International CXL 2017 Experts´ Meeting

Nov 30 - Dec 2, 2017

Mövenpick Hotel - Zurich Airport

Switzerland

www.cxlexpertsmeeting.com

Advancing cross-linking technology and clinical application

Introduction

The Light for Sight Foundation's mission is to stop preventable blindness in children and adolescents with keratoconus. Founded in 2013, this foundation supports three pillars: increasing awareness about keratoconus (outreach/education), providing access to treatment (outreach/intervention) and supporting research.

In 2016, the Foundation was asked to resume and manage the annual CXL Experts' Meeting in light of the Foundation's goal of promoting educational activities about keratoconus. Additionally, the Foundation felt that this congress would be a good platform to increase its presence among key opinion leaders and building its network of clinical partners. With the successful completion of these goals in 2016, the scientific and organizing committees agreed to proceed with hosting the 13th annual meeting from November 30 - December 2, 2017 in Zurich, Switzerland.

This year's meeting has already exceed its expectations due to the number of submitted abstracts and registrants one month prior to the congress dates. For the 2017 annual meeting, we will host 200 participants representing 41 countries. The fact that there is a growing participation rate demonstrates that the CXL field continues to evolve and grow.

This abstract book is a testament to the versatility of the method as well as the scientific efforts dedicated to improving the method for better surgical outcomes, reduced risks and increased patient comfort.

On behalf of the Light for Sight Foundation, scientific and organizing committee, we thank you for your contributions in the field!

Nikki Hafezi
Co-Founder

Farhad Hafezi
Co-Founder

Thursday, Nov. 30

Wetlabs & Hands-On Workshops

Thursday, November 30

WetLab "CXL for Beginners"

8 a.m. to 10 a.m., Room "Zurich I – SOLD OUT

Moderated by Kristina Mikek, Slovenia (organizer of the ESCRS wetlab on CXL over the past years), Farhad Hafezi, University of Geneva and USC Roski Eye Institute, and Emilio Torres, University of Zurich and University of Sao Paolo, this wetlab will give participants the opportunity to perform every single step of the cross-linking procedure accompanied by leading experts in the field with 10+ years of experience in the field. Every step of the procedure will be discussed in detail. including explanations and background knowledge.



Workshop "Corneal wavefront-guided treatments & CXL using the AMARIS"

10.30 a.m. to 12.30 p.m., Room "Zurich II" – Space limited, register soon

Moderated by Shady Awwad from the American University of Beirut, and with the participation of Farhad Hafezi, University of Geneva and USC Roski Eye Institute, this workshop will discuss the combination of wavefront-guided excimer laser treatments with CXL. Concrete cases of keratoconus and other ectasias will be presented, discussed and ablation profiles will be generated during the workshop. Also, the question of simultaneous vs sequential treatment and the necessity of adapted nomograms will be addressed. This workshop is sponsored by Schwind eye-tech solutions.

SCHWIND eye-tech-solutions


Lunch will be served from 12.30 p.m. to 2 p.m.

WetLab "PACK-CXL for veterinarians"

2 p.m. to 4 p.m., Room "Zurich I" – Space limited, register soon

Moderated by Simon Pot from the University of Zurich, this wetlab will give a concise overview about the treatment of infectious keratitis in cats, dogs and horses, including the use of accelerated protocols and riboflavin saturation protocols adapted to species-specific corneal thicknesses. This wetlab is sponsored by Peschke Trade.

PESCHKE TRADE MedTech is our passion


Workshop "Introduction to Clinical Research"

2 p.m. to 3.30 p.m., Room "Zurich II" – Space limited, Course is free of charge, register soon

Organized by the Light for Sight Foundation and moderated by Nikki Hafezi, University of Antwerp and Farhad Hafezi, University of Geneva and USC Roski Eye Institute, this workshop will give an introduction on how to start performing clinical research. Specifically addressed to clinicians with little to no experience in performing clinical research, Light for Sight will point to ways how to participate in exciting new multicenter research projects. Sponsored by the Light for Sight Foundation.

Workshop "Screening for early ectatic diseases & keratoconus progression"

4 p.m. to 6 p.m., Room "Zurich II" – Space limited, register soon

Co-moderated by Renato Ambrósio from the University of Sao Paolo, Paolo Vinciguerra from Humanitas University Milan and J. Bradley Randleman from the USC Roski Eye Institute, this workshop will give a complete overview on current techniques for screening and detecting keratoconus and other ectatic corneal conditions using the Corvis® ST and Pentacam® AXL. The moderators will present selected cases, discuss clinical findings and provide concise next steps in the treatment. This wetlab is sponsored by OCULUS Optikgeräte GmbH.

