.66, -0.07; p=0.016]). No effect was observed in terms of sphere (p=0.878), cylinder (p=0.859), K1 (p=0.907) or K2 (p=0.169). Egger's test revealed no publication bias.

Conclusions: This meta-analysis shows that combining refractive laser ablation techniques with standard or accelerated CXL treatment resulted in improved visual, refractive outcomes, and anterior corneal curvature values. However negatively impacted corneal thickness compared to CXL alone.

Biography - Asaf Achiron

Dr. Achiron's research aims to improve clinical practice using big data and mathematical algorithms combined with advanced statistical analysis. By combining clinical and bench studies,

he focuses on the outcomes of corneal and cataract surgery to better understand treatment-related mechanisms.

Dr. Achiron has published widely, with over 130 publications to his name; He has received numerous grants for his research work in ophthalmology.

Combining Crosslinking with Keratoplasty: the DRXL- DALK Procedure

Authors

Dr. Marco Zagari - European Center of Ophthalmology, Clinica Oculistica Vampolieri

Dr. Manuela Pulvirenti - Pulvirenti Ophthalmological Center, Centro Oculistico Domus

Prof. Cosimo Mazzotta - Siena Crosslinking Center

Abstract

Purpose:

To report the efficacy and safety of the combination of "Circular Donor-recipient Accelerated Cross-linking" CDR-ACXL and DALK, in the so called DRXL- DALK.

Materials and methods: The prospective interventional study included 24 KC patients (Stage III and IV). A peripheral circular or anular "doughnuts-shaped" accelerated 9mW 5.4/cm² ACXL was applied pre-operatively in both the donor and the recipient corneas at different times: one month before the DALK surgery in the recipient cornea and before the DALK surgery in the donor cornea on a same day basis. A dextran-free plus hydroxyl-propyl methylcellulose (HPMC) 0.1% isotonic riboflavin solution was applied for the CDR-CXL for 10 minutes followed by 10 minutes of UV-A irradiation at 9mW/cm² UV-A power and fluence of 5.4 J/cm². A specifically designed marker named Zagari-Mazzotta (ZM Marker) ® was used which offered a central shield of 6 mm.

Results: A reduction of early and late postoperative edema around the wound and the suture was noted, facilitating the passage and the sealing of the sutures. The CDR-ACXL seemed to keep the tissue more compacted, helping to perform a more precise and perpendicular trephination cut. A higher rate of 92% type 2 bubble formation was achieved in the DRXL-DALK. Sutures were removed just after months.

Conclusions: The preliminary results showed that CDR-ACXL can be useful prior to the DALK surgery to achieve higher stability of the corneal wound, reducing the timing of sutures removal and peripheral wound dehiscence. The early decellularization may also reduce the probability of stromal rejection.

Biography - Marco Zagari

In 2009 he obtained the Degree in Medicine and Surgery at the Faculty of Medicine and Surgery of the University of Catania. In 2015, he obtained the Specialty Diploma in Ophthalmology at the University of Palermo with the maximum score. During this period, he obtained a master's degree in glaucoma surgery at the Udine Hospital.

In 2015 he obtained the title of Professor of Ocular Anatomy at Optometry School Don Bosco (CT). From 2015 until now he works at European Centre of Ophthalmology as cataract, cornea, and glaucoma surgeon.

He performed surgery of cornea and anterior segment of the eye at the "Casa di cura Valsalva", Policlinico Morgagni and Clinica Oculistica Vampolieri. From 2018 to 2021 he was Head / Director Ophthalmology Surgery Department "Casa di cura San Camillo".

Since 2010, he published over 20 publications scientific papers. He has participated as speaker, instructor, and moderator in over 100 conferences.

Comparative Localized Corneal Biomechanical Changes Following Corneal Cross-Linking Using Brillouin Microscopy

Authors

Prof. J. Bradley Randleman - Cleveland Clinic Cole Eye

Dr. Hongyuan Zhang - Cleveland Clinic Cole Eye Institute

Dr. Lara Asroui - Cleveland Clinic Cole Eye Institute

Dr. Imane Tarib - Cleveland Clinic Cole Eye Institute

Prof. William Dupps - Cleveland Clinic Cole Eye Institute

Prof. Giuliano Scarcelli - Cleveland Clinic Cole Eye Institute

Abstract

Purpose: To identify focal corneal biomechanical alterations in vivo after Standard Protocol CXL using motion tracking Brillouin microscopy.

Methods: Prospective study comparing motion tracking Brillouin shift data from patients before and 3 months after undergoing CXL. The primary endpoint was regional change in Brillouin longitudinal modulus (postoperatively (MHz) as measured within the central 6mm.

Results: Postoperatively, CXL induced stiffening across the central 6mm of the cornea in all patients, with mean Brillouin shift increasing by 20.42 ± 10.81 MHz. There was wide variation in induced stiffening across different patients, with individual Mean Brillouin shifts ranging from 11.94 ± 5.35 to $25.39 \text{ MHz} \pm 12.72$ MHz.

Conclusions: Brillouin microscopy was able to successfully measure focal corneal stiffness increases after CXL, thereby providing novel, highly specific localized corneal biomechanical data in vivo. The wide range of induced stiffening measured after standard protocol CXL mirrors the clinical variation seen between after CXL procedures.

Biography - J. Bradley Randleman

J. Bradley Randleman, MD, is Professor of Ophthalmology at the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University and co-director of the Refractive Surgery Service at the Cleveland Clinic Cole Eye Institute in Cleveland Ohio. A widely respected refractive surgeon, his areas of expertise include laser vision correction and the management of corneal ectatic disorders. His research focuses on corneal biomechanics and the identification and management of corneal ectatic diseases including keratoconus and postoperative ectasia after LASIK. He has been awarded multiple research grants, including multiple R01 grants from the NIH to evaluate corneal biomechanical analysis using Brillouin Microscopy.

Dr. Randleman has served as Editor-in-Chief for the *Journal of Refractive Surgery* since 2011. He has delivered more than 300 lectures, authored more than 175 peer-reviewed publications in leading ophthalmology journals and 5 textbooks on refractive surgery evaluation, corneal cross-linking, and an atlas of corneal imaging.

Comparative Localized Corneal Biomechanical Changes Following Laser Vision Correction Using Motion Tracking Brillouin Microscopy

Authors

Prof. J. Bradley Randleman - Cleveland Clinic Cole Eye

Dr. Hongyuan Zhang - Cleveland Clinic Cole Eye Institute

Dr. Lara Asroui - Cleveland Clinic Cole Eye Institute

Dr. Imane Tarib - Cleveland Clinic Cole Eye Institute

Prof. William Dupps - Cleveland Clinic Cole Eye Institute

Prof. Giuliano Scarcelli - Cleveland Clinic Cole Eye Institute

Abstract

Purpose: To identify focal corneal biomechanical alterations in vivo after PRK, LASIK, and SMILE using motion tracking Brillouin microscopy.

Methods: Prospective study comparing motion tracking Brillouin shift data from patients before and 3 months after undergoing PRK, (n=5), LASIK (n=5), or SMILE (n=5). The primary endpoint was regional change in Brillouin longitudinal modulus (postoperatively (MHz) as measured within the central 6mm.

Results: Preoperatively, average age (36.3 years), MRSE (-5.02 D \pm 0.9 D), thinnest pachymetry (548 μ m \pm 34.5 μ m), RSS (372 \pm 41.5 μ m), and mean Brillouin shift (5.702 GHz \pm 0.011 GHz) were not significantly different between groups. Postoperatively, all three procedures induced central weakening ($p < 0.0001$ for all). Average mean reduction in Brillouin longitudinal modulus was 33.04 MHz after LASIK, 19.90 MHz after PRK, and 14.04 MHz after SMILE. These values were significantly different between LASIK and SMILE ($p = 0.001$), and between LASIK and PRK ($p = 0.008$), but there were no significant differences between PRK and SMILE ($p = 0.16$).

Conclusions: Brillouin microscopy was able to successfully measure focal corneal stiffness reduction for all three procedures, thereby providing novel, highly specific localized corneal biomechanical data in vivo. LASIK induced the greatest biomechanical impact among procedures, while PRK and SMILE induced similar postoperative changes.

Biography - J. Bradley Randleman

J. Bradley Randleman, MD, is Professor of Ophthalmology at the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University and co-director of the Refractive Surgery Service at the Cleveland Clinic Cole Eye Institute in Cleveland Ohio. A widely respected refractive surgeon, his areas of expertise include laser vision correction and the management of corneal ectatic disorders. His research focuses on corneal biomechanics and the identification and management of corneal ectatic diseases including keratoconus and postoperative ectasia after LASIK. He has been awarded multiple research grants, including multiple R01 grants from the NIH to evaluate corneal biomechanical analysis using Brillouin Microscopy.

Dr. Randleman has served as Editor-in-Chief for the *Journal of Refractive Surgery* since 2011. He has delivered more than 300 lectures, authored more than 175 peer-reviewed publications in leading ophthalmology journals and 5 textbooks on refractive surgery evaluation, corneal cross-linking, and an atlas of corneal imaging.

Continuous Corneal Thinning and Flattening After Corneal Cross-linking in Progressive Keratoconus.

Authors

Dr. Cynthia Hernandez - Instituto Cubano de Oftalmología Ramón Pando Ferrer

Prof. Madelyn Jareño - Instituto Cubano de Oftalmología Ramón Pando Ferrer

Prof. Zaadia Perez - Instituto Cubano de Oftalmología Ramón Pando Ferrer

Prof. Silvia López - Instituto Cubano de Oftalmología Ramón Pando Ferrer

Prof. Alexeide Castillo - Instituto Cubano de Oftalmología Ramón Pando Ferrer

Abstract

Purpose: To report a case of progressive keratoconus treated with CXL, that developed a continuous flattening and thinning, with a hyperopic shift with a 10-year of follow-up.

Materials and Methods: Case Report

Results: A 43-year-old male with progressive keratoconus and corrected distance visual acuity (CDVA) of 20/50 (-2,25- 6,00x112) in the right eye and 20/40 (-0,50-1,00x67) in the left eye was treated 10 years ago with corneal CXL (Dresden protocol) in the eye with the most advanced disease (right eye). In the slit-lamp examination, he presented a mild central and paracentral haze in the 1/3 of the anterior stroma, corneal thinning at that level, with iron deposits in the cone base with an incomplete Fleisher ring and Vogt striae.

At 12 months after the procedure, the patient presented a CDVA of 20/50 (+1,75-9,00x116) with a spheric equivalent of - 2,75D. After 8 years, the patient remained the CDVA of 20/32 (+3,00-5,00x114) with a spheric equivalent of -0,13 D. With an 8-year follow up, significant corneal flattening was observed that induced a hyperopic shift and astigmatism. The patient demonstrated gradual corneal thinning (459 μm preoperative to 276 μm), with a 1/3 deep stromal haze. The mean K value was 52,77 D preoperatively, 47,70 D at 12 months, 43,50 D at 48 months, and 41,80 D at 96 months.

Conclusion: The current case reveals the significance in the long-term assessment of the eyes treated with CXL, in spite of being safe and effective in progressive keratoconus.

Biography - Madelyn Jareño

II Grade Specialist in Cornea and Refractive Surgery.

Head of the Cornea and Refractive Surgery Department in the Cuban Ophthalmology Institute "Ramón Pando Ferrer"

Corneal Cross- Linking in Resistant Corneal Abscess

Authors

Dr. Hazem Elnashar - Consultant of cornea and Refractive Surgery

Abstract

Aim of work: To assess the results of using corneal cross- linking in resistant corneal abscess

Patients and Methods: Prospective interventional study of (20) eyes of (20) patients (15 males and 5 females) aged between 22-53 years with unilateral resistant corneal abscess. Inclusion Criteria: patients with unilateral corneal abscess, resistant to medical treatment ,any causative organism. Exclusion Criteria : corneal abscess responded to medical treatment. Preoperative: full ophthalmic examination especially measures of abscess. Post operative: signs of improvement

Results: 90% of eyes (18 eyes) treated with cross linking showed marked improvement within few days. Those 18 eyes showed different types of infection: (Bacterial ,Fungal and Acanthamoeba keratitis). Only 2 eyes showed resistant to cross linking (fungal keratitis), and I repeated cross linking for these 2 eyes after 1 week. 1 of them improved after 2nd cross linking session and the other also showed resistance to cross linking and need keratoplasty . This eye was re-infected again within 1 week with aggressive course. I treated this eye after reinfection with cross linking again: This time showed marked improvement with crosslinking.

Conclusion: The use of crosslinking in resistant corneal abscess gives marvelous results and it is easy and safe. Whatever the organism , we can use corneal crosslinking in resistant corneal abscess. In cases in which crosslinking failed we can repeat cross linking again .also ,we still have the chance to do keratoplasty.

Biography - Hazem Elnashar

Vice Dean of The Memorial Institute for Ophthalmic Research

Corneal Cross-Linking Complications

Authors

Dr. Yasmine Bennani - Cheikh Zaid hospital

Dr. Boutaina Bousellam - Cheikh Zaid hospital

Prof. Mohammed Belmekki - Cheikh Zaid hospital

Abstract

Purpose: Corneal cross-linking (CXL) is an effective treatment for halting progression in keratoconus and secondary ectasia. Meanwhile, several complications have been rarely reported.

Materials and Methods: We report four patients who underwent different CXL protocols for progressive keratoconus and present corneal complications.

Results: The first Patient had an acute corneal necrosis; he underwent an emergency therapeutic penetrating keratoplasty. The second patient reported decreased vision related to corneal haze resistant to treatment. The third patient was reviewed on day 15 with central corneal keratitis. The fourth patient showed a large and central corneal opacity few weeks after the procedure. No treatment gives an improvement even after 12 months .

Discussion: Standard CXL has an inherent risk of infection and corneal melting reported by different authors.

According to some authors, performing CXL with intact epithelium may reduce the risk of infective keratitis, reduces stromal haze, and intraoperative corneal thinning.

Conclusion: Cross-linking is a low-invasive procedure with low failure rate, but it may have several complications due to many factors.

A certain set of safety measures are taken by using trans-epithelial CXL, particularly for thin corneas.

Biography - Yasmine Bennani

I am a fourth-year resident in the ophthalmology center at Cheikh Zaid hospital in Rabat, I am very interested in all the ocular surface diseases.

Corneal Cross-Linking Protocol Modifications Influence Resistance to Enzymatic Digestion and Treatment Depth.

Authors

Dr. Malwina Kowalska - Vetsuisse Faculty, University of Zurich

Dr. Elisa Mischi - Vetsuisse Faculty, University of Zurich

Dr. Szymon Stoma - Scientific Center for Optical Electron Microscopy (ScopeM), Swiss Federal Institute of Technology (ETHZ)

Prof. Simon Noerrelykke - Harvard Medical School

Dr. Sonja Hartnack - Vetsuisse Faculty, University of Zurich

Prof. Simon Pot - Vetsuisse Faculty, University of Zurich

Abstract

Purpose: To determine the effects of various Photoactivated Chromophore for Keratitis - Corneal Cross-linking (PACK-CXL) protocol modifications on corneal resistance to enzymatic digestion and treatment depth.

Materials and Methods: 801 *ex vivo* porcine eyes were randomly divided into groups with 7-39 corneas each, treated with various epi-off PACK-CXL modifications, including acceleration (30 > 2 minutes, 5.4 J/cm²), increased fluence (5.4 > 32.4 J/cm²), deuterium oxide (D₂O) supplementation, different carrier types (dextran vs. hydroxypropyl methylcellulose (HPMC)), increased riboflavin concentration (0.1 > 0.4%) and riboflavin replenishment during irradiation (yes/no). Control group eyes did not receive PACK-CXL. A pepsin digestion assay was used to determine corneal resistance to enzymatic digestion. A phalloidin fluorescent imaging assay was used to determine PACK-CXL treatment effect depth. Differences between groups were evaluated using a linear model and a derivative method, respectively.

Results: PACK-CXL increased corneal resistance to enzymatic digestion compared to no treatment ($p < 0.03$). Fluences of 16.2 J/cm² and higher increased corneal resistance to enzymatic digestion, whereas acceleration, carrier type, supplementation of D₂O or 0.4% riboflavin, and a lack of riboflavin replacement during irradiation did not significantly change corneal resistance to enzymatic digestion compared to corneas that received a 10 min, 5.4 J/cm² PACK-CXL protocol ($p < 0.001$). A 16.2 J/cm² fluence led to stronger collagen compaction in the anterior stroma compared to 5.4 J/cm². Omitting riboflavin replenishment during irradiation increased treatment depth.

Conclusion: Increasing fluence will likely optimize PACK-CXL treatment effectiveness. Treatment acceleration reduces treatment duration without compromising effectiveness.

Biography - Simon Pot

Originally from the Netherlands, Simon graduated from the Utrecht University School of Veterinary Medicine in 2000 and worked as a private practitioner for a number of years before pursuing an internship in Utrecht and an ophthalmology specialty residency in Madison, Wisconsin. Since 2009, he has worked as a faculty member at the Vetsuisse Faculty in Zurich, Switzerland, where he currently holds an associate professorship. He has simultaneously

completed a PhD on corneal wound healing and fibrosis in the Laboratory of Applied Mechanobiology at the Swiss Federal Institute of Technology in Zurich (ETHZ).

His main clinical research interests include the treatment of corneal infections with a focus on corneal crosslinking (PACK-CXL) and advanced ocular and orbital imaging using OCT and high-resolution MRI.

Corneal Densitometry in Keratoconus Cases

Authors

Dr. Cigdem Coskun - Ankara City Hospital

Dr. Sebile Çomçalı - Ankara City Hospital

Dr. Neslihan Bayraktar Bilen - Ankara City Hospital

Abstract

Purpose: Investigation of corneal densitometry measurements in keratoconus patients and comparison with healthy group

Materials and methods: 112 eyes of 64 Keratoconus patients followed in the corneal outpatient clinic and 246 eyes of 123 age-matched healthy individuals were included in study. K1, K2, K Max, central corneal thickness, thinnest corneal thickness, anterior elevation, posterior elevation, and corneal densitometry values of all subjects were measured using Scheimpflug imaging system (Pentacam HR, Oculus, Germany). Corneal densitometry was evaluated according to 4 concentric radial zones (0-2 mm, 2-6 mm, 6-10 mm, and 10-12 mm) and depth (anterior, central, posterior, and total) on the Scheimpflug imaging system. Keratoconus patients were divided into 4 stages. Corneal densitometry values were compared between each stage and the healthy group. The results were analyzed statistically.

RESULTS: Corneal densitometry values were higher in keratoconus patients compared to the healthy control group in all zones and depths, except the anterior 10-12 mm zone, and were statistically significant ($p < 0.01$). There was no statistically significant difference between corneal densitometry values between keratoconus stages ($p > 0.05$).

Conclusion: Corneal densitometry measurement with Scheimpflug topography is a non-invasive examination method that provides information about corneal transparency. Changes in corneal histology may affect densitometry values in keratoconus patients. According to our study, the higher corneal densitometry values in keratoconus patients compared to the healthy group may be supportive of other criteria used for the diagnosis of keratoconus. The absence of difference in densitometry values between the stages of keratoconus indicates that densitometry values are not an indicator of progression.