Friday, Dec. 1

Main CXL Course

Date: Friday, December 1, 2017

Basics

Chairs: Eberhard Spoerl / Ahmed Elsheikh

9.00	Fluence and corneal thickness	Eberhard Spoerl (Germany)
9.20	CXL: Riboflavin, oxygen, light	Sabine Kling (Switzerland)
9.40	Corneal structure and biomechanics	Sally Hayes (GB)
10.00	Corneal Biomechanics: modulating factors	Ahmed Eksheikh (GB)
10.20	Riboflavin absorption kinetics , enzymatic resistance	David O'Brart (GB)
10.40	Corneal topography	Mazen Sinjab (KSA)
11.00	Biochemical changes after Cross-Linking	Rohit Shetty (India)
11.20	Panel discussion	
11.40-13.30	**Lunch**	

CXL Protocols 1

Chairs: Brad Randleman / Farhad Hafezi

13.30	CorVis to measure biomechanics in vivo	Paolo Vinciguerra (Italy)
13.50	Brillouin microscopy to measure biomechanics in vivo	Brad Randleman (USA)
14.10	Keratoconus	Frederik Raiskup (Germany)
14.30	Customized CXL	Theo G. Seiler (Switzerland)
14.50	Panel discussion	
15.10-15.40	**Coffee Break**	

CXL Protocols 2

Chairs: **Frederik Raiskup / Paolo Vinciguerra**

15.40	CXL/PRK and Xtra procedures	A. John Kanellopoulos (Greece)
16.00	PACK-CXL for corneal infections	Emilio Torres (Switzerland)
16.20	CXL in very thin corneas	Farhad Hafezi (Switzerland)
16.40	CXL as a refractive procedure	Theo Seiler (Switzerland)
17.00	Panel discussion	
17.30	**End**	

Poster Reception

Rooms: **Paris & London**

17.45 to 19.00	Wine and cheese served

Banquet Dinner

Room: **Zurich**

19.00	Honoring a special guest

Saturday, Dec. 2

Scientific Program

Date: Saturday, December 2, 2017

8.25	Introduction	Farhad Hafezi (Switzerland)

Basics

Chairs: John Marshall / Sabine Kling

Rapid Fire

8.30	Structural differences of the collagen fibrils (CFs) and proteoglycans (PGs) between the peripheral and central part of the keratoconus cornea (KC)	S. Akhtar (KSA)
8.35	An investigation of the effects of riboflavin concentration on the efficacy of corneal cross-linking using an enzymatic resistance model in porcine corneas"	D. O'Brart (UK)
8.40	A New Tomographic Matrix for Early Detection of Keratoconus	M. Sinjab (KSA)
8.45	Discussion	
8.50	In vivo Brillouin frequency shifts of crosslinked and uncrosslinked corneas in keratoconus	T. G. Seiler (Switzerland)
8.55	Laser Induced Ionization Field Crosslinks Biological Media in Absence of Photosensitizers	S. Vukelic (USA)
9.00	Non-contact technique for direct corneal strength measurement	D. Chernyak (USA)
9.05	Discussion	
9.10	Riboflavin concentration during crosslinking at the endothelial level	T. G. Seiler (Switzerland)
9.15	The role of oxygen in corneal cross-linking (CXL) reactions	G. Lytle (USA)
9.20	Optimizing Genipin concentration for corneal collagen cross linking: An ex-vivo model	J. Alio (Spain)
9.25	Discussion	
9.30	Predicting cross-linking outcomes and infiltrates using molecular biomarkers – implications for point of care diagnostics	N. Pahuja (India)
9.35	Carbon Nanostructures for ocular tissue reinforcement	A. Vega

CXL for ectasia

Chairs: John A. Kanellopoulos / Farhad Hafezi

Rapid Fire

9.50 WITHDRAWN	Corneal haze and densitometry in Keratoconus Post-collagen Cross-Linking by three different protocols	A. Badawi (Egypt)
9.55	Reproducibility and repeatability of corneal OCT cross-linking demarcation line measurement by human operators compared to a novel automated detection software"	S. Awwad (Lebanon)
10.00	Hormonal effect on progression of corneal ectasia – case reports	M. Vesela (Czech Republic)
10.05	Discussion	
10.10-10.40	**Coffee Break**	
10.04	High dose dietary riboflavin and sunlight treatment of keratoconus and ectasia - preliminary results	J. Jarstadt (USA)
10.45	Evaluating Efficacy in Varying Protocols of Customized Crosslinking (CXL)	R. Rajpal (USA)
10.50	Update on successful corneal crosslinking without epithelial removal	D. Stulting (USA)
10.55	Discussion	
11.00	Safe CXL of thin corneas: light attenuation (RF/UVA) versus limited photosensitizer penetration (WST-D/NIR) protecting the endothelium in corneas below 400µm	J. Brekelmans (Netherlands)
11.05	How effective is crosslinking in keratoconus? A Malaysian study of 60 cases	Jenny P. Deva (Malaysia)
11.10	Prolonged Iontophoresis-assisted Transepithelial Corneal Cross-linking for Pediatric Keratoconus: Three Years Results"	Z. Lin (China)
11.15	Discussion	
11.30-12.30	**Lunch**	
12.30	Long-term follow-up on pediatric keratoconus	Cosimo Mazzotta (Italy)
12.40	A new biomechanical index for keratoconus	Paolo Vinciguerra (Italy)
12.50	CXL in ultrathin corneas, new algorithm	Farhad Hafezi (Switzerland)
13.00	Discussion	

13.15	Customized Cross-Linking for keratoconus	Theo Seiler (Switzerland)
13.25	Molecular biomarkers & its future therapeutic potential in crosslinking	Rohit Shetty (India)
13.35	Oxygen diffusion limits the effectiveness of iontophoresis-assisted epi-on CXL	Emilio Torres (Switzerland
13.45	Discussion	

PACK-CXL for infection

Chairs: **Guoyung Mu / Shihao Chen**

Rapid Fire

14.00	Inhibitory effect of photodynamic antimicrobial therapy (PDAT) on healthcare- and community-acquired methicillin resistant Staphylococcus aureus (MRSA) isolates of ocular origin"	H. Durkee (USA)
14.05	The Therapeutic Effect of Accelerated Photoactivated Chromophore Corneal Cross-linking (PACK-CXL) compare to the standard antibiotic therapy in Infectious Keratitis.	B. Knaizer (Israel)
14.10	Assessment of UV-A/riboflavin corneal cross-linking efficacy for the treatment of experimentally induced corneal lesions in an ex vivo animal model	A. Perazzi (Italy)
14.15	Discussion	
14.25	Blue-light activation of riboflavin for possible use in PACK-CXL	K. Makdoumi (Sweden)
14.30	TBD	Guoying Mu (China)
14.40	Quantifying the antimicrobial efficacy of PACK-CXL for different bacterial strains as a function of UV fluence and irradiated volume	S. Kling (Switzerland)
14.50	Discussion	
15.05-15.45	**Photo Shoot & Coffee Break**	

CXL in refractive surgery

Chairs: **Mazen Sinjab / David O'Brart**

Rapid Fire

15.45	Biomechanical analysis of different re-treatment options after SmILE refractive surgery	B. Spiru (Germany)
15.50	Topo-guided removal of epithelium in keratoconus eyes (TREK): A novel tissue saving customised ablation strategy.	P. Khamar (India)

15.55	CXL+ is it safe?	J. Frucht-Pery (Israel)
16.00	Discussion	
16.10	Phototherapeutic intrastromal corneal collagen cross-linking (PiXL) with two different UV irradiation protocols for treatment of low-grade myopia	A. Fredriksson (Sweden)
16.15	Topography and pachymetry guided customised tissue saving epithelial ablation in cross-linking of thin cornea : the SAVE protocol	A. Bajaj (India)
16.20	Brillouin microscopy for LASIK Xtra	J. Bradley Randleman (USA)
16.30	TBD	John Marshall (UK)
16.40	Discussion	

Hot Topics

16.50 - 17.15	Is epi-on established? Yes: Doyle Stulting (5') No: David O'Brart (5') Panel discussion (15')	Panel: Hafezi, Chen
17.20 - 17.45	Does Cross-linking as a refractive stand-alone procedure work? Yes: Matthias Elling (5') No: Theo Seiler (5') Panel discussion (15')"	Panel: Sinjab, Torres, Spoerl
17.50 - 18.15	Does LASIK Xtra work? Yes: John Kanellopoulos (5') No: Brad Randleman (5') Panel discussion (15')"	Panel: Vinciguerra, Awwad
18.20 - 18.30	Theo Seiler Award	Scientific Committee
	Poster Prize	Scientific Committee
	Final Remarks, CXL Experts Meeting 2018 announcement	Farhad Hafezi