Biography - Cigdem Coskun

I was born on November 25, 1980, in Trabzon, Turkey. I have finished my higher education in Istanbul University, and I graduated from Istanbul Medical Faculty. I completed my ophthalmology specialization training at Bakırköy Training and Research Hospital in Istanbul. I am working as cornea specialist at City Hospital in Ankara, Turkey. I have 18 years' experience. I am married and have two children.

Corneal Posterior Elevation and Densitometry Changes After Corneal Cross-linking Treatment in Keratoconus

Authors

Dr. Emine Esra Karaca - University of Health Sciences, Ankara City Hospital

Dr. Esra Öztürk - University of Health Sciences, Ankara City Hospital

Mrs. Dilay Özek - University of Health Sciences, Ankara City Hospital

Prof. Özlem Evren Kemer - University of Health Sciences, Ankara City Hospital

Abstract

PURPOSE: To examine the relationship between posterior elevation changes and corneal densitometry changes in patients with keratoconus who underwent corneal cross-linking treatment.

MATERIALS AND METHODS: 20 eyes of 20 patients with a diagnosis of keratoconus were included in this retrospective study. Pentacam measurements and corneal densitometry values of patients who underwent accelerated corneal crosslinking (CXL) for progressive keratoconus before and at 6 months after crosslinking were examined.

RESULTS: The mean age of the patients was 23.57 ± 4.75 years (16-37 years). The corneal apex posterior elevation value was measured as $26.68 \pm 19.49 \mu\text{m}$ ($p=0.324$) at the 6th month after cross-linking. The posterior corneal density value at 0-2mm before the procedure was 10.92 ± 1.31 ; 11.88 ± 2.01 ($p=0.126$) were measured at 6 months after the procedure. No complications were observed after the procedure in any of the patients.

CONCLUSION: There may be an increase in posterior elevation and corneal densitometry after corneal cross-linking treatment in patients with keratoconus. In our study, it was observed that the posterior corneal elevations of the patients increased after cross-linking, while there was an increase in the densitometry in all layers of the cornea, but this increase was not statistically significant in the posterior cornea ($p=0.126$). These results also support the idea that cross-linking is not effective in the posterior 1/3 of the cornea, and accordingly, posterior elevation increases.

Biography - Emine Esra Karaca

She is working as a cornea specialist in Ankara City Hospital. Her main interest areas are keratoconus and keratoplasty. She has several national and international publications. She is married and has 2 children.

Corneal Zones Determined by Anterior Curvature Maps May Guide Cross-Linking

Authors

Dr. CARLOS G. ARCE - Eye Clinic of Sousas and Ophthalmic Hospital and Eye Bank of Sorocaba

Dr. Lycia Sampaio - Ophthalmic Hospital and Eye Bank of Sorocaba

Dr. Heanes Troglia Pfluck - Ophthalmic Hospital and Eye Bank of Sorocaba

Dr. ADRIANA DOS SANTOS FORSETO - Ophthalmic Hospital and Eye Bank of Sorocaba

Abstract

Purpose: To compare corneas with keratoconus (KC) and normal corneas using anterior instantaneous Galilei maps with 10-mm-diameter and CGA-1D-German color scale.

Materials and Methods: Seventy corneas with KC and 100 normal corneas from a private eye clinic and an ophthalmic hospital were studied with the anterior instantaneous Galilei map with 10-mm-diameter and CGA-1D-German color scale.

Results: Three main curvature zones were found in corneas with KC: an extreme flat periphery (less than 39D) with navy- and light-blue color located beyond the 6- to 8-mm-diameter and that seem to be more evident in more quadrants according to the progression of the disease, a paracentral ring zone with yellow-green color (Brazilian-flag sign) and with normal range of curvature surrounding a central ectatic zone (steeper than 48D) with orange-red-gray color.

Peripheral flattening was classified by quadrants. More flat quadrants below 39D were found according to the degree of KC as compared with normal corneas ($p < 0.001$).

Conclusions: Peripheral flattening observed by anterior instantaneous maps was frequently found in corneas with KC but is rare in normal corneas. Maps allowed to describe the Brazilian-flag sign as a para-central ring with normal curvature. The distribution of three clear zones of curvature found in corneas with KC seem to be related with the progression of the disease, might be related with the biomechanical behavior of the cornea and the Dua membrane, and has been used to guide surgical procedures like corneal crosslinking (CXL), intracorneal ring segment (ISCRS) implantation, deep anterior lamellar keratoplasty (DALK) and contact lens fitting.

Biography - Carlos G. Arce

- Director, Eye Clinic of Sousas, Campinas

- Ophthalmologist, Cornea, Refractive Surgery, Contact Lens, Research & Technology Sectors, Ophthalmic Hospital and Eye Bank of Sorocaba, São Paulo Brazil.

- Volunteer Collaborator, Refractive and Ocular Bioengineering Sectors, Department of Ophthalmology, Paulista School of Medicine, Federal University of São Paulo, Brazil

- Consultant, Ziemer Ophthalmic Systems AG, Switzerland; Ziemer USA Ltd, OH, USA; Mediphacos, BH, Brazil

- CEO, R.E.I. Consultoria Tecno-Médica EIRELI, Sousas, São Paulo, Brazil

Customized Transepithelial Cross-Linking for Keratoconus: 2-Year Follow-Up

Authors

Dr. Miltiadis Balidis - Ophthalmica Eye Institute

Dr. Spyridon Koronis - Papageorgiou General Hospital

Dr. Panagiotis Garitsis - Ophthalmica Eye Institute

Dr. Penelope Politis - Ophthalmica Eye Institute

Dr. Dimitrios Sakellaris - Ophthalmica Eye Institute

Abstract

Purpose: To present the long-term results of customized transepithelial corneal collagen cross-linking (customized remodeled vision – CuRV) augmented with oxygen, in patients with keratoconus.

Materials/Methods: Epi On customized Cross linking (CuRV) performed on consecutive keratoconus patients with confirmed progression, between 03/2018 and 08/2020. Each patient was evaluated for best-corrected visual acuity (BCVA) measured in ETDRS charts, maximal K readings (Kmax) and thinnest corneal pachymetry measured with Scheimpflug corneal tomography/topography, and demarcation line depth measured with anterior segment optical coherence tomography.

Results: 44 eyes of 37 patients with a mean age of 27.3 ± 8.9 years have a complete one-year follow-up. Among those, 27 eyes of 24 patients completed the two-year follow-up. BCVA was stable at one month postoperatively ($p=0.1$) and significantly improved thereafter, from 20/25 at baseline to 20/20 at the end of follow-up ($p=0.0031$). The demarcation line was most prominent at one month postoperatively, with a mean depth of 347.3 ± 59.4 μm . Median Kmax at baseline was 51.5 D, decreased significantly by -1 D at one month postoperatively ($p<0.001$) and remained stable during follow-up (median change of -1.2 D compared to baseline, $p<0.001$). The thinnest pachymetry was 474.78 ± 41.3 μm at baseline and significantly decreased at one month postoperatively (-14.2 ± 15.9 μm , $p<0.001$). Nonetheless, the difference was smaller at 24 months (mean change of -8.2 ± 16.5 μm , $p=0.012$).

Conclusions: Epi on CuRV with Oxygen is an effective procedure for stabilizing keratoconus and improving visual performance long-term.

Biography - Miltiadis Balidis

- PhD, Fetopathy, ICOPhth
- Miltos Balidis is a specialist surgeon of the Cornea and the anterior segment. He was trained at Moorfields Eye Hospital. He is currently the President of the HELLENIC Society of Intraocular Implant and Refractive Surgery (HSIOIRS), the Director of Ophthalmica Eye Institute and former President of the Southeastern Society of Cataract and Refractive Surgery (SESCRS).
- Dr. Balidis was for ten years the representative of Greece in the International Council of International Society of Refractive Surgery of the American Academy of Ophthalmology (ISRS | AAO).

Demarcation Line Formation and its Relationship with Clinical Outcomes

Authors

Dr. Ömer Özer - Department of Ophthalmology, Rize State Hospital

Dr. Mustafa Vatansever - Department of Ophthalmology, Mersin University

Abstract

Purpose: The aim of this study was to investigate the relationship between demarcation line formation and clinical outcomes after corneal cross-linking (CXL) surgeries performed in our clinic.

Materials and Methods: For this purpose, 74 eyes of 74 patients who underwent CXL surgery were included in the study. Patients who did not develop demarcation line after CXL were divided into group 1 and patients who developed demarcation line were divided into group 2.

Results: There was no difference between the groups in terms of age and gender. The mean time to formation of the demarcation line was $43,8 \pm 19,1$ (minimum 27 - maximum 122) days. The mean postoperative follow-up period was $19,47 \pm 5,57$ months in group 1 and $20,79 \pm 5,77$ months in group 2. The median postoperative visual acuity value was 0,65 (0,3 - 1) in group 1 and 0,65 (0,2 - 1) in group 2. The median spherical value of the postoperative patients was - 0,88 D (- 5,50 D to + 3,25 D) in group 1 and - 1,33 D (- 12,00 D to + 5,25 D) in group 2.

Conclusion: In conclusion, corneal crosslink surgery contributes to corneal rigidity by increasing the number of cross-links in corneal collagen fibers. It can be said that the spherical value improves more, and the treatment is more effective in patients with demarcation line. There is a need for multicenter, prospective, and large participatory studies investigating the effect of the depth of the demarcation line on clinical outcomes.

Biography - Ömer Özer

I was born in 1992. I have been working as a specialist and fellow in Ophthalmology for six years. I am a member of Turkish Ophthalmological Association (TOA) and TOA-Young Ophthalmologists. I am also a member of Young Ophthalmologists in ESCRS (YO-ESCRS) and EuRETINA (YOURS). I have published more than 40 research papers and 3 chapters.

Different Rose Bengal Formulas for Green Light Corneal Cross-Linking

Authors

Dr. Jinhai Huang - Fudan University

Dr. Rongrong Gao - Wenzhou Medical University

Dr. Sally Hayes - Cardiff University

Prof. Keith M. Meek - Cardiff University

Abstract

Purpose: To explore central corneal thickness (CCT) changes during in vivo rose bengal-green light corneal cross-linking (RGX) and compare the cross-linking efficacy of new rose bengal (Rb) formulations.

Materials and Methods: After epithelium removal, the right eyes of rabbits were immersed in Rb solution for 2 or 20 minutes, then the Rb distribution in the corneal stroma was analyzed by confocal fluorescence detection. During the RGX process, the CCT was measured at 7 time points. The left eyes served as untreated control group. Corneal enzymatic resistance and corneal biomechanics were tested to compare the RGX efficacy.

Results: The Rb infiltration depths were about 100 μm and 200 μm for the 2-minute and the 20-minute groups, respectively. CCT increased significantly after infiltration, then decreased significantly in the first 200 seconds of irradiation and decreased slowly for the next 400 seconds. The CCT of the 20 min groups was significantly higher than that of the 2 min groups ($P < 0.0001$). All the RGX treatments improved the corneal enzymatic resistance and corneal biomechanics, with the effects being greater in the 20 min groups. The inclusion of 1.1% hydroxypropyl methylcellulose (HPMC) in the Rb formulation helped to maintain CCT during irradiation, whilst not affecting either the infiltration of Rb or the efficacy of RGX.

Conclusion: Within the range studied, RGX effectiveness increase with instillation time. The incorporation of a 20-minute instillation of 0.1% Rb-1.1% HPMC into the RGX procedure may further improve the safety of the treatment and its prospects for clinical use.

Biography - Jinhai Huang

Executive Vice President in Institute for Medical and Engineering Innovation, Eye & ENT Hospital, Fudan University; Vice President in Eye Institute and Department of Ophthalmology, Eye & ENT Hospital, Fudan University; Deputy Director in Shanghai Research Center of Ophthalmology and Optometry.

Specialized in methodologies, statistical methods, clinical techniques and model species/organisms of myopia prevention and control, refractive surgery planning, preoperative cataract measurement, IOL power calculation, keratoconus screening and corneal cross-linking.

Dr Huang conducted research in these areas, focusing on the cutting-edge cross technologies of ophthalmology and optometry, ocular biometric measurement, gene editing, and nano biomaterials. 170 academic papers were published and included in N Engl J Med, Lancet, JAMA, BMJ, ACS Nano, Ocul Surf, Chem Eng J, Ophthalmology, Carbohydr Poly, and other authoritative core professional journals.

Diffusion Depth and Efficacy of Different Infiltration Time for Rose Bengal-Green Light Corneal Cross-Linking in Rabbit Eyes

Authors

Dr. Jinhai Huang - Fudan University

Dr. Rongrong Gao - Wenzhou Medical University

Prof. Keith M. Meek - Cardiff University

Abstract

Purpose: To explore the diffusion depth and green light corneal cross-linking efficacy of different rose bengal (Rb) infiltration time in rabbit eyes.

Materials and Methods: Rabbit eyes were de-epithelialized and infiltrated in 0.1% Rb solution for 2min, 10min, 20min and 30min in vivo, respectively. The corneal frozen sections were cut and their Rb fluorescence were observed under the confocal microscope to evaluate the diffusion depth. Rabbit corneas were crosslinked in vivo with standard riboflavin/UV radiation (UVX, i.e., the Dresden protocol) or rose bengal/green light (RGX) of corresponding Rb infiltration time. Unirradiated corneas were infiltrated with Rb only. After infiltration or crosslinking, the corneas' resistance to keratolysis were evaluated in collagenase II solution.

Results: After 2min, 10min, 20min, and 30min of Rb infiltrating the cornea, the penetration depths in the stroma were about 100 μ m, 150 μ m, 200 μ m, and 270 μ m, respectively. The complete digestion time of the cornea after RGX was prolonged compared with infiltrated in Rb only, and the UVX group had the longest digestion time.

Conclusion: The diffusion depth of Rb in corneal stroma deepened with the infiltration time prolonging. Under the same infiltration time, the crosslinking effect were enhanced further by irradiation. 20RGX showed the best crosslinking effect among all the RGX groups, but worse than UVX.

Biography - Jinhai Huang

Executive Vice President in Institute for Medical and Engineering Innovation, Eye & ENT Hospital, Fudan University; Vice President in Eye Institute and Department of Ophthalmology, Eye & ENT Hospital, Fudan University; Deputy Director in Shanghai Research Center of Ophthalmology and Optometry.

Specialized in methodologies, statistical methods, clinical techniques and model species/organisms of myopia prevention and control, refractive surgery planning, preoperative cataract measurement, IOL power calculation, keratoconus screening and corneal cross-linking.

Dr Huang conducted research in these areas, focusing on the cutting-edge cross technologies of ophthalmology and optometry, ocular biometric measurement, gene editing, and nano biomaterials. 170 academic papers were published and included in N Engl J Med, Lancet, JAMA, BMJ, ACS Nano, Ocul Surf, Chem Eng J, Ophthalmology, Carbohydr Poly, and other authoritative core professional journals.

Dynamic Mechanical Evaluation of Corneal Cross-Linking and Osmotic Diffusion Effects Using Optical Coherence Elastography

Authors

Mr. Matteo Frigelli - ARTORG Center for Biomedical Engineering Research, University of Bern

Prof. Philippe Büchler - ARTORG Center for Biomedical Engineering Research, University of Bern

Dr. Sabine Kling - Computer Vision Laboratory, ITET department, ETH Zürich

Abstract

Purpose: To use optical coherence elastography (OCE) to investigate dynamic mechanical processes underlying corneal cross-linking (CXL) and to account for osmotically induced strains in the experimental setting.

Materials and Methods: A total of seven freshly enucleated porcine eyes were tested. Three eyes were subjected to standard CXL treatment (Dresden protocol, 30 min, 3mW/cm²), in which 0.1% riboflavin was injected every 5 min for 20 min before UV irradiation. In the control group no CXL was applied, and four eyes were kept in four different preservation conditions, characterized by different tonicities: (i) 5% saline solution, (ii) 0.1% riboflavin in phosphate buffered saline, (iii) distilled water, (iv) without any preservation media. The entire procedures were performed under an OCE setup, and a volumetric scan was taken every minute. Changes in OCE-derived axial deformations¹ were incrementally calculated between volumetric scans performed each minute.

Results: The preservation conditions had a strong influence on the observed strain patterns, which were consistent with the tonicity of the medium (swelling in hypotonic, deswelling in hypertonic environment). After the onset of UV irradiation, we observed a decreasing axial strain in the anterior stroma, indicating less swelling of the tissue compared to the riboflavin-only condition.

Conclusion: OCE is an effective tool to investigate subtle biomechanical changes in the cornea induced by CXL and/or osmosis. The observed macroscopic effects of CXL could be due to the tissue becoming stiffer and limiting the extent of deformation under the same loading conditions, or to active tissue shrinkage induced by the newly formed cross-links.

Biography - Matteo Frigelli

PhD student at University of Bern, working on the mechanical modeling of localized effect of corneal cross-linking.

Effect of Preoperative Belin ABCD Display Parameters on Corneal Cross-linking Outcomes

Authors

Dr. Pinar Kosekahya - Ulucanlar Eye Training and Research Hospital

Dr. Anil Gungor - Ulucanlar Eye Training and Research Hospital

Abstract

Purpose: To evaluate the preoperative characteristics of Belin ABCD Display parameters that may affect corneal cross-linking (CXL) outcomes as corneal flattening, corneal densitometric increase, and visual improvement.

Materials and methods: Fifty eyes of 50 progressive keratoconus patients who underwent accelerated CXL and followed at least 12 months were included to this study. Preoperative characteristics included age, best corrected visual acuity (BCVA), maximum keratometry, corneal densitometry, and Belin ABCD values.

Results: The mean age of the patients was 22.22 ± 6.51 years. BCVA was 0.36 ± 0.28 and 0.21 ± 0.21 logMAR before and 12 months after CXL ($p < 0.001$). Maximum keratometry value was 57.07 ± 7.20 and 55.20 ± 7.57 Diopters (D) before and 12 months after CXL ($p < 0.001$). Total corneal densitometry value was 13.36 ± 1.87 and 15.58 ± 2.40 gray scale units before and 12 months after CXL ($p < 0.001$). Independent predictive factors for visual improvement were preoperative BCVA and D value of ABCD display ($p < 0.001$, $p < 0.001$). None of the preoperative parameters were found to be effective on corneal flattening ($p > 0.05$ for all). Predictive factors for corneal densitometric increase were anterior corneal 0-2 mm zone densitometry and the A value of Belin ABCD display ($p = 0.01$, $p = 0.04$).

Conclusion: In patients with worse visual acuity and related high D value, more visual improvement can be expected after CXL. Corneal haze development after CXL may be more prominent in patients with a high anterior 0-2 mm corneal densitometry and a high A value before CXL. Visual and tomographical evaluation along with Belin ABCD display parameters before surgery might be important to predict the outcomes of CXL.

Biography - Pinar Kosekahya

1984- Born in Turkey

2008- Graduated from Ankara University Faculty of Medicine

2014- Ophthalmology specialist

2015- Cornea & External Diseases Unit

2019- Chief of Eye Bank

2019- FEBO

2019-2020- ICO examinations

2020- Assoc. Prof.

2022- IOFF fellowship

Efficacy of Epi-Off Pulsed-Light Accelerated Corneal Collagen-Cross-Linking in the Treatment of Keratoconus: Three-Year Results

Authors

Dr. Tamara Shahinyan - Astghik Medical Center

Dr. Alina Terteryan - Astghik Medical Center

Abstract

Purpose: The aim of this study was to evaluate the 3-year results of epithelium-off pulsed-light accelerated corneal collagen crosslinking treatment in progressive keratoconus using 9 mW/cm² ultraviolet A light for 20 min with a total dose of 5.4 J/cm².

Methods: A total of 45 eyes of 30 patients with documented progressive keratoconus and treated with epithelium-off pulsed-light accelerated corneal collagen crosslinking using the crosslinking device (Peshke, Switzerland) were included in this retrospective study. Corneal tomographic measurements and best spectacle-corrected visual acuity were compared using analysis of variance with repeated measurements between the baseline visit (before the corneal collagen crosslinking treatment), and the three month, six months, first, and second year visits.

Results: Improvement in BCVA at 3 year (+0.4 logMAR BCVA 11 eyes), stable in 25 eyes and decrease in 9 eye (up to -0.3 logMAR BCVA) Improvement in UCVA at 3 year (+0.1-0.4 logMAR UCVA 26 eyes), stable in 19 eye and decrease (-0.1-0.4 logMAR aCVA), Average Kmax flattening was -1.1 \pm 2.1D. (57%) flattened by \leq 2.0 D. Average Kmax steepening was 0.25--0.495D. (43%) steepened by \leq 0.5 D.

Conclusion: Pulsed light accelerated corneal collagen crosslinking using 9 mW/cm² ultraviolet A light for 20 min with a total dose of 5.4 J/cm² is an effective treatment modality in cases with progressive keratoconus.

Biography - Tamara Shahinyan

Dr. Tamara Shahinyan is originally from Armenia, Yerevan. She received her Bachelor of Medical degree in Yerevan State Medical University.

Dr. Tamara Shahinyan received her Doctor of Ophthalmology degree from Yerevan State Medical University. Other internships at private eye care clinics in Europe allowed her to improve her skills in her special areas of interest including Lasik and other refractive surgeries keratoconus, post refractive ectasia, presbyopic correction, as well as diagnosis and treatment of eye diseases.

Dr. Tamara Shahinyan is a member of the ESCRS, Armenian Ophthalmologists Association.

she enjoys spending time with her husband and her two kids. She is good in communication and friendly.

Enhanced transepithelial Corneal Cross-Linking Using Novel Hibiscus-Like RF/ZIF-8 Composites

Authors

Dr. Jinhai Huang - Fudan University

Dr. Mei Yang - Fudan University

Dr. Colm McAlinden - Singleton Hospital

Prof. Keith M. Meek - Cardiff University

Prof. Xingtao Zhou - Fudan University

Abstract

Purpose: Hibiscus-like RF@ZIF-8NF composites was constructed with a purpose to achieve a good TE-CXL effect with the preservation of epithelium, providing a new strategy for the treatment of keratoconus.

Materials and Methods: Using 5-phosphoric acid-riboflavin (RF), 2-methylmimi and zinc nitrate as raw materials, RF@ZIF-8 composites were obtained by adjusting reaction conditions. The material characterization, in vitro and in vivo biological evaluations of the obtained RF@ZIF-8 composites were carried out in detail.

Results: The doping of RF in appropriate range has little effect on the phase structure of ZIF-8, while the morphology and size of the composites can be adjusted by changing reaction factors. Under same conditions, kinds of experimental results indicated that the obtained RF@ZIF-8 composites have excellent corneal permeability, the RF content in the stroma was higher than that in other groups. The biocompatibility evaluation showed that the RF@ZIF-8 NF nanocomposites had excellent biocompatibility and no obvious damage to cornea. The in vivo TE-CXL effect of the RF@ZIF-8 composite was comparable to, or even slightly better than that of SCXL.

Conclusion: The constructed hibiscus-like RF@ZIF-8NF composites have excellent TE-CXL effect with epithelium preserved, its TE-CXL effect is comparable to that of SCXL, or even slightly better than that. It is expected to become a new type of TE-CXL nano-drug, providing new strategy for the treatment of keratoconus, which has high scientific research value, opens up a new direction for the development of CXL.

Biography - Jinhai Huang

Executive Vice President in Institute for Medical and Engineering Innovation, Eye & ENT Hospital, Fudan University; Vice President in Eye Institute and Department of Ophthalmology, Eye & ENT Hospital, Fudan University; Deputy Director in Shanghai Research Center of Ophthalmology and Optometry.

Specialized in methodologies, statistical methods, clinical techniques and model species/organisms of myopia prevention and control, refractive surgery planning, preoperative cataract measurement, IOL power calculation, keratoconus screening and corneal cross-linking.

Dr Huang conducted research in these areas, focusing on the cutting-edge cross technologies of ophthalmology and optometry, ocular biometric measurement, gene editing, and nano

biomaterials. 170 academic papers were published and included in N Engl J Med, Lancet, JAMA, BMJ, ACS Nano, Ocul Surf, Chem Eng J, Ophthalmology, Carbohyd Poly, and other authoritative core professional journals.

Epi-Off Customized CXL with Supplemental Oxygen for Keratoconus – 1-Year Results

Authors

Dr. Theo G. Seiler - IROC

Prof. Beatrice Früh - Inselspital Bern

Abstract

Purpose: To evaluate potential advantages of supplemental oxygen in of epi-off customized CXL.

Setting: Prospective observational study at the Department of Ophthalmology, University Hospital Bern, Switzerland

Methods: Forty eyes of 40 patients with documented progressive keratoconus were treated with epi-off customized CXL using 15 mW/cm² and maximal energy levels of 10 J/cm². Twenty eyes were treated in an atmospheric (21% O₂) environment, while 20 eye were treated in a hyperoxic environment (>90% O₂) and followed for 1 years. Analyzed parameters were Scheimpflug tomographies, endothelial cell count, BSCVA and anterior segment OCT.

Results: Keratoconus progression was halted in all eyes. Kmax regression in the supplemental oxygen subgroup was significantly greater compared to the normoxic subgroup (-2.8 vs. -1.2 D). High flattening (>4D) was observed in 8 eyes (40%) in the hyperoxic vs. 2 eyes (10%) in the normoxic subgroup. BSCVA increased in both groups, however, significantly more in the supplementary oxygen subgroup. Densitometry peaked in both groups by month 3 and reached preoperative values in the normoxic subgroup, but not completely in the supplementary oxygen subgroup. Demarcation lines were observed significantly deeper using CXL with supplemental oxygen (334 vs 230 microns).

Conclusions: Supplementary oxygen optimizes the effect and outcome of epi off CXL with 15mW/cm². Flattening, corneal regularization and visual acuity improvement go along with an increased haze formation and deeper demarcation line depth using supplemental oxygen.

Experimental and Lab Model of Potential Gene Therapy in Keratoconus

Authors

Dr. Pooja Khamar - Narayana Nethralaya

Dr. Rohit Shetty - Narayana Nethralaya

Abstract

Introduction: Keratoconus is characterized by progressive stromal weakness and thinning. Levels of collagen crosslinking enzyme lysyl oxidase (LOX) are inversely related to the severity of keratoconus. This study explores potential benefits of enhancing LOX expression in keratoconic tissues. We also aim to establish the safety and efficacy of recombinant AAV mediated gene delivery of Lysyl oxidase(LOX) in corneal tissues as a potential therapy for Keratoconus.

Methods: After ethical approval and due consent, human donor corneal lenticules were obtained from SMILE surgeries. LOX expressing AAV vectors were generated and purified. Human donor corneal lenticules and mouse corneas were transduced with AAV.LOX and AAV.GFP as controls. LOX, Collagen I, Collagen IV and MMP9 levels were measured in human ex-vivo tissues (4 weeks later) and mouse corneas (6weeks later) by immunofluorescence (IF) and mRNA analysis.

Results: AAV transduction of corneal tissues was safe in mouse corneas with no haze/other ocular surface events on periodic examination. Gene therapy vectors effectively transduced corneal fibroblasts in both primary human and mouse corneas. Higher levels of LOX expression correlated with higher expression of collagens and ECM/fibrosis genes like Fibronectin and α -SMA, and lower basal levels of MMP9.

Conclusion: Recombinant AAV-mediated LOX therapy in ectatic corneas is safe and effective. LOX augmentation enhances expression of collagens and reduces MMP9 levels, thus blocking the thinning processes and strengthening the cornea. Reduced MMP9 can alleviate the inflammatory milieu, hence treating keratoconus.

Biography - Pooja Khamar

Dr Pooja Khamar is currently working in the department of Cataract , Refractive, and Dry eye services at Narayana Nethralaya, India. She is also associated as a Clinical and Translational Scientist at GROW Laboratory and IBMS, Narayana Nethralaya. Her Current areas of work include molecular and Imaging bio- markers, Wound Healing in refractive surgery and crosslinking. Her unique areas of work include using a Bio M Pathfinder Kit for targeted therapy, Polarization sensitive OCT for collagen imaging and many more. She has Presented in various national and international conferences and has won many awards for the same.

External Validation of the Artificial Intelligence Indices for Enhanced Detection of Corneal Ectasia

Authors

Dr. Robert Herber - Department of Ophthalmology, University Hospital Carl Gustav Carus, TU Dresden, Germany, Dresden

Prof. Renato Ambrosio - Department of Ophthalmology, Federal University of São Paulo Rio de Janeiro, Rio de Janeiro

Prof. Frederik Raiskup - Department of Ophthalmology, University Hospital Carl Gustav Carus, TU Dresden, Germany, Dresden

Dr. Lisa Ramm - Department of Ophthalmology, University Hospital Carl Gustav Carus, TU Dresden, Germany, Dresden

Abstract

Purpose: To evaluate the diagnostic ability (area under the curve, AUC) of the optimized tomographic and biomechanical Index (TBIv2), current tomographic and biomechanical Index (TBIv1), and the Pentacam random forest index (PRFI), and the Belin/Ambrósio total deviation value (BAD-D) for the detection of early and clinically evident ectasia.

Methods: This prospective study enrolled 670 healthy and keratoconus eyes. Only one eye per subject was included. Three subgroups were divided according to the following inclusion criteria: 1) normal eyes (NE): KISA% index<60, BAD-D<1.6, I-S value<1.45 D and Kmax<47 D; 2) bilateral keratoconus (KC): clinical signs of corneal ectasia in both eyes; 3) very asymmetric ectasia (VAE-NT): the topographical normal eye from patients with clinical ectasia in the contralateral eye. Exclusion criteria were the presence of any ocular pathology except KC and previous corneal or ocular surgeries. DeLong test was used to compare AUC of ROC analysis.

Results: The TBIv2 had highest AUC of 0.987 in separating NE from all subgroups followed by PRFI (0.977), TBIv1 (0.969), and BAD-D (0.969). The AUC of TBIv2 was statistically significantly higher in comparison to all other parameters (all P<0.05). Separating NE from VAE-NT eyes, the TBIv2 statistically significantly outperformed all other parameters showing an AUC of 0.918 (all P<0.05). A cut-off value of 0.58 (sensitivity 91%/specificity 100%) and 0.28 (87%/88%) was found for TBIv2 to separate NE and all subgroups as well as VAE-NT, respectively.

Conclusions: The TBIv2 had the best diagnostic ability to detect corneal ectasia and subclinical cases.

Biography - Robert Herber

Dr. Robert Herber is a research associate at the Carl Gustav Carus University Hospital (Department of Ophthalmology), TU Dresden, Germany. He studied optometry at the University of Applied Sciences (EAH) Jena. He then graduated from EAH Jena with a master's degree in optometry and vision sciences. Afterwards, he worked as an optometrist until he started his Ph.D. doctoral studies in medical sciences. Since his dissertation, his scientific interests have been in the areas of keratoconus, corneal crosslinking, and biomechanics.

How to Have a Happy Keratoconus Patient with a Toric ICL? An Experience of 15 Years

Authors

Prof. Mohamed Shafik Shaheen - Professor of Ophthalmology, University of Alexandria

Abstract

The tips and tricks for visual rehabilitation of keratoconus patients using the Toric ICL to get the best visual performance for these patients. These tips are based on 15 Years' experience of implanting the lens for the cross-linked keratoconic eyes.

Biography - Mohamed Shafik Shaheen

- Professor of Ophthalmology, University of Alexandria, Egypt
- President of The Egyptian Society of Keratoconus & Cornea Transplant (ESKC&CT)
- Cornea and Refractive Surgery Consultant, Alexandria University Hospitals
- Master's degree of Ophthalmology (University of Alex) and Doctorate degree in Ophthalmology (University of Complutense Madrid, Spain), Fellow of Instituto Ramon Castroviejo, Madrid
- TFOS (Tear Film and Ocular Surface Society) Global Ambassador
- Board member of the Egyptian Society of Ocular Implants and Refractive Surgery (ESOIRS), the Egyptian Society of Cataract and Refractive Surgery (EgSCRS) & the Egyptian Refractive Club (ERC)
- CEO of Horus Vision Correction Center, Alexandria
- Member of Reviewers board of many of the leading Refractive Surgery Peer reviewed journals.
- Winner of many honors and awards from the Egyptian and regional Societies of Refractive Surgery.
- International Global Advisory Board Member of Cataract and Refractive Surgery Today (CRSTE)
- Author of more than 60 Original Articles and Book Chapters in the Field of Refractive Surgery.

Identification of Treatment Protocols for Effective Cross-Linking of the Peripheral Cornea: An Experimental Study

Authors

Dr. Ruth Donner - Medical University of Vienna

Ms. Maria Laggner - Medical University of Vienna

Dr. Julia Aschauer - Medical University of Vienna

Dr. Jan Lammer - Medical University of Vienna

Prof. Gerald Schmidinger - Medical University of Vienna

Abstract

Introduction: This study aimed to evaluate modified corneal cross-linking (CXL) protocols regarding improved treatment effects on the peripheral cornea in terms of tissue stability and cellular response.

Methods: Peripheral CXL (pCXL) was performed within a ring of 9-11 mm of 36 human donor corneas with variations in energy (5.4, 7.2, and 10 J/cm²) at 9 mW/cm² irradiance. Each energy level was modulated regarding the oxygen level surrounding the cornea during treatment (21%; 100%). Stress-strain tests with endpoints at 12% strain and collagenase A-assisted digestions to complete digestion were performed to evaluate the rigidity and resistance of treated and control tissue. Further, corneas were processed histologically via TUNEL assay and H&E staining to demonstrate the effects on stromal cells during treatment.

Results: Increases in energy dosage achieved significant increases in resistance to stress in all variations except when comparing protocols, A and B under normoxic conditions. Supplemental oxygen significantly increased rigidity in protocols B ($p < 0.01$) and C ($p = 0.018$). Hyperoxic conditions significantly increased resistance to digestion in all protocols. The number of DNA strand breaks in TUNEL assay staining showed significant increases in all increases in energy as well as with oxygen supplementation.

Conclusions: Increases in energy and supplemental oxygen improved the effect of CXL, though endothelial safety could not be verified with confidence in high-fluence CXL with supplemental oxygen. Results suggest that CXL protocols using 7.2 J/cm² with 100% O₂ or 10 J/cm² without supplemental oxygen prove most effective without anticipated risk of endothelial damage.

Biography - Ruth Donner

Ruth Donner is a resident at the Medical University of Vienna. She is part of the Vienna Cornea Study Group under the direction of Prof. Gerald Schmidinger.

Interplay of Vitamin D Receptors and Lysyl Oxidase in Keratoconus and Cross-Linking

Authors

Dr. Anushree Bhatkal - Narayana Nethralaya

Dr. Rohit Shetty - Narayana Nethralaya

Dr. Pooja Khamar - Narayana Nethralaya

Dr. Swaminathan Sethu - GROW Lab, Narayana Nethralaya

Abstract

Purpose: The relevance of inflammation in keratoconus (KC) pathogenesis is well known. Endogenous regulation of inflammation by vitamin-D is via its interaction with its receptor (vitamin-D receptor, VDR). Hence, it is important to determine the functional relevance of VDR status in endogenous collagen corneal cross-linking (CXL) and keratoconus (KC).

Materials and Methods: Corneal epithelium over ectatic and non-ectatic zones in keratoconic corneas from 30 KC patients undergoing CXL and 10 controls without keratoconus, was collected to determine the protein and/or mRNA levels of VDR, lysyl oxidase (LOX), MMP9 and collagen by western blot and/or qPCR. The effects of oxidative stress and vitamin-D on VDR, LOX, MMP9 and collagen in human corneal epithelial cells (HCE), in vitro was also studied.

Results: KC epithelium had significantly ($P < 0.05$) lower VDR, LOX, collagen, and higher MMP9 as compared to controls. Ectatic zones of KC had lower VDR than matched epithelium from non-ectatic zones in grade dependent manner. HCEs exposed to oxidative stress, in vitro, resulted in a marked reduction in the levels of VDR and LOX, and an increase in MMP9. On the contrary, vitamin-D treatment induced the expression of VDR and LOX along with a reduction in the levels of MMP9.

Conclusion: The findings demonstrate the clinical relevance of VDR in KC and the critical role of the vitamin D–VDR axis in regulating endogenous CXL components. It suggests VDR activation and modulation of extracellular matrix components by vitamin D supplementation to be a novel strategy for improving the outcomes in KC management.

Biography - Anushree Bhatkal

The presenting author is currently a cataract and refractive fellow at Narayana Nethralaya, Bengaluru, India.

Her interest lies in research related to keratoconus therapeutics and to learn about newer technologies in refractive surgery.

Iontophoresis-CXL for Young Early Keratoconus After Epithelium Off-CXL in the Fellow Eye

Authors

Dr. Pietro Rosetta - Humanitas San Pio X - Milan

Dr. Gianmaria Barone - Humanitas University - Milan

Dr. Matilde Buzzi - Humanitas University - Milan

Dr. Vanessa Ferraro - Humanitas University - Milan

Dr. Francesco Santoru - Humanitas University - Milan

Prof. Paolo Vinciguerra - Humanitas University - Milan

Abstract

To assess the long-term outcomes of transepithelial iontophoresis cross-linking for early progressive keratoconus under the age of 25.

CDVA, spherical equivalent, corneal topography and tomography indices were assessed at baseline and at least 24 months of follow up. The statistical analysis showed no significant change over time in CDVA, maximum keratometry and A, B, C values of the Belin Progression Display. I-CXL is an effective and safe method to stabilize early progressive keratoconus with limited improvement noted.

More studies will be needed to assess its long-term outcomes

Biography - Pietro Rosetta

Dr. Pietro Rosetta is Head of Ophthalmology Department at Humanitas San Pio X in Milan (Italy) and Adjunct Professor at Humanitas University in Milan. He graduated with honors in Medicine and Surgery, and he is a Board-Certified Ophthalmologist at the University of Milan (Italy).

From 1990 to 1992 he worked as assistant at the Eye Clinic of Ophthalmology Foundation A. de Rothschild of Paris directed by Prof. Danièle Aron Rosa.

In 1992, he earned at the University of Paris VII the title of "Assistant étranger" in Ophthalmology. Since 1997 to 2018 he worked, as Corneal Unit Head, at Ophthalmology Department directed by Prof. Paolo Vinciguerra at Humanitas Research Hospital.

Dr Pietro Rosetta is author of many international scientific papers regarding Cross-Linking for keratoconus and for infectious corneal ulcers, transplantation of limbal stem cells, corneal keratoplasty.

He has contributed to the development in Italy of CXL.