Posters

Posters

Friday, December 1, 2017 at 17.45 – 19.00

No	Title	Presenting Author	Country
CXL in Ectasia			
1	Measuring Corneal Haze with OCT after Epithelial Disruption Corneal Collagen Cross-linking (CXL) with Trans-epithelial Riboflavin (TE) in patients with Keratoconus.	Dhwni Shahanand	India
2	The analysis of early safety and stability after Corneal collagen cross-linking in keratoconus	Wei Shengsheng	China
3	Transepithelial Versus Epithelium-off Corneal Cross-Linking for Progressive Corneal Ectasia: A Meta-Analysis of Randomized Controlled Trials	Hidenaga Kobashi	Japan
4	Contact lens-assisted collagen cross-linking (CACXL).	Elhaddi Mahfoudi	Algeria
5	Simultaneous transepithelial Intra-tunnel cross linking with ICRS implantation versus simultaneous epi-off cross linking with ICRS implantation for keratoconus management	Mohamed Hosny WITHDRAWN	Egypt
6	Corneal Stability after Corneal Collagen Cross Linking in Early Adolescency	Maja Bohac WITHDRAWN	Croatia
7	The application of Transepithelial Phototerapeuthic Kerathectomy and Collagen Cross-linking in Pellucid Marginal Degeneration/PMD/ case report	Beata Sawicka Wojtiuk	Poland
8	Long-term results of mechanical epithelial removal versus phototherapeutic keratectomy followed by accelerated corneal cross-linking for pediatric keratoconus	Ozge Sarac	Turkey
9	Intraoperative Corneal Thickness Changes during Pulsed Accelerated Corneal Cross-Linking Using Isotonic Riboflavin with HPMC	Nihal Elghryany	Egypt
10	Need of explantation of an intrastromal titan ring after penetrating keratoplasty in two patients with keratoconus	Kassandra Xanthopoulou	Germany
11	K Readings, Corneal Thickness and Demarcation Line 3 Months After Accelerated Pulsed Corneal Cross Linking	Nihal Elghryany	Egypt
12	An artificial intelligence based customized crosslinking– A new dimension in keratoconus management	Ritika Dalal	India

13	Distinguishing keratoconic eyes and healthy eyes using Ultrahigh-Resolution (UHR)-OCT based Corneal Epithelium Thickness Mapping	Niklas Pircher	Austria
14	Decreased UV Light Filtering Ability of the Corneal Epithelium: Is it the Cause of Stromal Pathologies in Keratoconus	Nurullah Cagil	Turkey
15	Comparison of Outcomes with Standard and Accelerated Corneal Cross-linking Protocols in Patients with Progressive Keratoconus	Bradley Randleman	United States
16	Altered Epithelial Cells in Keratoconus : Implications in Crosslinking	Sheetal Mahuvakar	India
17	Effectivenes of Accelerated Corneal Collagen Crosslinking for Keratoconus Patients : A Comparison of Two Protocols	Reny Setyowati	Indonesia
18	Accelerated Corneal Collagen Cross Linking for Mild Keratoconus	Suhardjo .	Indonesia
19	Tomographic and refractive characteristics of pediatric first degree relatives of Keratoconus patients	Shady Awwad	Lebanon
20	Effects of Iontophoresis - UVA cross-linking and hypotonic riboflavin solution on the ultrastructural architecture of human corneal stroma	Saeed Akhtar	Saudi Arabia
21	Biomechanical assessment of keratoconic eyes after corneal cross-linking by Scheimpflug-based tonometry	Robert Herber	Germany
22	Comparative Analysis of Outcomes of Customised Topoguided Cross Linking versus conventional Cross Linking for progressive keratoconus	Gitansha Sachdev	India
23	Stromal Demarcation Lines in Corneal Crosslinking (CXL): What We Know about Supplemental Oxygen	Alexandra Nicklin	United States

CXL in refractive laser surgery

24	Wide Area Surface Ablation Laser Guided by Corneal Wavefront Combined With Accelerated Cross-linking in the Treatment of Keratoconus	Safwan Albayati	United Arab Emirates
25	Pilot evaluation of photorefractive corneal collagen crosslinking for the treatment of low myopia: 6 month results	Safa El Hout	France
26	Photorefractive intrastromal cross-linking (PiXL) for the treatment of low myopia	Gitansha Sachdev	India
27	Epithelium-on Photorefractive Intrastromal Corneal Cross-linking (PiXL) with Supplemental Oxygen for the Treatment of Low Myopic Refractive Error: 6 Month Results of a Prospective Clinical Study	Matthias Elling	Germany
28	Epithelial corneal mapping in keratoconus: to do or not to do ?	Mouhcine El Bakkali	Morocco

PACK-CXL for infectious keratitis

29	The Effect of Accelerated Photoactivated Chromophore for Keratitis-Corneal Collagen Cross-Linking as Adjuvant Therapy on Il-6 Level of Corneal Ulcer Patient	Suhardjo .	Indonesia
30	Rose Bengal Photodynamic Antimicrobial Therapy as an Adjunct Treatment for Infectious Keratitis	Jaime Martinez Martinez	United States

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CXL in ectasia

A New Tomographic Matrix for Early Detection of Keratoconus

Oral - Abstract ID: 45

Prof. Mazen Sinjab [1]

1. *Global Eye Center*

Purpose

To present the validity and predictability of innovative new indices based on corneal tomography, in addition to a new probability system.