Istanbul Nomogram for KeraNatural in 110 Keratoconic Eyes

Authors

Dr. Ziya Burke - None

Dr. Zeki Yiğit Karaca - Ophthalmologist

Dr. Feyza Keskin - Ophthalmologist

Dr. Burcu Yücekul - Ophthalmologist

Dr. Cafer Tanriverdi - Ophthalmologist

Dr. Aylin Kılıc - Medipol

Abstract

Purpose : To compare changes in vision, keratometry (Km), elevations (Pentacam, Oculus Optogeräte), stromal thicknesses (Anterior, Heidelberg Engineering) after allograft intracorneal ring segment (KeraNatural, Lions Vision Gift, Portland, OR, USA) implantation.

Patients and methods: 110 eyes of 81 patients who were implanted with allogenic ring segments. The mean follow up was 334 ± 30 (1- 30 months). All rings were implanted single and according to the Istanbul nomogram (tunnel was 4×7.5 mm diameter and 35% depth Changes in distance visual acuity (UDVA), corrected distance visual acuity (CDVA), spherical equivalent (SE), Km values, elevation were compared preoperatively versus postoperatively.

Results: The mean K decreased from $48.26 \pm 4.78D$ preoperatively to $44.50 \pm 4.42D$ ($p=0.004$), corrected distance visual acuity increased from 0.29 ± 0.18 (Snellen) to 0.70 ± 0.24 (Snellen) ($p<0.001$), and spherical equivalent decreased from $-6.94 \pm 4.32D$ to $-1.44 \pm 4.44D$ ($p<0.001$). The mean Anterior stromal thickness decreased $17.39 \pm$ and 5.78 mm in the postoperative first month compared to the first day of the surgery ($p=0.040$).

Conclusion: The results of this pilot study show that sterile allograft corneal ring segments may be safe, effective and enhance the visual performance of keratoconus patients. Larger clinical studies are needed to demonstrate the effectiveness and safety with long term follow-up.

Biography - Ziya Burke

Education 2020: Haseki Training and Research Hospital 2015 :Cerrahpaşa Medical Faculty 2009: Güzelyurt Türk Maarif College 2002: Güzelyurt Kurtuluş Primary School

Publications Conferences Paraneoplastik Etki ile Görme Kaybı Gelişen Olgularımızın Değerlendirilmesi '53. TOD Ulusal Kongresi, Kemer, Antalya, 2019'. Oral Presentation İlk Bulgusu Santral Retinal Arter Tıkanıklığı Olan Temporal Arterit Olgularımız '52. TOD Ulusal Kongresi, Kemer, Antalya, 2018'. Poster Horizontal Şaşılığın Olan Serebral Palsili Çocuklarda Kaba Motor Fonksiyonel Değerlendirme ile Oküler Motor ve Görsel Fonksiyonlar Arasındaki İlişkinin Değerlendirilmesi. (Specialization Thesis, 2020)

Certificates and Awards International Council of Ophthalmology (ICO) Clinical Exam , 2020
International Council of Ophthalmology (ICO) Optic Refraction and Instruments, 2019
International Council of Ophthalmology (ICO) Visual Sciences , 2019 Cerrahpaşa Medical F

Keratoconus Classification According to the Topographic Ectasia Phenotype

Authors

Dr. Tiago Monteiro - Cornea and Refractive Surgery Department, Ophthalmology Department, Hospital de Braga

Dr. Belén Alfonso-Bartolozzi - Instituto Universitario Fernández-Vega

Dr. Luis Fernández-Vega Cueto - Instituto Universitario Fernández-Vega, Oviedo

Dr. José F. Alfonso - Instituto Universitario Fernández-Vega, Oviedo, Spain; Universidade de Oviedo, Spain

Abstract

Purpose: To describe a new classification of the disease according to the ectasia topographic phenotype.

Methods: The keratoconic corneas were divided into different phenotypes according to several clinical parameters provided by current technology: refractive and topographic astigmatism, location of the ectasia according to the thinnest point, higher order aberration and asphericity.

Results: The study included the analysis of 1171 eyes; the topography device used was the Sirius (CSO, Italy), the pachymetric map was collected with OCT Visante (Carl Zeiss, Germany). The classification includes five major phenotypes of keratoconus. The first step of the classification is the definition of the localization of the ectasia: central (thinnest point centrally located at a distance of 0,625 mm or less from the center of the cornea); paracentral (thinnest point located between 0,625 to 1,875 mm of the center of the cornea). The second parameter is the relationship between the flat topographic axis and the coma higher order aberration (HOA) axis: coincident (inferior to 30 degrees); non-coincident (30-60 degrees); or perpendicular (superior to 60 degrees). The third parameter used is corneal asphericity: high with $Q < -1,25$ or low with $Q > -1,25$. Five phenotypes were described: the "Nipple", the "Bow-tie", the "Croissant", the "Duck", and the "Snowman".

Conclusion: The development of a new classification of keratoconus according to the clinical characteristics of the disease is a crucial tool to develop and improve the efficacy, safety, and predictability of the surgical treatments available for keratoconus; providing a basis for comparison studies between several available treatments.

Biography - Tiago Monteiro

Cornea and Refractive Surgery Department, Ophthalmology Department, Hospital de Braga, Braga, Portugal.

Keratoconus Detection Using Smartphone Selfie

Authors

Dr. Hidenaga Kobashi - Tsubota Laboratory Inc.

Dr. Kazuo Tsubota - Tsubota Laboratory Inc.

Abstract

Purpose: Keratoconus is a progressive corneal disease which may cause blindness if it is not detected in the early stage. Smartphone is easy tool for patients and ophthalmologists to communicate the data access. In this paper, we propose a portable, low-cost, and easily measurable keratoconus detection device which is based on smartphone selfie camera images.

Materials and Methods: We designed the gadget comprising of a 3D-printed Placido rings of LED light combined with the smartphone. Selfie photographs were taken using the ring attached smartphone in normal and keratoconus subjects. Captured images of the reflection of the Placido rings on the cornea were analyzed by an intelligent smartphone app based on the parameters such as ellipticity and eccentricity. Standard anterior segment optical coherence tomography was also performed in each subject.

Results: In a clinical study, we successfully identified the diagnosis of keratoconus based on ellipticity and eccentricity in smartphone selfie style. However, no significant correlations were found between the smartphone and standard tomography in parameters.

Conclusion: Preliminary experimental results show that the proposed method roughly detected keratoconus. The disagreements between the two devices might be attributed to the alignment and distance to cornea in smartphone selfie style. Our novel Placido rings attached with smartphone is useful for the screening under remote medicine.

Biography - Hidenaga Kobashi

04/2006-03/2008 Medical Intern

Kyorin University School of Medicine

04/2008-03/2016 Research Fellow

Department of Ophthalmology,

Kitasato University School of Medicine

04/2016-09/2017 Postdoctoral Research Fellow

Harvard Medical School, Schepens Eye Research Institute / Massachusetts Eye and Ear Infirmary

PI: Dr. Joseph B. Ciolino

10/2017-Present Associate Professor

Department of Ophthalmology,

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Tsubota Lab. Inc. Tokyo

3/2020-Present CEO,

Toneasy. Inc. Tokyo

Keratocyte Apoptosis features induced by UV Cross-Linking

Authors

Dr. Usubov Emin - Ufa Eye Research Institute

Dr. Azat Khalimov - Ufa Eye Research Institute

Prof. Mukharram Bikbov - Ufa Eye Research Institute

Abstract

Purpose: To study the mechanisms of keratocyte apoptosis with standard UV corneal crosslinking in an experiment.

Methods: All procedures were carried out on laboratory animals. 20 adult rats were divided into 2 groups: 1 - intact, 2 - Epi-Off CXL (3 mW/cm² - 10 min) with 0.1% riboflavin + 20% Dextran. Immunohistochemical analysis was performed by indirect immunoperoxidase staining using monoclonal and polyclonal antibodies to caspases-3 and -8, Bcl-2 and p53 (Santa Cruz Biotechnology, USA). Polyclonal indirect streptavidin-biotin detection system Leica BOND (Novocastra™, Germany) with staining hematoxylin dye (BioVitrum, Russia) was used for visualization. Statistical analysis was carried out using single-factor analysis of variance.

Results: The number of immunopositive cells in the cornea of rats to caspases -3 and -8 was increased on the 3rd day after CXL. After 90 days, a slight decrease in immunopositive cells to caspase-3 and -8 was noted. Bcl-2-immunopositivity was also significantly higher on the 3rd day after the procedure, then by the 3rd month the number of Bcl-2-positive cells decreased by half compared to the early postoperative period. No p-53 immunopositive cells were detected in the corneal stroma during the entire observation period (up to 90 days).

Conclusions: The production of caspase-3 and -8 in the early stages indicates the activation of an external signaling pathway and the induction of a caspase cascade in keratocytes in response to damage to the cornea caused by its deepithelization and exposure by UV radiation. Keratocyte death is not associated with the development of p-53-mediated apoptosis.

Biography - Usubov Emin

Usubov Emin Logman - ophthalmologist, PhD, head of corneal and cataract surgery department of Ufa Eye Research Institute.

Keratometric Changes in Anterior Sagittal Curvature, Total Corneal Refractive Power, and True Net Power Maps after Corneal Cross-Linking in Patients with Keratoconus

Authors

Dr. Pinar Kosekahya - Ulucanlar Eye Training and Research Hospital

Dr. Seyfullah Ikbak Aksu - Ulucanlar Eye Training and Research Hospital

Abstract

Purpose: To investigate the post corneal cross-linking (CXL) changes in the keratometry values obtained with the maps of anterior sagittal curvature (ASC), total corneal refractive power (TCRP), and true net power (TNP) of Scheimpflug corneal tomography.

Materials and Methods: Fifty eyes of 50 keratoconus patients who underwent accelerated CXL and followed-up at least 24 months were included to this retrospective study. Maximum keratometry (K_{max}) value, mean K, K values in 3,2,1 mm zones of cone centered maps, vertex centered, and pupil centered 3 mm zones in ASC, TCRP, and TNP maps were noted at the baseline visit and at the 6, 12, and 24 months after CXL.

Results: The mean age of the patients was 21.7 ± 3.1 years. All keratometric values significantly changed after CXL, and the changes were significant between the baseline and 6th, 12th, 24th months visits ($p < 0.01$ for all values). The decrease amount was more pronounced in the TCRP map than in the ASC, TNP maps. When the values of the 3 mm cone zones of the ASC, TCRP and TNP maps were compared, all changes were less than the K_{max} change and the changes were -1.9 ± 1.2 , -2.1 ± 1.2 and -2.1 ± 1.4 , respectively.

Conclusion: In addition to K_{max} , the changes in the vertex and cone zones especially in the TCRP map should be taken into account in the evaluation of CXL effectiveness. Especially in patients who require re-CXL, planning a customized treatment area for each patient may increase the success of CXL.

Biography - Pinar Kosekahya

1984- Born in Turkey

2008- Graduated from Ankara University
Faculty of Medicine

2014- Ophthalmology specialist

2015- Cornea & External Diseases Unit

2019- Chief of Eye Bank

2019- FEBO

2019-2020- ICO examinations

2020- Assoc. Prof.

2022- IOFF fellowship

Late-Onset Immune Infiltrate After Corneal Cross-Linking

Authors

Dr. Didar Anwar - North Eye Center

Abstract

Purpose: To report the incidence of late-onset immune infiltrate after uneventful corneal cross-linking (CXL) and to demonstrate its clinical presentations and treatment modalities.

Methods: This is a retrospective study. Patients presented with new onset pain, photophobia, and redness of one eye started more than 3 months (from 3 months to 6 years) after uneventful surgery. Slit lamp exam showed multiple round or geographic stromal infiltrates that are coalesced in the form of a complete or incomplete ring at the border of cross-linked area with non-cross-linked. All of the patients had the other eye involved in subsequent attacks. The condition is recurrent, and it recurs few to several months after the first attack.

Since scrapings were negative, patients were started on topical steroids every two hours for several days. Weak steroid drops were ineffective. The peripheral infiltrates gradually resolved and were replaced with faint haze.

Results: Total of 2400 patients with bilateral CXL were included. The mean age was 25.3 (13–35) years. Nine patients developed the condition. Incidence was 0.4%. Two (22.2%) were male and 7 (77.7%) were female. Three of the patient had conventional cross-linking and 6 had accelerated cross-linking (10 minutes).

Conclusions: Recent studies showed that corneal cross-linking induces inflammatory response for at least six months after surgery.

Late onset immune infiltrates are an uncommon but bothersome complication after CXL, the exact mechanism of the occurrence is still unclear. Long-term follow-up is necessary to detect more late-onset sterile keratitis and study the mechanism and the risk factors.

Biography - Didar Anwar

Didar S. Anwar is a corneal specialist. Finished corneal fellowship training at University of Texas Southwestern Medical Center in 2012. He has several peer-reviewed publications in international journals and was also reviewer in many of those international journals. He is the first who started deep anterior lamellar keratoplasty, Descemet's stripping automated endothelial keratoplasty and keratoprosthesis in Iraq in 2012. He is the inventor of scissors DALK technique which was published in Clinical Ophthalmology journal in 2013.

He is now the owner and the medical director of North Eye center in Erbil, and he is the head of Erbil branch of Kurdistan board of ophthalmology.

Management Moderate and Unstable Keratoconus by Combined Cross Linking and Wave Guided Corneal Photo Ablation

Authors

Prof. Mouhcine El Bakkali - Rabat Eye Clinic

Ms. Asmae Sami - Rabat Eye Clinic

Ms. Yousra Oumzil - Rabat Eye Clinic

Ms. Ines Laaroussi - Rabat Eye Clinic

Abstract

The arrival for cross linking twenty years ago was a real breakthrough in the keratoconus management , since the keratoconus is stabilized in more than 90 % of cases and the Corneal graft is delighted or avoided , however even if the keratoconus is stabilized , the vision still low because of persistent HOA and the patient still unhappy

So, the question which arises, in the unstable Keratoconus management , it is possible to stabilize and to improve the vision at the same time ?

The answer is yes , by combining corneal cross linking and wave guided photo ablation

We present our experience about 80 cases of moderate unstable keratoconus admitted at the eye clinic of rabat between 2019- 2021, the corneal screening was done (TOMO OCT ABERROMETRY) to confirm both the Keratoconus and the instability , then all our patients was treated by corneal crosslinking and WG corneal photo ablation , the mean follow up was 9 months , even if our short follow up we notice in all cases , the Keratoconus stability , the increase of the BCVA , the decrease of HOA and K max and two cases of persistent haze.

However, some debatable question still presents concerning the stability , the safety , the simultaneous or sequential treatment , the protocol of photo ablation TOPO guided or WF guided,

The long follow up and the results of multiple comparative study will certainly improve this procedure .

Biography - Mouhcine El Bakkali

Prof. Mouhcine El Bakkali

Ex Professor of Rabat and Marrakech University of Medicine

Member of CXL expert since 2015

Member of ESCRS since 2004

Corneal cataract and refractive Surgeon

Past president of Moroccan society of Refractive surgery

General secretary of the Moroccan society of ophthalmology

President of RESO (Reso Enseignement Solidarity en Ophtalmogy)

General secretary of Private Medical Professor Fondation

Motion Tracking Brillouin Microscopy Differentiates Normal, Keratoconic, and Post-Laser Vision Correction Corneas

Authors

Prof. J. Bradley Randleman - Cleveland Clinic Cole Eye Institute

Dr. Hongyuan Zhang - Cleveland Clinic Cole Eye Institute

Dr. Lara Asroui - Cleveland Clinic Cole Eye Institute

Dr. Imane Tarib - Cleveland Clinic Cole Eye Institute

Prof. William Dupps - Cleveland Clinic Cole Eye Institute

Prof. Giuliano Scarcelli - Cleveland Clinic Cole Eye Institute

Abstract

Purpose: To characterize 3-dimensional spatially resolved biomechanical differences between normal, stage I/II keratoconic (KC), and post-laser vision correction (LVC) corneas using motion tracking Brillouin microscopy.

Methods: Thirty patients (10 controls, 10 LVC, 10 KC) had clinical Scheimpflug imaging and motion tracking Brillouin microscopy performed. Brillouin shift was measured at multiple points within the central 8mm of the cornea and regional Brillouin maps were constructed. Mean Brillouin shift (Mean), Maximum Brillouin shift (Max), Minimum Brillouin shift (Min), Spatial standard deviation (SSD), and Max-Min values, all measured in GHz, were compared.

Results: Mean (C=5.713 GHz, LVC = 5.706 GHz, KC = 5.679 GHz, ANOVA $p < 0.0003$), Min (C = 5.696 GHz, LVC = 5.671 GHz, KC = 5.64 GHz, ANOVA $p < 0.00001$), SSD ($p < 0.01$), and Max-Min ($p < 0.001$) values were all significantly different between groups. Min (AUROC = 1.0) and Mean (AUROC = 0.96) values performed better than or equal to K max and thinnest pachymetry in distinguishing between Control and KC eyes, while Max (AUROC = 0.94) and Mean (AUROC = 0.9) values best differentiated between LVC and KC eyes.

Conclusions: Motion tracking Brillouin microscopy effectively characterized focal corneal biomechanical alterations after LVC and in keratoconic corneas and clearly differentiated these groups from normal controls. This is the first demonstration of superior performance of Brillouin biomechanical metrics to Scheimpflug metrics in distinguishing between controls and eyes with early-stage keratoconus, and the first clinical demonstration of focal biomechanical alterations after laser vision correction.

Biography - J. Bradley Randleman

J. Bradley Randleman, MD, is Professor of Ophthalmology at the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University and co-director of the Refractive Surgery Service at the Cleveland Clinic Cole Eye Institute in Cleveland Ohio. A widely respected refractive surgeon, his areas of expertise include laser vision correction and the management of corneal ectatic disorders. His research focuses on corneal biomechanics and the identification and management of corneal ectatic diseases including keratoconus and postoperative ectasia after LASIK. He has been awarded multiple research grants, including multiple R01 grants from the NIH to evaluate corneal biomechanical analysis using Brillouin Microscopy.

Dr. Randleman has served as Editor-in-Chief for the *Journal of Refractive Surgery* since 2011. He has delivered more than 300 lectures, authored more than 175 peer-reviewed publications in leading ophthalmology journals and 5 textbooks on refractive surgery evaluation, corneal cross-linking, and an atlas of corneal imaging.

Novel Therapeutic Targets in Keratoconus

Authors

Dr. Durgalaxmi Modak - Narayana Nethralaya

Dr. Rohit Shetty - Narayana Nethralaya

Dr. Pooja Khamar - Narayana Nethralaya

Dr. Arkasubhra Ghosh - GROW Lab, Narayana Nethralaya

Mr. Nithin Kiran - GROW Lab, Narayana Nethralaya

Abstract

Purpose: Keratoconus(KC) is a corneal ectatic disorder characterized by progressive thinning and steepening of the cornea. A multitude of studies have established high levels of matrix metallo-proteinase 9 (MMP-9) and reduced Lysyl oxidase (LOX) in KC. In this study, we targeted these dysregulated factors using Batimastat (BST), a matrix metallo-proteinase inhibitor and Trehalose (TRE) an anti-inflammatory and autophagy inducer using in vitro, ex vivo and in vivo models.

Methods: Donor SMILE lenticules and primary fibroblasts from keratoconus patients were treated with TRE and BST and assessed for gene/protein expression of LOX, MMP9, Collagen as well as inflammatory signaling. Mouse corneas underwent repeated eye rubbing (ER) & inflammatory challenge (IC) followed by daily TRE & BST eyedrops and measurement of corneal gene expression 7 days post treatment.

Results: TRE and BST treatment reduced MMP9 levels which increased LOX and Collagen expression in lenticules and corneal cells under inflammatory stress. Mouse corneas show reduced LOX & increased MMP9 upon ER+IC which was reversed by the treatment.

Conclusion: Increased inflammation drives loss of LOX and collagen in cornea. TRE and BST in combination reverses this effect in cell and animal models. Therefore, TRE and BST treatment has potential for halting the progression of or reversing the pathology in keratoconus.

Biography - Durgalaxmi Modak

MS in Ophthalmology, Fellow in Cornea & Refractive Surgery Services, Narayana Nethralaya, Bangalore, India.

Optical Coherence Elastography Evaluation of Localized Corneal Cross-Linking Patterns in Porcine Eyes

Authors

Mr. Matteo Frigelli - ARTORG Center for Biomedical Engineering Research, University of Bern

Prof. Philippe Büchler - ARTORG Center for Biomedical Engineering Research, University of Bern

Dr. Sabine Kling - Computer Vision Laboratory, ITET department, ETH Zürich

Abstract

Purpose: To quantify the refractive and mechanical effects of patterned corneal cross-linking (CXL) with optical coherence elastography (OCE).

Materials and Methods: A patterned CXL (Dresden protocol) was performed on freshly enucleated porcine eyes using different irradiation masks (bowtie, central spot, trefoil). For biomechanical assessment via OCE, each eye was placed in a negative pressure chamber. A volumetric scan of the cornea was then obtained (i) at atmospheric pressure and (ii) after applying a vacuum of 30mmHg to the chamber. The axial strain distribution in the stroma induced by the ocular inflation was quantified, and the maps of anterior sagittal curvature was calculated.

Results: High resolution strain and refractive power maps of the cornea show that regions treated with CXL have a more positive strain amplitude (3×10^{-3} [-]) and a local reduction in sagittal curvature (8-10 diopters) compared with the untreated condition.

Conclusion: OCE demonstrates that mechanical and refractive changes go hand in hand. As such, OCE is a valid technique to evaluate the treatment outcome of refractive CXL and a promising tool to be used in combination with numerical models for treatment optimization.

Biography - Matteo Frigelli

PhD student at University of Bern, working on the mechanical modeling of localized effect of corneal cross-linking.

Outcome of Customized Corneal Collagen Crosslinking for Keratoconus Patients in Oman – Up to 3 Years Results

Authors

Dr. Rashid Al Saidi - MOD Hospital

Dr. Ashoka Bandara - MOD Hospital

Abstract

Purpose: To report the outcome of customized corneal collagen crosslinking (CXL) for keratoconus patients in Oman.

Methods: Keratoconus patients in the age group of 12-30 with progression were included in the study. Epithelial ablation was done over the specific targeted treatment area and CXL was carried out with the application of Riboflavin followed by UVA light. The treatment area and energy levels were customized according to the topographic findings.

Results: A total of 54 eyes were treated. 1-year follow-up data were available in 48 eyes for analysis, but 3-year follow-up data was available in 20 eyes only.

After 3 years, each of the 20 eyes was compared with their achievement at 1-year follow-up. 19 eyes(95%) had further improvement in UCVA up to 2 lines or remained stable while 1 eye(5%) showed further deterioration of 1 line. 5(25%) eyes showed further improvement of BCVA from 1 to 3 lines. All the other 15 eyes(75%) had maintained the BCVA same as the 1-year follow-up visit. Considering the corneal steepness; 19(95%) eyes showed further reduction or stability in Kmax while 1 eye(5%) showed further steepening of more than 1D. Change in the Topographical Keratoconus Classification(TKC); all 20 eyes (100%) maintained the TKC stage as same as 1-year follow-up.

Conclusion: Epithelium-off CXL was safe and effective in stabilizing the progression of keratoconus by 12 months for most patients in this study group. The final results show that almost all patients who have completed 3 years of follow-up have maintained or further improved their visual function.

Biography - Rashid Al Saidi

Dr. Rashid Al Saidi is a senior consultant ophthalmologist and the head of the Ophthalmology Center at MOD hospital, Muscat, Sultanate of Oman.

He earned a Doctor of Medicine degree from Sultan Qaboos University in Muscat, Oman, and completed his Ophthalmology Residency at University Eye Hospital, Ludwig-Maximillan University, Munich, Germany.

He had his fellowship training at the same University Eye Hospital and has passed the German Board of Ophthalmology Examination(FACHARZT).

He is a fellow of the European Board of Ophthalmology (FEBO).

He is the president of the Oman Ophthalmic Society, Chief Editor of the Oman Journal of Ophthalmology, and the head of the ophthalmic section of the higher medical committee at present.

Cornea & Refractive surgery is the areas he is interested in.

Outcomes of Accelerated Corneal Crosslinking in eyes with Keratoconus with and Without Associated Vernal Keratoconjunctivitis

Authors

Dr. K Priyadarshini - Dr Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi

Prof. Namrata Sharma - Faculty in Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi

Abstract

Purpose: The purpose of this study is to compare the outcomes of accelerated corneal cross-linking in eyes with and without vernal keratoconjunctivitis (VKC) in keratoconus patients

Materials and Methods: A prospective interventional study was done on 26 eyes of 19 patients who were diagnosed with keratoconus, in whom epithelium off- accelerated corneal cross linking (15mW/cm² for 6 minutes) was done. Of the total 26 eyes treated, 12 eyes (8 patients) were associated with VKC (group 1) while the other 14 eyes (11 patients) did not have VKC (group 2).

Results: Both the groups did not show any significant change in the Best corrected distant visual acuity (BCDVA), thinnest pachymetry, K_{max} or K_{steep} from the preoperative to postoperative 1-year values. The demarcation line was formed at 241.66±16.37µm depth in group 1 and 266.33±37.2µm in group 2 (p-value: 0.04) respectively. No patient in group 1 could tolerate use of contact lens despite suboptimal visual acuity with glasses in group 1, whereas 3 patients in group 2 were using RGP contact lens to improve visual acuity. Post-operative haze was noted in 2/12 and 3/14 eyes in group 1 and group 2 respectively. Complications noted were progression at 1-year post-CXL in one eye and early-onset bacterial keratitis caused by *S.epidermidis* in one eye in the VKC group.

Conclusion: Though the visual and tomographic outcomes are comparable between eyes with and without VKC undergoing A-CXL for keratoconus, there might be a slightly higher chance of progression and complication like post-CXL keratitis in VKC eyes.

Biography - PRIYADARSHINI K

I have completed my MD Ophthalmology from the All-India Institute of Medical Sciences, New Delhi in the year 2020 and have joined as Senior Resident in the same institute in the year 2020 after passing out, I have been training in cornea, refractive, cataract and ocular surface procedures since then in the prestigious All India Institute of Medical Sciences, New Delhi, India for the past 2 years.

Oxygen-Independent Corneal Cross-Linking for Keratoconus Treatment and Non-Invasive Vision Correction

Authors

Mr. Jiashuai Fan - Columbia University

Dr. Sinisa Vukelic - Columbia University

Abstract

Non-enzymatic cross-linking (CXL) methods, which utilize UV-A light and a photosensitizer, such as riboflavin, are used to increase corneal stiffness to treat progressive keratoconus. Such practices, like the Dresden protocol, are proven to be effective in clinical settings; however, they rely on the presence of oxygen and require epithelial debridement. We propose that advanced glycation end products-mediated CXL (Glycation-CXL), a non-enzymatic cross-linking mechanism via the Maillard reaction, can be a viable alternative if the process is accelerated by reactive oxygen species (ROS). Proposed ROS-Glycation-CXL employs ribose to initiate protein glycation and does not require oxygen presence. Being a small molecule (150.13 Da), ribose should be able to penetrate through the epithelium, which would eliminate the need for painful epithelium removal. Further, oxygen independence allows for combining CXL with external mechanical loading, which could be instrumental in the reshaping of the corneal curvature. In this study, we hypothesize that the ROS-accelerated, glycation-mediated CXL could achieve oxygen-independent corneal stiffening for keratoconus treatment. In addition, we examine the simultaneous application of ROS-glycation-CXL and mechanical loading for corneal flattening toward non-invasive vision correction.

Biography - Sinisa Vukelic

Sinisa Vukelic's research focuses on the alteration of mechanical properties of biomaterials subjected to ultrafast laser irradiation, with an emphasis on understanding underlying biochemical processes that occur when the laser treatment regime is confined below the optical breakdown. Vukelic has been working on the theoretical framework behind the low-density-plasma -- tissue interaction, which has led to two distinct translational medicine efforts. The first is noninvasive permanent vision correction, which aims to provide a new and groundbreaking paradigm in correction of refractive errors. His research has gained a considerable traction at Columbia's Department of Ophthalmology, where he recently received interdisciplinary appointment. Second is development of a novel treatment modality for early osteoarthritis (OA), a degenerative disease that affects millions of Americans. At the moment only late-stage treatment options are available, which are limited to major interventions, including joint replacement.

Peripheral High-Fluence Corneal Cross-Linking for Neovascularization: Restoring the Cornea's Angiogenic Privilege

Authors

Prof. Gerald Schmidinger - Medical University of Vienna

Dr. Ruth Donner - Medical University of Vienna

Dr. Julia Aschauer - Medical University of Vienna

Abstract

Purpose: The aim of this study was to investigate peripheral corneal cross-linking (pCXL) for angioregression in eyes with mature corneal neovascularization, and to non-invasively monitor vascular changes using anterior-segment optical coherence tomography angiography (AS-OCTA).

Materials and Methods: The CV region of interest (ROI) was irradiated as a partial, circumscribed "epithelium-off" area with limbal stem cell (LSC) protection using a riboflavin-soaked, custom-cut LSC protection shield. Topical application of 0.1% riboflavin in 20% dextran phosphate sodium was instilled as a photosensitizing agent prior to continuous UV-A irradiation with a total energy of 7.2J/cm² (9mW/cm² for 13.12 minutes). Objective non-invasive imaging of ROI included slit-lamp photography and swept-source AS-OCTA (Plex Elite 9000, Carl Zeiss Meditec) acquired before, 1 week after and 1 month after pCXL to assess the change in qualitative and quantitative morphologic vascular details after pCXL.

Results: Ten eyes with stromal CV were treated with the accelerated high-fluence protocol. Peripheral CXL resulted in significant fragmentation and closure of CV as early as one week after treatment, with partially preserved effects until one month after treatment. AS-OCTA was superior to slit-lamp photography in the quantification of a decrease in active vessel perfusion, offering novel vascular parameters including CV area, vessel density, and number of CV junctions/end points, with additional three-dimensional CV depth illustration.

Conclusion: This pilot study suggests high efficiency and safety of accelerated high-fluence pCXL as a valuable angioregressive preconditioning option prior to high-risk keratoplasty. AS-OCTA may complement this therapy as an expedient, non-invasive and objective vascular monitoring tool.

Biography - Gerald Schmidinger

Assoc.-Prof. Gerald Schmidinger, MD is head of the cornea service at the Medical University of Vienna and head of the Vienna Cornea Study Group. The group is focusing on clinical trials in the field of Keratoconus, corneal Dystrophy as well as refractive Surgery.

Photosensitizer Penetration Within the Human Cornea: Applications in Photodynamic Therapy

Authors

Mr. James Lai - University of Miami Miller School of Medicine, Miami, FL, USA

Dr. Heather Durkee - Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Dr. Jaime D. Martinez Martinez - Anne Bates Leach Eye Hospital, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Dr. Guillermo Amescua - Anne Bates Leach Eye Hospital, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Dr. Jean-Marie Parel - Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Dr. Noel Ziebarth - Department of Biomedical Engineering, University of Miami, Coral Gables, FL, USA

Abstract

Purpose: Photodynamic antimicrobial therapy using rose bengal is an effective method to treat infectious keratitis. However, rose bengal penetration is insufficient to treat deeper infections, like acanthamoeba. We hypothesize that hydrophobic formulations of rose bengal or alternative photosensitizers may improve penetration for antimicrobial applications.

Materials and Methods: Human corneas less than 30 days postmortem were soaked for 30 minutes epithelial side down in 0.0075% concentration of disodium rose bengal (n=5), lactone rose bengal (n=5), disodium Erythrosin B (n=3), lactone Erythrosin B (n=3), or disodium Eosin Y (n=3). NaCl solution was the control (n=5). DAPI stain was applied to the endothelial layer. Samples were imaged with confocal microscopy to assess photosensitizer penetration depth and corneal thickness via the Z-stack. Statistical significance was quantified using one-way ANOVA.

Results: There was no significant difference between the mean corneal thickness in all 5 groups (p=0.353). All photosensitizers penetrated a significant depth within the cornea as compared to control (control: $0\pm 0\mu\text{m}$; lactone RB: $113\pm 21\mu\text{m}$, disodium RB: $102\pm 12\mu\text{m}$, lactone Erythrosin B: $217\pm 24\mu\text{m}$, Erythrosin B: $280\pm 34\mu\text{m}$, disodium Eosin Y: $258\pm 8\mu\text{m}$). Between photosensitizer groups, all differences were significant (p<0.05) except between lactone RB and disodium RB (p=0.63) and between disodium Erythrosin B and disodium Eosin Y (p=0.771).

Conclusion: Our results demonstrate that alternative photosensitizers may provide a viable solution to poor penetration issues in photodynamic therapy. Additionally, since lactone and disodium formulations of rose bengal had comparable penetration, our results show that hydrophobicity alone cannot improve penetration depth.

Biography - James Lai

James is a second-year medical student at the Miller School of Medicine who is currently working under the guidance of Dr. Jean-Marie Parel and Dr. Noel Ziebarth at the Ophthalmic Biophysics Center at Bascom Palmer Eye Institute in Miami. He has worked on multiple abstracts and papers, ranging from photodynamic therapy to evaluating the mechanical properties of surgical

ophthalmology equipment. He graduated Summa Cum Laude in 2021 from the University of Miami with a degree in biomedical engineering. He is a recipient of the Jean B and Harry Fiegelman full scholarship from the Miller School of Medicine and a 2022 recipient of the Fight for Sight summer student fellowship for his work in photodynamic therapy. He plans to specialize in ophthalmology upon completion of his medical training.

Postoperative Corneal Remodeling After Allograft Corneal Ring Implantation for Keratoconus: An Optic Coherence Tomography Study

Authors

Dr. Burcu Yücekul - Ophthalmologist

Dr. Ziya Burke - None

Dr. Zeki Yiğit Karaca - Ophthalmologist

Dr. Feyza Keskin - Ophthalmologist

Dr. Cafer Tanriverdi - Ophthalmologist

Dr. Aylin Kılıç - Medipol

Abstract

Purpose: To demonstrate corneal remodeling after allograft corneal ring implantation with an anterior segment ocular coherence tomography (AS-OCT) device.

Methods: In this non-comparative observational study, keratoconus patients who underwent allograft intracorneal ring segment implantation into a stromal tunnel created with the femtosecond laser at the cone location at 35% depth of the total corneal thickness were enrolled. The topographical, refractive, and visual changes were obtained from patients' records. Epithelial thickness (ET), anterior stromal thickness (AST), allograft corneal ring thickness (ACRT) and posterior stromal thickness (PST) measurements were measured 1 day, 1,3,6 and 12 months postoperatively by AS-OCT.

Results: The study included the 35 eyes of 27 advanced keratoconus patients. The average Sim K decreased from $48.26 \pm 4.78D$ preoperatively to $44.50 \pm 4.42D$ postoperative 1 year ($p=0.004$), corrected distance visual acuity increased from 0.29 ± 0.18 (Snellen) to 0.70 ± 0.24 (Snellen) ($p<0.001$), and spherical equivalent decreased from $-6.94 \pm 4.32D$ to $-1.44 \pm 4.44D$ ($p<0.001$). The mean AST decreased $17.39 \pm$ and 5.78 mm in the postoperative first month compared to the first day of the surgery ($p=0.040$) After the first month statistically significant variations were not observed in AST. There was no statistically significant difference in the mean ET, ACRT, and PST measurements between the follow-up times.

Conclusion: Allograft corneal ring segment implantation is an effective treatment method that does not cause significant changes in graft thickness, or recipient corneal epithelial and stromal thicknesses while increasing visual acuity and improving keratometry measurements in keratoconus patients during the 1-year follow-up peri

Biography - Burcu Yücekul

MD Specialist

Health Sciences University Haseki Training and Research Hospital

Department of Ophthalmology May 2019

Education

Hacettepe University, Department of Ophthalmology

Gazi University, Faculty of Medicine

Ankara Ataturk Anatolian High School

Fellowship

International Ophthalmological Fellowship Foundation Cornea and External Diseases

Subspecialty Fellowship

Zentrum für Refraktive Chirurgie, St. Francis Hospital

Predicting Factors for Efficacy of Corneal Collagen Cross-Linking for Pediatric Keratoconus

Authors

Prof. Abraham Solomon - Hadassah Medical Center

Dr. Denise Wajnsztajn - Hadassah Medical Center

Dr. Or Shmueli - Hadassah Medical Center

Dr. Yehuda Tarnovski - Hadassah Medical Center

Prof. Joseph Frucht-Pery - Hadassah Medical Center

Abstract

Purpose: To evaluate predicting factors of success in corneal collagen cross-linking (CXL) for pediatric keratoconus (KC) patients.

Participants: Patients (18 years old or younger) who had CXL for KC from 2007 to 2017 with 1-year follow-up or more.

Methods: Univariate and multivariate analysis of the effects of CXL type, demographics (age, gender, background of ocular allergy, ethnicity) and pre-operative LogMAR visual acuity, maximal corneal power (K_{max}), pachymetry (CCT_{pre}) and refractive cylinder as well as follow-up (FU) time on outcome measures.

Outcome measures: The final change of K_{max} ($\Delta K_{max} = K_{max_{last}} - K_{max_{pre}}$) and the final change in LogMAR visual acuity ($\Delta LogMAR = LogMAR_{last} - LogMAR_{pre}$).

Results: 131 eyes from 110 children were included (mean age 16 ± 2 years, range 10 to 18 years). K_{max} and LogMAR significantly improved from baseline to last visit: from $53.81 D \pm 6.39 D$ to $52.31 D \pm 6.06 D$ ($p < 0.001$) and from 0.27 ± 0.23 LogMAR units to 0.23 ± 0.19 LogMAR units ($p = 0.005$), respectively. Negative ΔK_{max} was associated with long FU, low CCT_{pre} , high $K_{max_{pre}}$, high $LogMAR_{pre}$ and non-accelerated CXL in univariate analysis. Of those, high $K_{max_{pre}}$ and non-accelerated CXL were associated with negative ΔK_{max} in multivariate analysis. Negative $\Delta LogMAR$ was only associated with high $LogMAR_{pre}$ in univariate analysis.

Conclusions: CXL for pediatric KC patients is an effective treatment. Our results showed that the topographic CXL effect is time-dependent, and that non-accelerated treatment is more effective than the accelerated protocol. Corneas with advanced disease had greater CXL effect.

Biography - ABRAHAM SOLOMON

Abraham (Avi) Solomon is an Associate Professor and Head of the Cornea Service at the Department of Ophthalmology at Hadassah-Hebrew University Medical Center, Jerusalem, Israel. He performed his residency in Ophthalmology at the Department of Ophthalmology at Hadassah Medical Center, followed by a Cornea fellowship at Bascom Palmer Eye Institute, in Miami Florida. He had published 90 articles and reviews in peer-reviewed journals.