Materials and Methods

Based on subjective evaluation of corneal tomography (Pentacam HR), 240 eyes were grouped into Group A (134 normal) and Group B (106 Keratoconus). ROC was plotted for 8parameters and 8 newly developed indices using SPSS 23 software. Differentiation was decided based on nearly 100% specificity and highest possible sensitivity. A new probability system was estimated. The influence of demography and refractive errors on predicting keratoconus was reviewed and considered.

Results

Apart from y-coordinate of the thinnest location, all other parameters were significantly different in the two groups. Although all newly devised indices (S_1 to S_8) were significantly different, the validity for predicting keratoconus was acceptable only for S_1 to S_4 indices. The cutoff values with validity of the 8 parameters and 8 indices were determined.The probability system will be presented.

Conclusions

Taking into consideration the influence of demography and refractive errors, indices S_1 to S_4 were useful to differentiate normal from keratoconic corneas.

Biography

Mazen Sinjab, *Global Eye Center*

Mazen M Sinjab

D.O.B 1970

1993: MD: Aleppo University, Syria

1996: MSc: Damascus University, Syria

1997: ABOphth: Arab Council of Heath Specialties

2009: PhD: Damascus University

2015: Honorary FRCOphth, The Royal College of Ophthalmologists, London, UK

Professor of Ophthalmology, Damascus University, Syria

Examination Board Member in The Royal College of Surgeons of Edinburgh, UK

Anterior Segment and Refractive Surgeon with Global Eye Center, Riyadh, SA and with Gulf Diabetes Specialized Center, Bahrain

Author of ophthalmology books https://www.amazon.com/author/sinjab

The Appreciation Shield Award from Prince AbdulAziz Bin Ahmad, President of Saudi Ophthalmology Society for excellence in field of training and education 2017

Accelerated Corneal Collagen Cross Linking for Mild Keratoconus

Poster - Abstract ID: 67

Prof. Suhardjo . [1], ***Mrs. Reny Setyowati*** [1], ***Dr. Indra Tri Mahayana*** [1]

1. *Universitas Gadjah Mada*

Purpose

This case series was aimed to present the effect of accelerated transepithelial corneal collagen cross-linking (CXL) 9 mW/cm^2 in 10 minutes in grade I and grade II keratoconus.

Materials and Methods

This study presented a case series of four patients with keratoconus. According to Amsler-Krumeich keratoconus classification we classified two patient with grade I keratoconus and two patients with grade II keratoconus. All patients had symptom such as blurred vision at young age, discomfort using eye glasses, and unable to reach the best corrected visual acuity of 6/6. Ophthalmological examination revealed Rizutti and Munson's sign for all patient.

Results

Patients with grade I and II keratoconus had mean K_{flat} 43,97 D and 43,64 D, respectively, and mean K_{steep} was 50,91 D, and 53,87 D, respectively. After 1 month follow-up, patients with grade I keratoconus had mean K_{flat} and K_{steep}decreased by 0,12 D and 0,19 D, respectively. Patients with grade II keratoconus thad mean K_{flat} and K_{steep}decreased by 0,3 D and 0,95 D, respectively.

Conclusions

Acccelerated transepithelial CXL was shown more effective decreasing keratometric parameters in grade II keratoconus than in grade I keratoconus.

Biography

Suhardjo ., *Universitas Gadjah Mada*

Born in Yogyakarta, Indonesia

He is the opthalmology professor who are interested in corneal dan refractive surgery at Universitas Gadjah Mada

He has a lot of publications, one of them is CXL prior to photorefractive keratectomy

ALTERED EPITHELIAL CELLS IN KERATOCONUS : IMPLICATIONS IN CROSSLINKING

Poster - Abstract ID: 63

Dr. Sheetal Mahuvakar [1], ***Dr. Rohit Shetty*** [1], ***Dr. Poojita Vunnaya*** [1], ***Dr. Pooja Khamar*** [1], ***Dr. Debashish Das*** [1]

1. *Narayana Nethralaya*

Purpose

To study the cellular charecteristics of epithelial cells in the affected cone and unaffected periphery of corneas in keratoconus patients

Materials and Methods

Corneal epithelial cells from the affected cone and unaffected periphery were collected during the epithelial debridement procedure performed during corneal cross linking (CXL). Patients undergoing phtorefractive keratectomy (PRK) for correction of refractive errors were the control group. Collected epithelial cells ere analysed further for differentiation, proliferation, epithelial mesenchymal transition, apoptosis using real time quantitative polymerase chain reaction, immunostaining and western blot. Statistical analysis was performed using s Student t test.

Results

corneal epithelial cells from affected cone showed significantly lower expression of differentiation marker CK3/12 (P <0.05) compred to controls. Significantly higher expression of pro apoptotic marker BAX (p<0.005) and a concurrent lower expression of antiapoptotic marker BC12 (p<0.005) in affected cone in comparison to controls. Corneal epithelial cells of affected cone showed significantly higher levels of ZO-1 (p <0.005) and lower levels of vimentin 9P <0.005) compared to controls

Conclusions

kertoconic coreas show enhanced cell death, poor differentiation, proliferation and epithelial mesenchymal transition. It is imperative to ensure that CXL doesnot cause any further deleterious effects to corneal epithelium thereby affecting the treatment outcome and repopulation of the epithelium. Keeping in mind the long term risks of limbal epithelial cell health and its subsequent impact on corneal epihelium, it is with great prudence that one selects patients for cross linking

Biography

Sheetal Mahuvakar, *Na*

Cornea, Cataract & Refractive surgeon. Completed cornea fellowship from L V Prasad eye institute, Hyderabad, India. Completed bespoke refractive fellowship from Narayana nethralaya, Bangalore, India.

Currently working as a cornea, ocular surface and refractive surgeon in India.

An artificial intelligence based customized crosslinking– A new dimension in keratoconus management

Poster - Abstract ID: 49

Dr. Ritika Dalal [1], ***Dr. Rohit Shetty*** [1], ***Dr. abhijit sinha roy*** [1], ***Mr. Mathew Francis*** [1], ***Dr. Pallak Kusumgar*** [1]

1. *Narayana Nethralaya*

Purpose

To evaluate the refractive and keratometric outcomes of an artificial intelligence (AI) based approach for topography guided customized crosslinking.

Materials and Methods

Five keratoconic (KC) eyes underwent topography guided crosslinking. A 3D AI based model was used to calculate the shape and size of the cone and design concentric treatment zones to deliver differential energy. The delivered energy varied from 10.8J/cm^2 at the center to 3J/cm^2 at the periphery of the UV beam. The maximum treated diameter was 8mm. Refractive and keratometric data was measured pre and post (3 months) surgery.

Results

Over 3 months, mean manifest refraction spherical equivalent (MRSE) remained same (-1.25), mean keratometry and maximum keratometry showed reduction of 0.32D and 0.9D respectively. Average root mean square (RMS) anterior cornea lower order aberration and higher order aberrations reduced by 0.463 and 0.124µm respectively. Spherical aberrations increased by 0.202µm.

Conclusions

A mathematical AI based approach for customized topoguided cross linking shows acceptable refractive and keratometric outcomes. Further study is needed with varying pre-progression material property parameters and comparison with standard procedure to establish AI based cross linking as new treatment modality.

Biography

Ritika Dalal, *Narayana Nethralaya*

I am currently working as a refractive fellow at Narayana Nethralaya, Bangalore. I have presented at various national and international conferences and have papers in peer reviewed journals. My area of interest is Refractive surgery and keratoconus management.

I enjoy music and travel.

An investigation of the effects of riboflavin concentration on the efficacy of corneal cross-linking using an enzymatic resistance model in porcine corneas.

Oral - Abstract ID: 52

Prof. David O Brart [1], ***Ms. Naomi O Brart*** [2], ***Mrs. Nada Aldahlawi*** [3], ***Dr. Sally Hayes*** [3], ***Prof. Keith Meek*** [3]

1. *King's College, London,* ***2.*** *Moorfield's Eye Hospital,* ***3.*** *3)Structural Biophysics Research Group, School of Optometry and Vision Sciences, Cardiff University, Maindy Road, Cardiff*

Purpose

To investigate riboflavin concentration on enzymatic resistance following corneal cross-linking (CXL) in a porcine eye model using a pepsin digestion model in 96 eyes divided into 5 groups in two treatment runs.