He served as the chairman of the Israeli Cornea Society; the Chairman of the Israeli Society for Vision and Eye Research (ISVER), which is an ARVO chapter affiliate; and recently as the chairman of the Israeli Refractive Surgery Society.

Prof. Solomon's main clinical and basic research interests are in the areas of ocular surface diseases and ocular surface reconstructive surgery, limbal stem cell deficiency, ocular surface inflammation and anti-inflammatory drug research, ocular allergic eye diseases, keratoconus and corneal cross linking and advanced corneal imaging.

Predicting the Corrected Distance Visual Acuity (CDVA) After Corneal Cross-Linking (CXL)

Authors

Dr. Fanka Gilevska - 1. Refractive surgery department, Eye Clinic Sistina Oftalmologija, Skopje, Republic of North Macedonia.

Dr. Ivan Gabric - 2. Refractive surgery department, Specialty Eye Hospital „Svjetlost“, Zagreb, Croatia, School of Medicine University of Rijeka, Croatia

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Dr. Maja Bohac - 2. Refractive surgery department, Specialty Eye Hospital „Svjetlost“, Zagreb, Croatia, School of Medicine University of Rijeka, Croatia

Dr. Sudi Patel - 2. Refractive surgery department, Specialty Eye Hospital „Svjetlost“, Zagreb, Croatia, School of Medicine University of Rijeka, Croatia

Abstract

Purpose: An earlier analysis revealed the log CDVA at 1-year post-CXL (ψ) could be predicted, using log preop CDVA(x_1) and the preop ratio between the anterior and posterior corneal radii over the thinnest region of the cornea(x_2), by $\psi=0.356x_1-1.312x_2+1.806$ [$r^2_{x_1}=0.494, p<0.01; r^2_{x_2}=0.203, p<0.01$.Eq.1]. Could purely objectively derived preoperative markers of corneal optical density and pachymetry (thinnest corneal thickness, TCT) be useful for predicting ψ ?

Materials and Methods: CDVA, 7 markers of corneal density and TCT (using Pentacam™) were monitored over 1 year in [1]keratoconus treated with the standard Dresden protocol($n=69$), [2]relatively stable untreated keratoconus($n=23$), [3] age/gender matched controls($n=24$).

Results: CDVA improved in group 1 and remained stable in groups 2&3. Intergroup differences in the markers of corneal optical density were insignificant at preop, but some significant differences were found at postop ($p<0.01$). In group 1, the mean (\pm sd, 95% CI) marker of corneal optical density (0-100 gray scale units) in the anterior central region of the cornea (x_4) & TCT(μ) changed from 21.4(\pm 3.77, 20.5-22.3) & 452 μ (\pm 37.1, 443-461) to 31.6(\pm 9.43, 29.4-33.8) & 424 μ (\pm 49.7, 421-436) by 12 months. In groups 2&3 CDVA and TCT remained stable while x_4 values tended to reduce. At 12 months postop, a significant relationship was revealed between ψ , preop values of TCT(x_3) and x_4 whereby $\psi=0.005x_3 - 0.019x_4 - 2.318$ [$r^2_{x_3}=0.302, p<0.01; r^2_{x_4}=0.102, p<0.01$.Eq.2].

Conclusion: CXL improved CDVA, increased corneal optical density and reduced thickness of the cornea. Eqs.1&2 are useful for predicting CDVA at 1 year postop, but the prediction according to eq.2 is based purely on objectively derived preoperative corneal data.

Biography - Fanka Gilevska

Fanka Gilevska works on the refractive surgery department in Sistina Ophthalmology Hospital for 7 years now. She is experienced in performing all the diagnostic tests for screening the candidates' prior refractive surgery procedures, performing the surgical techniques LASIK and

PRK and also adequate treatment of the post-operative complications. She pioneered corneal cross-linking in N. Macedonia in 2015 and it stayed her main interest.

She is Ph.D. candidate on the Biomedicine and Health Sciences at the University of Zagreb. Her subject of research is predicting the visual acuity and corneal morphology and topography changes after the CXL procedure.

Progression of Keratoconus and Body Weight Gain Coincidence or Association - Case Reports

Authors

Dr. Enkela Hrdličková - European Eye Clinic Lexum, Prague

Abstract

Purpose: The association between obesity and keratoconus has been proposed by comparing keratoconic patients and control group on previous retrospective studies. We report the progression of keratoconus at the same time during the extreme body weight gain. In these cases, the obesity could be the direct cause of activating the ectatic process on the cornea.

Methods: Case report based on chart review.

Results: Three patients at age from 36 to 47 were referred to our clinic for worsening of vision due to hydrops. They reported gain of body weight at average 20 kg, (from 15kg to 57kg) during last years. The fourth patient, age 32, showed a progression of keratoconus after gaining body weight 17 kg for 15 months. The fifth patient developed cornea ectasia after refractive laser surgery which was performed 15 years ago. Patient reported gaining of body weight of 23 kg. last two years

Conclusion: Eye rubbing, and family history of keratoconus are known as significant risk factors for keratoconus development. The reported cases support the evidence that obesity is another risk factor for the corneal ectasia. Patients have to be informed that obesity as well as the rubbing of the eye can affect the process of ectasia on the cornea.

Biography - Enkela Hrdličková

Undergraduate studies

1987-1992: graduated in Faculty of Medicine, Tirana University, Albania 1986-1992

Post graduate studies

1992-1993 Fellowship in Clinical Virology Unit, Hadassah University Hospital, Jerusalem, Israel

1993-1997 Residency in Ophthalmology, Hadassah University Hospital, Jerusalem, Israel, Tutor Prof. Zauberman Hanan MD

1997-1999 Fellowship in pediatric and immune-ophthalmology unit, Haddassah University Hospital, Jerusalem, Israel, Tutor Prof. BenEzdra David MD

2000-2009 Staff specialist in Cornea service, ophthalmology department, Charles University Hospital, Prague, Czech Republic

2000- 2016 Postgraduate researcher in Biology and Pathology of cells, Charles University, Prague, Czech Republic.

2010- now Staff specialist in European Eye clinic Lexum, Prague, Czech Republic,

2017- now Director of *Center for diagnosis and treatment of dry eye disease*, ophthalmology department, University Hospital Královské Vinohrady, Prague, Czech Republic.

2017- now Staff specialist in the Cornea service, Department of Ophthalmology University Hospital Královské Vinohrady, Prague, Czech Republic,

Progression of Pediatric Keratoconus After Corneal Cross-Linking: A Systematic Review and Pooled Analysis

Authors

Dr. Asaf Achiron - Sackler School of Medicine, Tel Aviv University, Tel Aviv.

Dr. Omar El-Hadad - Bristol Eye Hospital

Dr. Duncan Leadbetter - Bristol Eye Hospital

Dr. Idan Hecht - Ophthalmology department, Shamir medical center, Sackler Faculty of Medicine, Tel-Aviv University

Dr. Derek Tole - Bristol Eye Hospital

Dr. Kieren Darcy - Bristol Eye Hospital

Abstract

Purpose: Corneal collagen cross-linking (CXL) is an effective treatment to slow down adult keratoconus (KC) progression. Several studies have also shown efficacious outcomes in pediatric populations, yet no systematic analysis has been performed, and no accepted definition for progression is available in children after CXL. This study aimed to establish the most commonly used criteria for progression and to conduct a systematic review of the literature with pooled analysis to assess children's keratoconus progression after CXL.

Methods: A systemic literature review combined with pooled analysis was performed on full-length studies of KC after CXL treatment in a pediatric population, and the methods used to report progression were analyzed.

Results: Thirty-seven studies (2078 eyes) were identified on the rates of KC progression after CXL. The most common method to report progression was increased Kmax, Kmean, or Ksteep by ≥ 1.0 diopter (78.3% of studies). Using these criteria, the mean pooled progression rate after epithelium-off CXL was 9.9% (95% confidence interval: 6.1% -14.6%, total pooled sample size: 1508 eyes) with high heterogeneity between studies [$I^2 = 86.48\%$ (95% confidence interval: 80.98 - 90.39), $P < 0.0001$].

Conclusions: When considering KC progression after CXL in children, with an increase in Kmax, Kmean, or Ksteep ≥ 1.0 diopter, the progression risk was roughly 10%. We encourage transparent quantitative reporting of KC progression in future studies evaluating CXL efficacy in pediatric populations.

Biography - Asaf Achiron

Dr. Achiron's research aims to improve clinical practice using big data and mathematical algorithms combined with advanced statistical analysis. By combining clinical and bench studies, he focuses on the outcomes of corneal and cataract surgery to better understand treatment-related mechanisms.

Dr. Achiron has published widely, with over 130 publications to his name; He has received numerous grants for his research work in ophthalmology.

Progressive Keratoconus in Older Patients with Delayed Corneal Cross-Linking Treatment

Authors

Ms. Nicole Kantor - Florida International University Herbert Wertheim College of Medicine

Dr. William Trattler - Center for Excellence in Eye Care

Dr. Andrew Yazji - BronxCare Health System

Abstract

Purpose: Identify the prevalence and rate of progressive keratoconus among patients forty and older who delayed treatment by six months or longer.

Materials and Methods: A retrospective case series was performed on 37 eyes from 21 patients at one center in Miami, FL who met inclusion criteria. Patients included in the study were diagnosed with keratoconus, delayed corneal cross-linking treatment for over six months, and were over age 40 at the time of corneal cross-linking. Pentacam images were obtained on the initial visit and the day of their CXL (prior to the procedure). The patients' Kmax on the initial visit and day of CXL were evaluated. An increase in Kmax of 1 D or more was considered to be progressive keratoconus.

Results: The average age of patients at the time of their CXL procedure in this review was 47.9. 12 of 37 eyes (32%) had an increase in Kmax of 1D or more during the period of time in which corneal cross-linking treatment was delayed. The average patient delayed corneal CXL treatment for 328 days. The average increase in Kmax in the 12 eyes with progressive keratoconus from their initial visit to the day of CXL treatment was 3.7D.

Conclusion: Although older patients are generally thought to have stable keratoconus, it is important for clinicians to be aware that older patients with keratoconus can progress. Therefore, all patients with keratoconus, regardless of age, should be monitored regularly to identify progression of keratoconus.

Biography - Nicole Kantor

Nicole Kantor is a third-year medical student at the Florida International University Herbert Wertheim College of Medicine in Miami, Florida. She received a bachelor's degree in Behavioral and Cognitive Neuroscience from the University of Florida where she was the team lead in genetic engineering research. She also contributed to research regarding deep brain stimulation in patients with Parkinson's disease. Nicole's current interests include identifying patient populations with progressive keratoconus to improve patient care and exploring the role of genetics in patients with keratoconus who develop ectasia following LASIK/PRK. Outside of the medical field, she enjoys training her two Huskies, snowboarding, traveling, and weight training.

Refractive Profile of Keratoconus in Adolescents at City Eye Hospital, Kenya.

Authors

Dr. Alexandria Mashep - City Eye Hospital, Nairobi.

Abstract

Purpose: To highlight the severe visual impairment caused by keratoconus in this population, and to advocate for a customized protocol to optimize visual outcomes.

Materials and method: This is a cross-sectional, observational clinical audit of keratoconus patients aged <19 years, seen between January 2021 and August 2022. All underwent the following baseline assessments: visual acuity; refraction; axial length measurement; slit lamp examination; corneal tomography and specular microscopy. The ABCD keratoconus grading system was used to categorize the relevant data sets.

Results: 110 patients (n=220 eyes) patients were included, aged 9-19 years, mean age 15.0 years, with male preponderance of 1.63:1. Keratoconus was bilateral in 99% and asymmetric in 64%, with nipple central being the predominant JF Alfonso phenotype at 60.7%. The majority of eyes per classification were: 32% in grade A3, 43.9% in B4, 39.2% in C2, 38.1% in D4. Of those with satisfactory refraction (n=171), 86.5% had significant cylinders. 32.6% of patients had significant anisoastigmatism; 28.1% significant anisomyopia; 7% acute corneal hydrops and 4.1% corneal scars.

Conclusions: Keratoconus in children is aggressive and often results in significant visual impairment. Late, in-hospital diagnoses constrict the treatment window and options, increase treatment costs but eventually yield suboptimal visual outcomes. Corneal crosslinking remains the most efficacious treatment option but will be most profitable if done at the earliest opportunity, before the onset of significant and amblyogenic refractive errors, media opacities or significant corneal thinning. This necessitates mass screening of preadolescent children to diagnose and promptly address keratoconus and attendant refractive errors.

Biography - Alexandria Mashep

Dr. Alexandria Mashep is a consultant ophthalmologist, currently based at City Eye Hospital, a charitable tertiary level institution. She is largely involved in the provision of anterior segment services, with some involvement in medical retina work. In the past two years, she has been involved in the setting up of a keratoconus/ corneal ectasia database at City Eye. She has an MBChB and MMed (Ophthal) from Kenyan universities and is a COECSA Fellow.

Scheimpflug Corneal Densitometry Comparison of Epithelium-off, Contact Lens Assisted and Transepithelial Cross-Linking

Authors

Prof. Chintan Malhotra - Advanced Eye Centre, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Dr. Barkha Gupta - Advanced Eye Centre, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Prof. Arun Kumar Jain - Advanced Eye Centre, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Prof. Amit Gupta - Advanced Eye Centre, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Dr. Supriya Dhar - Advanced Eye Centre, Post Graduate Institute of Medical Education and Research, Chandigarh, India

Abstract

Purpose: To evaluate corneal backscattering after cornea cross-linking (CXL) for progressive keratoconus using 3 techniques: standard epithelium-off CXL, contact lens assisted (CACXL), and transepithelial (TECXL)

Methods: 94 eyes were evaluated (standard CXL: 47, CACXL: 30 and TECXL: 17). Haze was quantified (using the densitometry function of the Pentacam) in anterior 120 μm , posterior 60 μm and middle stromal layer in a 12-mm-diameter around the corneal apex . Imaging was done pre and post CXL at 1 ,3,6 and. 12 months respectively.

Results: Baseline mean density scores at central anterior stromal layer were 16.14 ± 7.07 , 15.85 ± 7.89 and 15.89 ± 7.2 in standard CXL, CACXL and TECXL respectively (p 0.93). Post standard CXL, it increased to 28.83 and 31.34 at 1 and 3months (p<0.001),and then dropped at 6 (28.66, p<0.001) and 12months (23.72, p 0.003). Post CACXL and TECXL only a small increase was noted at 3 (p 0.14) and 6months(p 0.17) respectively returning to baseline thereafter. All three procedures demonstrated comparable efficacy with mean flattening of Kmax of $1.75 \pm 1.99\text{D}$, $1.35 \pm 1.77\text{D}$ and $1.37 \pm 1.87\text{D}$ post standard CXL, CACXL and TECXL respectively (p 0.64).

Conclusion: Mean Corneal haze increased significantly after standard CXL peaking at 3 months and returning to baseline at 12 months. In contrast post TECXL and CACXL there was only slight increase in anterior haze which returned to baseline within 3- 6 months. CXL associated haze did not correlate with post CXL outcomes- both topographic as well as visual

Biography - Chintan Malhotra

I am working as faculty for the last 11 years in the cornea and refractive services of a tertiary care ophthalmology institute in North India , which caters to a large patient base from various states . Corneal cross linking has been of special interest to me since the beginning, and I have guided student thesis as well as published articles relating to this subject in prominent peer reviewed journals including JCRS. I was also awarded for a publication relating to cross linking during a keratoconus and ectatic corneal diseases symposium in ESCRS 2019 at Paris. I am

currently working on evaluating the structural and functional outcomes of transepithelial CXL using various combinations of fluency, pulsing UVA, and oxygen supplementation

Scleral Lens as a Reservoir of Riboflavin During the Soaking Phase of Corneal Cross-Linking

Authors

Dr. Moatez Billah Mekki - Ibn Al Haythem Center

Mr. Nour Elislem Sadouki - Ibn Al Haythem Center

Dr. Amine Taibi - Ibn Al Haythem Center

Dr. Karim Haddoum - Ibn Al Haythem Center

Prof. Ouzzani Mhamed - Oran University

Abstract

Purpose: to determine the safety and efficacy of using a scleral lens filled with transepithelial (TE) riboflavin as a reservoir during the soaking phase before corneal cross-linking CXL and to compare corneal CXL with and without oxygen (O₂) supplementation.

Materials and Methods: Prospective study of 307 eyes with evolutive corneal ectasia, who underwent CXL after 30 min of corneal soaking by wearing an appropriate vault scleral lens filled with TE riboflavin. 122 corneas were cross-linked without O₂ supplementation in 2021 and 185 corneas were cross-linked with 9 l/min of O₂ supplementation in 2022. Corneal OCT to assess the demarcation line was done at 1 month, and a Pentacam tomography every 6 months.

Results: Riboflavin diffused to all the cornea and the anterior chamber when checked at slit lamp examination in all patients after the soaking phase. No evolution was noticed during the follow-up according to the ABCD Belin progression display. The demarcation line was found at 300 µm of depth in the third of cases in the two groups without significant difference.

Conclusion: Using a scleral lens to deliver B₂ vitamin is a simple, effective, safe, economic, delegable, and time-saving way to soak continuously the cornea with TE riboflavin before corneal CXL in ectatic corneas. Oxygen supplementation does not improve the rate of demarcation line presence at 1 month.

Biography - Moatez Billah Mekki

Moatez Billah Mekki is an ophthalmologist, anterior segment / refractive surgeon, and contact lens specialist, working at Ibn Al Haythem Center in Algiers which is a reference center in keratoconus in the country. He participated in national and international ophthalmologist congresses and wrote some articles in the field of cornea ectasia and contact lenses. He won the SFO 2011 francophonie prize and the best paper in refractive surgery session in Eucornea 2014. He co-moderated the special interest symposia at EVER for 5 years since 2014. He is the president of Menilens, a company that imports and distributes customized contact lenses in Algeria.

Selective Corneal Cross-Linking in Keratoconus and Radial Keratotomy Guided by Galilei Topography

Authors

Dr. Carlos G. Arce - Eye Clinic of Sousas and Ophthalmic Hospital and Eye Bank of Sorocaba

Dr. Adriana Dos Santos Forseto - Ophthalmic Hospital and Eye Bank of Sorocaba

Abstract

Purpose: A protocol of corneal cross-linking (CXL) is presented based in the recognition of very flat, normal curvature, and steeper than 48D zones observed on anterior instantaneous Galilei maps with 10-mm-diameter and CGA-1D-German color scale.

Materials and Methods: Following the hypothesis that very flat zones may not need CXL, a protocol was designed for selectively treat only the ectatic zone. Epithelium was damaged but not retired with alcohol 40%. Riboflavin was downloaded using a scleral contact lens as container. A mask was used to avoid CXL at the flat periphery (KC and RK) and center (RK) flat zones. A soft contact lens with UV blocker and a 6-mm to 8-mm central trephination was used to mask the periphery. CXL was performed with 9 mW for 10 minutes. In RK, treatment was adapted to only the steeper para-central ring representing the elbow of incisions.

Results: Outcome is presented, several with more than 1 year follow-up. Epithelization happened in less than 3 days in more than 90%. Comparative curvature and/or elevation maps in KC shown that a paracentral ring zone become steeper and the ectatic zone become flatter, as postulated by our original hypothesis.