Materials and Methods

Group 1 remained untreated. Group 2 received riboflavin 0.05%, group 3 0.1%, group 4 0.2% and group 5 0.3%. Treated eyes underwent CXL. 8.0-millimetre discs were submerged in pepsin digest. In run one, disc diameters were measured daily. After 10 days, dry weights were recorded from 5 samples in each group. In run two, dry weights were recorded in 5 samples in each group at 10 and 20 days.

Results

CXL-treated corneas took longer to digest than untreated ($P < 0.001$). In run 1 and 2, dry weights at 10 days demonstrated, with each increase in concentration, an increase in weight of residual undigested tissue ($P<0.001$). At 20 days in run 2, the dry weight was lower with 0.05% riboflavin compared to 0.3% ($P<0.001$) and 0.2% and 0.1% solutions ($p<0.05$), with no other difference between groups.

Conclusions

There is a consistent dose response curve with higher concentrations of riboflavin achieving greater CXL efficacy, suggesting that manipulation of riboflavin dosage as well as the UVA protocol can be used to optimize CXL.

Biography

Naomi O'Brart, *Moorfield's Eye Hospital*

Naomi is a qualified Optometrist under-taking an Master in Optometry at Moorfields Eye Hospital. She has a research interest in collagen cross-linking, which the subject of her undergraduate research dissertation at Cardiff University.

Biomechanical assessment of keratoconic eyes after corneal cross-linking by Scheimpflug-based tonometry

Poster - Abstract ID: 76

Mr. Robert Herber [1]***, Prof. Eberhard Spörl*** [1]***, Prof. Frederik Raiskup*** [1]

1. *Department of Ophthalmology, Univ. Hospital Carl Gustav Carus, TU Dresden*

Purpose

The aim of this study was to assess the biomechanical changes after corneal cross-linking (CXL) in patients with progressive keratoconus using the Scheimpflug-based tonometry (Corvis ST, CST).

Materials and Methods

Group 1 includes 19 eyes of 19 patients showing a progressive keratoconus and was cross-linked with the modified Dresden Protocol (9 mW/cm², 10 min). The control group (group 2) included 8 fellow eyes with a stable keratoconus.

All dynamic corneal response parameters of CST were analyzed and 4 of them were reviewed closer (IOP, biomechanical corrected intraocular pressure (bIOP), maximum inverse radius (MaxInvRad) and integrated radius (IntRad)).

Results

The mean patient age and follow-up were 34±10 years and 24±11 months, respectively. The mean IOP and bIOP increased significantly after CXL by +1.57±2.4 mmHg (P=0.013) and +1.8±2.5 mmHg (P=0.005), respectively. However, the control group showed no significant changes in IOP and bIOP. The MaxInvRad reduced significantly by -0.017±0.034 mm^{-1} (P=0.041), whereas group 2 showed no significant differences. Also, IntRad was reduced (ΔIntRad=-0.6±1.5 mm^{-1}) but not significantly.

Conclusions

IOP and bIOP showed significantly higher values after CXL, whereas control eyes remain stable after the same follow-up time. Particularly, bIOP that is less influenced by main corneal parameters and age, seems to be a valuable parameter to significant changes in biomechanical properties after CXL in vivo. Additionally, a decrease of maximum inverse radius showed more corneal consistency.

Biography

Robert Herber, *University Eye Center at Carl Gustav Carus Dresden*

Robert Herber is a Ph.D. student at University Hospital Carl Gustav Carus (Department of Ophthalmology), TU Dresden, Germany. He studied optometry at the University of Applied Science (EAH) Jena. After that, he graduated from EAH Jena with a master degree in optometry and vision science. Following this, Robert worked as an optometrist until he started his doctoral studies in medical science. Since his master thesis, Robert's scientific interests are in corneal cross-linking, keratoconus, and biomechanics.

CARBON NANOSTRUCTURES FOR OCULAR TISSUE REINFORCEMENT

Oral - Abstract ID: 46

Dr. Alfredo Vega [1], Dr. Jorge Alió del Barrio [1], Prof. Jorge Alió [2]

1. *V, **2.*** *Vissum Corporación*

Purpose

To assess if carbon nanomaterials are safe for the corneal tissue and also to evaluate the mechanical properties of the cornea after the implantation of carbon nanostructures

Materials and Methods

Experimental protocol where 24 rabbit's eyes were implanted with a composition containing Graphene and Carbon Nanotubes. A pocket was created in the middle of the stroma in which carbon nanomaterials were inplanted. Biocompatibility of the composition in the corneal tissue was assessed by means of pathology examination. Mechanical properties of the cornea were analyzed by performing stress-strain measurements in order to determine the modulus of elasticity of the corneal tissue.