Conclusions: The use of 40% alcohol without epithelium scrapping allowed a method with regular riboflavin which is not epi-off neither epi-on. A scleral contact allowed an appropriate download of riboflavin without blocking a surgical room. A soft contact lens mask allowed a selective CXL only at the ectatic corneal zone and a has a potential reduction of complications.

Biography - Carlos G. Arce

- Director, Eye Clinic of Sousas, Campinas
- Ophthalmologist, Cornea, Refractive Surgery, Contact Lens, Research & Technology Sectors, Ophthalmic Hospital and Eye Bank of Sorocaba, São Paulo Brazil.
- Volunteer Collaborator, Refractive and Ocular Bioengineering Sectors, Department of Ophthalmology, Paulista School of Medicine, Federal University of São Paulo, Brazil
- Consultant, Ziemer Ophthalmic Systems AG, Switzerland; Ziemer USA Ltd, OH, USA; Mediphacos, BH, Brazil
- CEO, R.E.I. Consultoria Tecno-Médica EIRELI, Sousas, São Paulo, Brazil

Sensitivity and Specificity of Sirius indices in Diagnosis of Keratoconus and Suspect Keratoconus

Authors

Dr. Abdelrahman Salman - Department of Ophthalmology, Tishreen University

Abstract

Aim: To estimate the sensitivity and specificity of topographic and tomographic corneal parameters as determined by Sirius (CSO, Florence, Italy) in discriminating keratoconus (KC) and suspect keratoconus from normal cornea.

Method: In this retrospective case-series study, keratoconus screening indices were measured using Sirius tomographer. Receiver operating characteristics (ROC) curves were used to determine the test's overall predictive accuracy (area under the curve) and to identify optimal cut-off points to maximize sensitivity and specificity in differentiating keratoconus and suspect keratoconus from normal corneas.

Results: Receiver operating characteristics (ROC) curve analyses showed high predictive accuracy for Symmetry Index back (SIb), Keratoconus Vertex front (KVf), Symmetry Index front (SI f), Keratoconus Vertex back (KVb), Apex Keratometry (Curve-Apex) and Minimum corneal Thickness (ThkMin) to distinguish keratoconus from normal (area under the curve > 0.9, all). Symmetry Index back was identified as the best diagnostic parameter for detecting suspect keratoconus with AUC of 0.86. Highest specificity to detect keratoconus and suspect keratoconus was seen for SIb, 99.87% and 84.66%, respectively. These values were associated with optimal cut-off points of 0.46 D for keratoconus and 0.12 D for suspect keratoconus.

Conclusion: Sirius parameters evaluated in the study were effective to differentiate keratoconus from normal corneas. However, Symmetry Index back was the index with the highest ability to detect suspect keratoconus.

Biography - Abdelrahman Salman

Dr. Abdelrahman Salman is a certified of Cambridge and Glasgow Universities, UK. senior honorary clinical lecturer at Tishreen University. Dr. Salman is heavily involved in the practice and research of cornea and refractive surgery, and he has in his record more than 15 internationally peer reviewed papers. Local and international speaker. He has performed more than 7000 refractive and cornea surgeries. Scientific director of Tartous Specialist Eye Center. Scientific Director of Al-Mashrek Tartous Eye center.

Structural Transformation of Stromal Extracellular Matrix During Drying in Cross-Linked and Non-Cross-Linked Corneas

Authors

Dr. Sally Hayes - Cardiff University

Dr. Siân R. Morgan - Cardiff University

Dr. James Bell - Cardiff University

Prof. Keith M. Meek - Cardiff University

Abstract

Purpose: To investigate the structural transformation of the extracellular matrix during drying and determine the impact of cross-link formation on stromal architecture.

Materials and Methods: Twenty-five (de-epithelialized) pig corneas were divided into 5 groups. Group 1 remained untreated. The remaining corneas were immersed in 2.5% glutaraldehyde (Group 2), 20% dextran (Group 3) and 0.1% riboflavin/20% dextran (Groups 4 and 5) for 12 hrs. Corneas in Group 5 then underwent 3 mW UVA/30 min corneal cross-linking (CXL). X-ray scattering data were obtained from each cornea during the process of air-drying to determine collagen fibril diameter, fibril spacing and inter-molecular spacing. Corneal hydration (H), defined as the ratio of the weight of water to the dry weight, was calculated using wet and dry weights obtained during and after data collection.

Results: In each group, drying resulted in a reduction in each collagen parameter. Between $H = 5$ and $H = 1$, the fibril diameter in glutaraldehyde cross-linked corneas was larger than in any other group ($p < 0.01$). Fibril diameters in CXL corneas did not differ from those of non-cross-linked corneas at any hydration. However, between $H = 2$ and $H = 1$, the spacing between collagen fibrils was higher in the CXL-treated corneas than in any other group ($p < 0.01$).

Conclusion: The presence of CXL-induced cross-links does not restrict collagen fibril shrinkage during drying but does help to maintain a greater separation between fibrils. This suggests the involvement of proteoglycans in the CXL process and a bracing of the collagen fibrils during drying.

Biography - Sally Hayes

After graduating from Aberystwyth University in 2000 with a BSc in Animal Science, Dr Sally Hayes took up a 5-year MRC funded Research Assistant position within the Structural Biophysics Group at Cardiff University to study the relationship between corneal structure and function in keratoconus and was awarded a PhD for her work in 2005. Since then, she has continued to develop this line of research as an MRC-funded Research Fellow at Cardiff University, investigating the structural basis of keratoconus and the development of corneal cross-linking therapies. In 2013, Sally co-founded the UK-Crosslinking Consortium to bring together scientists and clinicians for the collaborative advancement of research into corneal cross-linking.

Three-Year Follow-Up of Accelerated Versus Standard Corneal Cross-Linking in Pediatric Keratoconus.

Authors

Prof. Boris Knyazer - Department of Ophthalmology, Soroka University Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva

Dr. Asaf Achiron - Sackler School of Medicine, Tel Aviv University, Tel Aviv.

Dr. Biana Dubinsky-Pertzov - Ophthalmology department, Shamir medical center, Sackler Faculty of Medicine, Tel-Aviv University

Dr. Idan Hecht - Ophthalmology department, Shamir medical center, Sackler Faculty of Medicine, Tel-Aviv University

Prof. Adi Einan - Ophthalmology department, Shamir medical center, Sackler Faculty of Medicine, Tel-Aviv University

Abstract

Purpose: Standard corneal collagen cross-linking (S-CXL) is an effective treatment to arrest Keratoconus (KC) progression in children. Less is known about the long-term efficacy of accelerated CXL (A-CXL) in pediatric populations.

Methods: A historical cohort analysis of pediatric patients (≤ 18 years) with KC who underwent S-CXL and A-CXL at two tertiary referral centers in Israel between 2010-2017. Preoperative and 3-year postoperative evaluation included changes in visual acuity (best corrected [BCVA]) and uncorrected [UCVA]), refractive errors, and keratometric data.

Results: Ninety-three eyes of 93 patients were analyzed (A-CXL: $n=39$; S-CXL: $n=54$). Baseline characteristics were similar between groups. Both groups showed a significant improvement in visual acuity compared to baseline (S-CXL: 0.810 to 0.602 LogMAR UCVA; A-CXL: 0.890 to 0.306 LogMAR UCVA, $p<0.05$ for both). Improvement in BCVA and UCVA following A-CXL was non-inferior to S-CXL ($< \pm 0.2$ LogMAR). Kmax decreased by a mean of 0.98 ± 5.56 diopters following S-CXL ($p=0.02$) and by 1.48 ± 8.4 diopters following A-CXL ($p=0.015$). Thinnest pachymetry decreased following both treatments (S-CXL: by 26.8 ± 40.7 μm , $p=0.001$, A-CXL: by 10.2 ± 13.4 μm , $p=0.028$), the difference between groups was within the non-inferiority margin ($< \pm 10$ μm).

Conclusions: Pediatric patients followed for three years after A-CXL showed improved visual function, reduced corneal astigmatism and Kmax, and decreased thinnest corneal thickness. A-CXL was non-inferior to S-CXL at three years in terms of best-corrected and uncorrected visual acuity, thinnest pachymetry, and astigmatism. For Kmax, non-inferiority could not be concluded.

Biography - Boris Knyazer

Head of Cornea and Cornea Transplantation Unit, Soroka University Medical Center, Beer-Sheva, Israel.

Boris Knyazer was born in Russia in 1972 and lived in Israel. He received his B.Sc. and MD degrees in 2005 at Medical School, Beer-Sheva, Israel. After graduation, he finished his residency in ophthalmology at Ophthalmology Department, Soroka University Medical Center. Prof. Knyazer is a board-certified ophthalmologist with fellowship training in cornea, cataract, and refractive surgery under the mentorship of Dr. Rajesh Fogla. Her areas of specialties include corneal transplantation, refractive surgery, cataracts, as well as medical and surgical treatment of diseases of the external eye. Prof. Knyazer's research interests include Keratoconus, CXL, PAK-CXL, infectious keratitis, hormonal changes, and cornea biomechanics. In 2021 Knyazer Boris received academic status as an associate professor in Ophthalmology at Ben-Gurion University in Negev, Beer-Sheva, Israel. He published above 50 articles in peer-review English language journals.

Understanding Collagen Structure in Suspect Corneal Topographies to Predict Ectasia

Authors

Dr. Ritica Mukherji - Narayana Nethralaya, Bengaluru, India

Dr. Rohit Shetty - Narayana Nethralaya

Dr. Pooja Khamar - Narayana Nethralaya

Abstract

Purpose: To determine and correlate role of topography, biomechanics, collagen fiber distribution and Bowman layer thickness (BLT) in differentiating healthy from suspect corneas

Methods: 68 patients (136 eyes) presenting to Refractive OPD, underwent corneal topography (Pentacam HR) and biomechanics (Corvis-ST) - 54 eyes with normal topography and biomechanics, 42 with normal topography and suspicious biomechanics and 40 incidentally diagnosed keratoconus eyes. They were scanned using ultra-high-resolution polarization-sensitive (PS-OCT), generating Phase Retardation (PR) maps from posterior corneal surface and Bowman's layer.

Results: Eyes showing normal topography and biomechanics demonstrated <25% structurally visible changes in collagen orientation and thick, uniform BLT, indicating healthy collagen orientation and ability to withstand any refractive procedure. Keratoconus eyes showed complete loss of collagen orientation and irregular BLT thinning. Eyes showing normal topography with suspicious biomechanics, demonstrated two patterns - those with 25-50% structurally visible changes in collagen orientation and thin, uniform BLT were selected for PRK; and those with >50% changes and irregular thinning of BLT, in whom refractive surgery was deferred due to KC-like collagen orientation. Among those with normal topography and poor collagen orientation, 3 progressed into ectasia.

Conclusion: Changes in collagen fiber orientation appearing before topographic and biomechanical changes, may be identified using PS-OCT. It can help choosing the right refractive surgery, deferring refractive surgery, or doing timely crosslinking in eyes with poor collagen orientation and weak Bowman's, which are at significantly higher risk of ectasia. PS-OCT may be of clinical utility in enhancing a clinician's ability in daily practice.

Biography - Ritica Mukherji

The chief author is a cataract and refractive surgeon currently pursuing a long-term fellowship at a tertiary eye care center in India. She is actively involved in multiple high yield research commissions and diagnostic research involving patients of keratoconus and refractive surgery.

Fungal Keratitis : What Should be the First Line Therapy ?

Authors

Ms. Maryame Boutkhal - Mohammed V University

Dr. Marwa Boutkhal - Cheikh Zaid Hospital

Abstract

Purpose: A spectacular amelioration of an atypical fungal keratitis following an atypical traumatic eye injury.

Materials and methods: A 22-year-old man presented with a keratitis complicating a traumatic eye injury, referred to our clinic due to poor response to initial antibacterial treatment.

Results: the ophthalmic examination revealed a corneal laceration with multiple microscopic stromal infiltrates and a perilesional corneal edema. The visual acuity was at finger counting in the affected eye. The corneal laceration depth was at 446 μm . Central corneal thickness was at 636 μm . No germs were detected in the corneal scraping. Considering the indolent evolution and unresponsiveness to broad-spectrum antibiotics, a fungal keratitis was suspected and treated with oral Fluconazole. One month later, the examination showed a complete healing of the infiltrates and the visual acuity recovered to 8/10. Central corneal thickness was evaluated at 570 μm . We questioned the place of PACK CXL in the treatment of similar cases, considering its cost effectiveness, and its efficacy in inducing rapid healing of the lesions. However, using CXL as a therapy in infiltrates that reached the posterior stroma may be associated with a higher risk of corneal perforation.

Conclusion: This paper sheds lights on an atypical fungal keratitis considering the location of the corneal infiltrates and the spectacular evolution under oral antifungals. Using PACK CXL as a first line treatment is a promising route due to its cost effectiveness but should be considered carefully in the case of deep infiltrates. Performing PACK CXL at the slit lamp is even more encouraging as it eliminates the need for an operating room to carry out the procedure.

Biography - Maryame Boutkhal

A final year medical student, with a special interest in anterior segment diseases.

Correlations Between Patients with Keratoplasties after Rose Bengal Photodynamic Antimicrobial Therapy

Authors

Dr. Jaime Martinez - Bascom Palmer Eye Institute, University of Miami Miller School of Medicine

Dr. Paula D. Sepulveda Beltran - Bascom Palmer Eye Institute, University of Miami Miller School of Medicine

Dr. Juan Carlos Navia - Bascom Palmer Eye Institute, University of Miami Miller School of Medicine

Dr. Jean-Marie Parel - Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Dr. Darlene Miller - Ocular Microbiology Laboratory, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Dr. Guillermo Amescua - Anne Bates Leach Eye Hospital, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Abstract

Purpose: To compare the genotypic profile and histopathology of *Acanthamoeba* isolates recovered from patients who underwent Therapeutic Penetrating Keratoplasties (TPK), and Optical Penetrating Keratoplasties (OPK) after adjunct treatment with Rose Bengal Photodynamic Antimicrobial Therapy (RB-PDAT).

Methods: Retrospective review of patients diagnosed with *Acanthamoeba* keratitis at the Bascom Palmer Eye Institute between August 2016 and August 2022, that underwent TPKs and OPKs after RB-PDAT. Treatment success was defined as resolution of the infiltrate and treatment with OPK for visual improvement. RB-PDT treatment failure was defined as undergoing TPK for treatment of the infection.

Results: Of patients with *Acanthamoeba* keratitis that received RB-PDAT (n=39), 17 met inclusion criteria. Mean follow-up time was 37.6±19.1 months. Of those, 9 patients (52.9%) required TPKs, and 8 (47.0%) underwent OPKs. Risk factors included contact lens use (88.2%), topical steroid use (52.9%). Of patients that underwent TPK, 3 (33%) required ≥2 PDATs, and 2 (22%) presented clear grafts at one year. Comparatively, in the OPK group, 6 (75%) patients required ≥2 RB-PDATs, and 7 (89%) presented clear grafts at one year. Negative growth on corneal buttons in both groups. Most common *Acanthamoeba* species was Castellani spp. and genotype T4. Presence of giant virus in both groups

Conclusions: *Acanthamoeba* isolates recovered from patients in South Florida may have increased resistance to SMT contributing to RB-PDT treatment failure with resulting TPK. Further studies are required to determine the association between these findings and the resistance to the current therapies available.

Biography - Jaime Martinez

Dr. Martinez completed his ophthalmology residency at one of the best eye centers in Latin America Asociación para Evitarla Ceguera, Mexico City in March of 2017.

After his residency, he became part of the Bascom Palmer Eye Institute family and completed his one-year research fellowship and continued for two years of training on Cornea, Cataract and External disease with Bascom Palmer.

In 2018 Dr. Martinez received the Gillingham Pan-American fellowship award for his research efforts. The funding propelled his research fellowship and allowed him to explore his interests of corneal infections, ocular corneal surface disease, and high-risk corneal transplants.

Dr. Martinez has great interest in infectious keratitis and seeks to develop novel therapies for this challenging disease. Currently, he is conducting research on the use of Rose Bengal Photodynamic Antimicrobial therapy (PDAT).

Corneal Cross-Linking: An Alternative Treatment in Infectious Corneal Ulcers

Authors

Dr. Susanne Marx-Gross - Department of Ophthalmology, Universitätsmedizin Mainz, Johannes Gutenberg-University, Germany

Prof. Paul-Rolf Preussner - Department of Ophthalmology, Universitätsmedizin Mainz, Johannes Gutenberg-University, Germany

Dr. Faustin Ngounou - Presbyterian Eye Services Acha Bafoussam, Cameroon

Abstract

For the treatment of infectious corneal ulcers in some African countries, there are no surgical options such as keratoplasty available. So cross-linking is an alternative treatment to improve vision and to avoid blindness or enucleation.

Method: Ten patients (age 24-73y) with corneal ulcers were diagnosed in Bafoussam, Cameroon, Africa. The cause was usually a "dirty" corneal trauma with inadequate therapy afterwards. The patients had complaints from one month to four days before their first examination. All patients received topical antibiotics. Visual acuity ranged from Log Mar 3 to Log MAR 0.5 with Median of "Hand Movements" (Log MAR 2.3). All cases were treated with a modified cross-linking protocol (370 nm, 60 mW/cm², 3 min.). Follow-up time was one month.

Results: In all cases, the eye could be preserved. The baseline visual acuity was in seven of the ten cases hand movement and worse (logMAR 3-0.5 in all cases). In one case, full visual acuity was regained (from logMAR 0.5 to 0). In four other cases, visual acuity was improved by at least log MAR 0.8 and better. In three cases, no significant increase in visual acuity was achieved, but the cornea was stabilized, and the eye was preserved.

Conclusion: Cross-linking represents an alternative treatment option for regions or countries where surgical options are not available to treat the infectious ulcer. The treatment protocol should be modified to achieve effective microbial elimination. In all cases the eye could be preserved and in seven cases visual acuity could be improved significantly.

Biography - Susanne Marx-Gross

Dr. Susanne Marx-Gross, MD is a Senior Physician and Head of Keratoconus Centre in the Department of Ophthalmology, Universitätsmedizin Mainz, Johannes Gutenberg-University, Germany

CXL Guards Against Infectious Keratitis; An Experimental Rabbit Model

Authors

Dr. Ayah Marrie - Cairo university

Abstract

Aims: to prove if PACK-CXL (Photo-Activated Chromophore for Keratitis – Corneal Cross-Linking) could guard against progression of infectious keratitis (IK) and stop organism penetration only through increasing corneal rigidity and resistance to proteolytic enzymatic digestion of collagen fibers even in the absence of riboflavin microbicidal role.

Methods: Induction of infection with *Pseudomonas aeruginosa* and *Staph aureus* bacteria in 20 eyes of 10 rabbits after 6 weeks of crosslinking in half of the eyes while the other acted as control group. Then clinical and histology examination for extent of inflammation, epithelial changes, ulceration, organism penetration, thickness of corneal stromal affection were evaluated.

Results: The control developed the severest inflammation that necessitated sacrifice after 72 hours. Corneal melting occurred in 6 eyes in the control versus none in crosslinked group. The inflammation was confined underneath the corneal epithelium in the superficial part of the stroma with localization in crosslinked eyes.

Conclusion: PACK-CXL provides localization of infection, inflammation, and tissues' damage through increasing the corneal rigidity and resistance to enzymatic digestion mechanically even in the absence of the riboflavin role. The inclusion of early PACK-CXL treatment in the IK treatment algorithm is considered to be appropriate.

Biography - Ayah Marrie

lecturer at ophthalmology Cairo university, specialized in cornea and refractive procedures.

PACK-CXL The Golden Tool in PKP

Authors

Prof. Ashraf Bor'i - Department of Ophthalmology, Zagazig university

Abstract

Purpose: To report the results of treating resistant bacterial keratitis by PACK-CXL followed by TPK .

Methods: Retrospective analysis of the medical records of 33 eyes of 33 patients diagnosed with resistant bacterial keratitis. Fourteen eyes (14 patients) were treated with PACK-CXL followed by therapeutic penetrating keratoplasty (TPK) (group I) and 19 eyes (19 patients) were treated by TPK alone (group II). The main outcome measures were graft clarity and the mean best corrected visual acuity at 1, 3, 6, 12 and 18 months after PKP.

Results: The mean age of the patients was 53.6 ± 1.9 years and 52.3 ± 1.8 years in group I and group II, respectively ($p = 0.374$), the mean ulcer size was 49.9 ± 16.2 mm² and $54.7.1 \pm 15.1$ mm² in group I and group II, respectively ($p = 0.239$). At the last follow-up visit, 12 corneal grafts (85.7%) maintained their clarity in group I while 13 corneal grafts (68.4%) maintained their clarity in group II ($p = 0.037$) and the mean best corrected visual acuity was 0.84 ± 0.63 log MAR in group I and 1.27 ± 0.81 log MAR in group II ($p = 0.024$). Postoperatively, one eye (7%) showed graft reinfection in group I that was controlled medically while 5 eyes (26.3%) showed resistant graft reinfection and ended in graft opacification in group II ($p = 0.042$).

Conclusion: In resistant bacterial keratitis, priming infected corneas with PACK-CXL before performing TPK improve the results in such cases.

Biography - Ashraf Bor'i

Professor of Ophthalmology, Zagazig University

Cornea and anterior segment consultant

Rapid High Fluence Corneal Cross-Linking with a Photoactivated Chromophore (PACK-CXL) for Treatment of Infectious Keratitis at the Slit-Lamp: A Pilot Study

Authors

Prof. Boris Knyazer - Department of Ophthalmology, Soroka University Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva

Dr. Alex Chorny - Department of Ophthalmology, Soroka University Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva

Dr. Hagar Olshaker - Sourasky Medical Center and Sackler School of Medicine, Tel Aviv University.

Dr. Tal Yahalomi - Department of Ophthalmology, Samson Assuta Ashdod Hospital and the faculty of Health Sciences, Ben-Gurion University of the Negev

Dr. Asaf Achiron - Sackler School of Medicine, Tel Aviv University, Tel Aviv.

Abstract

Purpose: To assess the therapeutic effect of PACK-CXL at the slit-lamp on patients with infectious keratitis using a high fluence of 10.0 J/cm² rather than the typical fluence of 5.4 J/cm².

Methods: This prospective interventional, nonrandomized cohort study included 20 eyes of 20 patients with bacterial, fungal, or mixed origin keratitis who underwent high fluent PACK-CXL treatment as an adjunct therapy between March 2021 and February 2022 at Soroka University Medical Center, Beer-Sheva, Israel (SUMC). The primary outcome was re-epithelization time. Endothelial cell density was evaluated before and after treatment to test the treatment's safety.

Results: Time to re-epithelization was 8.2± 2.8 days. After the PACK-CXL treatment, eight patients (40%) were discharged, while the rest remained in the hospital for 5.6±3.5 days. None of the cases had undergone tectonic graft surgery. Endothelial cell density was not altered post-treatment (2562.1 ± 397.3 cells/mm² before treatment vs. 2564.8 ±404.5 after, p=0.96).

Conclusion: Adding high fluence PACK-CXL as an adjunct treatment is efficient and safe in infectious keratitis. This could be a viable alternative in a rapidly progressive infectious keratitis or a lack of operating room availability.

Biography - Boris Knyazer

Knyazer Boris, MD.

Head of Cornea and Cornea Transplantation Unit, Soroka University Medical Center, Beer-Sheva, Israel.

Knyazer Boris was born in Russia in 1972 and lived in Israel. He received his B.Sc. and MD degrees in 2005 at Medical School, Beer-Sheva, Israel. After graduation, he finished his residency in ophthalmology at Ophthalmology Department, Soroka University Medical Center. Prof. Knyazer is a board-certified ophthalmologist with fellowship training in cornea, cataract, and refractive surgery under the mentorship of Dr. Rajesh Fogla. Her areas of specialties include corneal transplantation, refractive surgery, cataracts, as well as medical and surgical treatment

of diseases of the external eye. Prof. Knyazer's research interests include Keratoconus, CXL, PAK-CXL, infectious keratitis, hormonal changes, and cornea biomechanics. In 2021 Knyazer Boris received academic status as an associate professor in Ophthalmology at Ben-Gurion University in Negev, Beer-Sheva, Israel. He published above 50 articles in peer-review English language journals.

Risk Factor Analysis for PACK-CXL Treatment Failure in Animal Patients

Authors

Dr. Malwina Kowalska - Vetsuisse Faculty, University of Zurich

Dr. Angelie Shukla - Vetsuisse Faculty, University of Zurich

Dr. Sonja Hartnack - Vetsuisse Faculty, University of Zurich

Prof. Simon Pot - Vetsuisse Faculty, University of Zurich

Abstract

Purpose: Infectious keratitis is a common ophthalmic condition in canine and feline patients. The goal of this retrospective, multicenter study was to determine risk factors for treatment failure following photoactivated chromophore for keratitis – corneal cross-linking (PACK-CXL) in canine and feline patients suffering from suspected infectious keratitis

Materials and Methods:

Medical records from four veterinary ophthalmology services were reviewed, and information related to patient demographics, ophthalmic findings, the PACK-CXL protocol used, and epithelialization time was collected and analyzed. Due to the potential for intervariable relationships, an additive Bayesian network (ABN) analysis was performed to evaluate these complex relationships.

Results: 825 eyes were included in the analysis, including records for 668 dogs and 153 cats. Based on the ABN, canine patients who underwent an accelerated PACK-CXL protocol were less likely to experience treatment failure. In canine patients, mutual dependencies between exposure variables were identified by ABN, which would have been overlooked using classical regression. The overall success of PACK-CXL treatment was very high: 90% (95% CI 88 to 92) in dogs, and 88% (95% CI 84 to 93) in cats.

Conclusion: To our knowledge, this is the first study evaluating PACK-CXL using ABN analysis. It is possible that canine patients may benefit from the use of an accelerated protocol; however, the reasons for this apparent positive impact on treatment outcome remain unclear. PACK-CXL is a highly successful adjunctive treatment for the management of suspected infectious keratitis in dogs and cats.

Co-authors: Kevin Arteaga, Manuela Crasta, Chris Dixon, Frank Famose

Biography - Simon Pot

Originally from the Netherlands, Simon graduated from the Utrecht University School of Veterinary Medicine in 2000 and worked as a private practitioner for a number of years before pursuing an internship in Utrecht and an ophthalmology specialty residency in Madison, Wisconsin. Since 2009, he has worked as a faculty member at the Vetsuisse Faculty in Zurich, Switzerland, where he currently holds an associate professorship. He has simultaneously completed a PhD on corneal wound healing and fibrosis in the Laboratory of Applied Mechanobiology at the Swiss Federal Institute of Technology in Zurich (ETHZ).

His main clinical research interests include the treatment of corneal infections with a focus on corneal crosslinking (PACK-CXL) and advanced ocular and orbital imaging using OCT and high-resolution MRI.

Corneal Collagen Cross-Linking Versus Voriconazole Treatment in Experimentally Induced Fungal Keratitis in Rabbits

Authors

Prof. Ahmed El-Massry - Department of Ophthalmology, Alexandria University

Prof. Farhad Hafezi - Ophthalmology Department, Faculty of Medicine, Geneva University , Geneva, Switzerland . ELZA Institute

Dr. Ramy Awad - Ophthalmology General Hospital, Alexandria , Egypt

Prof. Alaa Gaith - Department of Ophthalmology, Alexandria University

Abstract

Abstract

Introduction: The aim of this study was to compare the efficacy of Photo-Activated Chromophore for Keratitis – Corneal Collagen Cross-linking (PACK-CXL) of three different total UVA fluence levels and topical voriconazole in treatment of fungal keratitis induced in rabbits.

Methods: an interventional experimental study including both eyes of 16 rabbits (32 eyes). Fungal keratitis was induced by intrastromal injection of *Fusarium Solani* into the cornea. Rabbits were divided into four groups (8 eyes for each) ; Group A received Voriconazole eye drops as control group. Group B, C, D received single PACK-CXL session with total fluence levels of 7.2, 10.0 and 15.0 J/cm² for each respectively. Daily examination was recorded, all corneas were examined for microbiology and histopathology on day ten.

Results: The mean clinical signs score eyes treated with high fluence PACK-CXL showed evident clinical improvement from fourth to tenth day of treatment. This improvement was equivalent to that of Voriconazole treatment. Results showed better improvement with increasing the UVA total fluence levels, but this difference was not statistically significant ($P < 0.05$). Similarly, the median CFU/ml declined on increasing UVA fluence but with no statistically significant values. Histopathological examination revealed better improvement of inflammatory signs on higher fluence levels compared to lower ones.

Conclusions: High intensity PACK-CXL (30 mW/cm²) was as effective as Voriconazole in the treatment of fungal keratitis in rabbits. Increasing the fluence of UVA was associated with slightly better clinical outcomes with no added risks. More clinical studies are needed to confirm these results

Biography - Ahmed El-Massry

- Ahmed El-Massry MD
- Professor Of Ophthalmology, Faculty of Medicine, Alexandria University, Egypt.
- Former Head of Ophthalmology department, Alexandria University.
- Wilmer Eye Institute, Johns Hopkins University Baltimore Maryland 1990
- Technical Director of Ophthalmology Department , Alexandria University 2006-2010.
- Head of Ophthalmology department from 8/2018 till 9/2020.
- Member of the American Academy of Ophthalmology, (AAO) for 30 years,

- American Society of Cataract and Refractive Surgery, (ASCRS) for 25 years, and international Society of Refractive Surgery (ISRS),
- Egyptian Society of Ophthalmology (ESO) for 35 years.
- President of the Delta Ophthalmology Society (25 years).
- Member of Board: (ESOIRS) Egyptian Society of Cataract and Refractive Surgery and performing life surgery 32 years in the ESOIRS meetings.
- Reviewer of Journal of Refractive Surgery , journal of cataract and refractive surgery
Cornea journal , International Journal of Ophthalmology,
- Published 110 papers in reputable journals.

Antimicrobial effect of PACK-CVX in model of fungal keratitis caused by *Fusarium* spp.

Authors

Dr. Liudmyla Troichenko - Ophthalmologist

Prof. Galyna Drozhzhyna - Ophthalmologist

Abstract

Purpose: Fungal keratitis (FK) remains a severe cause of visual impairment and blindness.

The novel methods of treatment FK should be designed to allow for fast and comprehensive microbicidal and microbistatic response on their target.

The purpose of our study was to evaluate the antimicrobial effect of PACK-CVX in models of FK caused by *Fusarium* spp (FS).

Methods: The experimental study was performed with the use of yeast culture of FS on 12 eyes of 6 chinchilla rabbits. We used the model of FK of Zborovska (2012). The instillation voriconazole was performed in all eyes according to the sensitivity of microflora. The PACK -CVX using a photosensitizer 0.1% riboflavin was additionally performed in the main groups of 6 eyes.

Results: Moderate and severe keratitis was 50/50 % for 10-13 days. The epithelialization on the FS model moderate keratitis main group was achieved on day $12,2 \pm 2,28$; control group - 4days later ($16,2 \pm 1,64$) $p=0,04$. Time of epithelialization in severe model had no difference between main ($18,8 \pm 1,64SD$) and control ($19,2 \pm 11,12SD$) groups. In all cases the fungal flora was not detected in microbiological studies after the treatment (except for 1 case severe control group when the epithelialization was no achieved)

Conclusions: In models of FK using FS showed a positive antimicrobial effect of PACK-CVX with photosensitizer of 0.1% riboflavin, which is confirmed by absence of fungal flora in microbiological studies and achievement of corneal epithelialization 4 days earlier FS moderate main group and had no difference between main and control groups in FS severe model.

Biography - Liudmyla Troichenko

PhD, medical doctor, Ophthalmologist,

Department of Corneal Pathology, Institute of Eye Diseases and Tissue Therapy named after V.P. Filatova, Odessa, Ukraine

Rose Bengal Photodynamic Antimicrobial Therapy: Species Diversity and Mycotoxin Profiles of *Fusarium* Isolates

Authors

Dr. Paula A. Sepulveda-Beltran - Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

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Dr. Darlene Miller - Ocular Microbiology Laboratory, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Abstract

Purpose: To evaluate the species diversity and mycotoxin profiles of *Fusarium* species recovered from patients with fungal keratitis treated with Rose Bengal Photodynamic Antimicrobial Therapy (RB-PDAT)

Methods: A combination of PCR and DNA sequencing was used to confirm and classify ten *Fusarium* isolates recovered from patients presenting at BPEI with fungal keratitis and treated with PDAT between January 2016 and May 2022. Five isolates were tested for mycotoxin production and antifungal susceptibility. Fumonisin and Trichothecene mycotoxins were identified using primer-specific PCR and DNA sequencing. CLSI-compliant tests were used to assess amphotericin B and voriconazole susceptibility profiles.

Results: Eight isolates (60%) belonged to the *Fusarium solani* species complex (FSSC), of which two were *Fusarium falciforme*, one *Fusarium keratoplasticum*, and one *Fusarium petroliphilum*. The other two isolates belonged to the *Fusarium chlamydosporum* species complex (FCSC) and the *Fusarium dimerum* species complex (FDSC), respectively. At least one mycotoxin was identified in the 5 isolates tested for mycotoxins. Fumonisin toxins were documented in 3 of 5 (60%) species, whereas Trichothecenes were documented in all 5 of the PDAT-treated species. None of the isolates demonstrated *in vitro* susceptibility to voriconazole and amphotericin B with MIC₉₀ of >32 µg/ml (R) at 72 hours, respectively.

Conclusions: Toxin-producing members of the FSSC were the most commonly recovered *Fusarium* species from fungal keratitis in PDAT-treated patients, potentially conferring increased resistance to standard antifungal treatment.

Biography - Paula A. Sepulveda-Beltran

Paula is a medical graduate of Rosario University in Bogota, Colombia, and a Research Fellow at the Bascom Palmer Eye Institute in Miami, Florida. She is particularly interested in translational and clinical research on the anterior segment, cataracts, corneal pathologies, and ocular surface

diseases. Her research has focused on evaluating various strategies to improve the efficacy of corneal-cross linking using Rose Bengal, such as the use of new delivery systems or different photosensitizers. She is currently applying for ophthalmology residency in the United States.

Repeated Sessions of PACK-CXL WA For the Treatment of Resistant Bacterial Keratitis: A Retrospective Study

Authors

Dr. Mohammed M. Mahdy Tawfeek - Faculty of Medicine - Zagazig University

Dr. Ahmed Mohamed Nashaat Ali Rady - Faculty of Medicine - Merit University

Dr. Ashraf Bor'i - Faculty of Medicine - Zagazig University

Abstract

Purpose: The aim of this work is to evaluate the safety and efficacy of repeated sessions of photo-activated chromophore for keratitis-cross linking (PACK-CXL) window absorption (WA) for the treatment of resistant bacterial keratitis.

Patients and Methods: This is a retrospective clinical cohort study. Thirty eyes with clinically suspected and lab-confirmed bacterial keratitis, resistant to appropriate antibiotic therapy modified by sensitivity reports for 2 weeks with failure of epithelialization for 4 weeks after the standard anti-microbial therapy (SAT) together with one set of PACK-CXL WA were included. These eyes underwent repeated sessions of PACK-CXL WA till the start of epithelialization and complete corneal healing with scar formation and negative culture on lab examination. Identification of organisms was made by lab study before and after treatment.

Results: Thirty eyes of 30 patients were recruited for this study. They were 16 males and 14 females, and their mean age was 42.7 ± 3.56 years. Complete healing and resolution (Successful treatment) were observed in 27 eyes (90 %) of cases and failure of epithelialization was observed in 3 eyes (10 %). They were statistically significant ($P = 0.003$) regarding the success and failure of the treatment, respectively.

Conclusion: PACK-CXL WA is a promising treatment option for superficial bacterial keratitis. It overcomes the antibiotic resistance that has become rapidly spreading worldwide. Repeated sessions of PACK-CXL WA were found to be more beneficial for the treatment of resistant bacterial keratitis till complete epithelialization and resolution of infectious keratitis than a single session.

Keywords: Corneal cross-linking, PACK-CXL, infectious keratitis, window absorption.

Biography - Mohammed M. Mahdy Tawfeek

I work as a lecturer of Ophthalmology at Zagazig University in Egypt and a corneal consultant. Also, I am a member of the royal college of surgeons of Edinburgh (MRCSEd) since 2016 and a member of the royal college of surgeons of Glasgow (MRCS) (Glasg.) (Ophth.) since 2022, and a fellow of the international council of ophthalmologist (FICO) since 2013.

Comparison Between Cross-Linking plus Topo-Guided Ablation and Intrastromal Ring Segments for Keratoconus

Authors

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Abstract

Purpose: To compare visual, refractive, and topographic outcomes at 12 months after cross-linking (CXL) plus topography-guided photorefractive keratectomy (t-PRK) and intrastromal corneal ring segments (ICRS) in a specific keratoconus phenotype population

Methods: Retrospective multi-center study; including a sample of 103 eyes with grade I-III Amsler-Krümeich. All patients were classified according to the phenotype of the ectasia with the "Alfonso Classification"; only patients with "Croissant Phenotype" were included. Parameters evaluated: visual acuity, refraction, topographic parameters, and vectorial analysis. Patients in group 1 were treated with CXL plus t-PRK according to the classic "Athens Protocol", patients in group 2 were treated with Ferrara-type ICRS implantation with manual technique.

Results: Group 1 included 36 eyes with a mean age of 31.23 ± 9.85 years; group 2 included 67 eyes with a mean age of 34.0 ± 11.30 years. Comparison of outcomes between group 1 and group 2 showed similar improvements in CDVA (0.19 [2.11] logMAR in subgroup 1 and 0.12 [0.15] logMAR in group 2, $P=.27$), refractive astigmatism (-1.4 [2.53] D in subgroup 1 and -2.37 [2.07] D in group 2, $P=.12$), K2 reduction (2.29 [1.94] D in subgroup 1 and 2.13 [1.67] D in group 2, $P=.56$) and average K (1.37 [1.66] D in subgroup 1 and 1.05 [1.67] D in group 2, $P=.21$). Vectorial analysis demonstrated similar improvement of astigmatism.

Conclusions: Both CXL plus t-PRK and ICRS were equally effective in improving CDVA and topographic parameters in a sample of keratoconus patients with the same phenotypic pattern.

Biography - Tiago Monteiro

Cornea and Refractive Surgery Department, Ophthalmology Department, Hospital de Braga, Braga, Portugal.