Results

Blue Alcian staining showed that there is no fibrous scaring and no mucopolysaccharides alterations in the stroma. No inflammation and no foreign body giant cell reaction against the carbon nanomaterials implanted were observed by Mason tricrhome staining. Biomechanics showed that there is a trend to obtained higher levels of rigidity in those samples implanted with carbon nanomaterials when comparing with a control group, although this changes were not significant ($p>0.05$).

Conclusions

Implanting carbon nanostructures (Graphene and Carbon nanotubes) are biocompatible and a safe procedure for the corneal stroma. Biomechanical evaluation shows that there is a trend to obtain more rigidity of the corneal tissue after carbon nanostructures implantation

Biography

Jorge Alió del Barrio, *Vissum Corporación*

Jorge L. Alió del Barrio MD, PhD specialised in Ophthalmology at the Ramón y Cajal University Hospital (Madrid, Spain) and he has completed Cornea Fellowships at Guy's and St Thomas' Hospital and Moorfields Eye Hospital (London, UK). He is currently working as a surgeon in the Cornea, Cataract and Refractive Surgery Service of Vissum Corporación (Alicante, Spain).He is also a Professor "ad Honorem" at Universidad Miguel Hernández(Alicante, Spain) School of Medicine. He is a PhD at the Surgery Department of Universidad de Alcalá (Madrid, Spain), with a Cum Laude Qualification.

Comparative Analysis of Outcomes of Customised Topoguided Cross Linking versus conventional Cross Linking for progressive keratoconus

Poster - Abstract ID: 77

Dr. Gitansha Sachdev [1], ***Dr. Shreyas Ramamurthy*** [1]

1. *The Eye Foundation*

Purpose

The purpose of the study was to compare the outcomes of Customised topography guided versus conventional cross linking (CXL) in the management of progressive keratoconus.

Materials and Methods

Consecutive patients with documented progression of keratoconus and a minimal thickness of 400u were included. Conventional CXL(Group A) was performed using an epithelium-off approach with 9mw/cm2 for 10 minutes. In the customized group(Group B), a fluence of 15,10 and 5.4J/cm2 was delivered in concentric circles(centered around maximum posterior float elevation) using a pulsed 30mw/cm2 beam.Outcome parameters included extent of flattening, improvement in visual acuity & depth of demarcation line

Results

40 eyes (20 per group) were included. At 6-months,a maximal flattening of 1.1D and 2.9D was demonstrated in Group A and B respectively(p=0.02) with greater regularisation in the latter(P=0.032).A deeper demarcation line(254u versus 181u) was noted in Group B(P=0.04).A greater proportion of eyes had improvement in Uncorrected visual acuity in Group B(62%) as compared to 18% in Group A.Extent of haze and specular counts were comparable at 3-months.

Conclusions

Customised topography guided cross linking provided superior flattening and greater improvement in visual acuity as compared to conventional crosslinking while maintaining the same degree of safety.

Biography

Gitansha Sachdev, *The Eye Foundation*

The author is currently working as the Academic Coordinator and Consultant - Cataract and Refractive Services at The Eye Foundation, Coimbatore. During her residency training she received the prestigious Indian Council of Medical Research (ICMR) grant for her work in corneal collagen cross-linking. She has authored various chapters in books on refractive surgery and has multiple publications to her credit. She is currently the assistant editor of refractive surgery for the Indian Journal Of Ophthalmology (IJO).

Comparison of Outcomes with Standard and Accelerated Corneal Cross-linking Protocols in Patients with Progressive Keratoconus

Poster - Abstract ID: 60

Prof. Bradley Randleman [1], ***Mr. Paul Lang*** [2], ***Prof. Farhad Hafezi*** [3]

1. *University of Southern California,* ***2.*** *USC,* ***3.*** *Ocular Cell Biology Lab, CABMM, University of Zurich*

Purpose

Purpose: To compare and evaluate the standard corneal cross-linking protocol with two accelerated protocols in patients with progressive keratoconu

Materials and Methods

Methods: Retrospective data analysis of three groups of patients receiving either standard 3mW/cm at 30 minutes corneal cross-linking protocol (3mW) or one of two accelerated protocols: 9mW/cm at 10 minutes (9mW) or 30mW/cm at 4 minutes (30mW). Data was gathered using a Scheimpflug based device (Pentacam HR, Oculus, Inc.) prior to and 6 months following treatment. Group comparisons included changes in refractive astigmatism, pachymetric, topometric, keratometric, and densitometric indices

Results

Results: Only IHA (p=0.17), Zonal K_{max} (p=0.04), and IS value (p=0.005) were significant. The 30mW group had a greater change in IHA (-17.9±32.3) compared to 3mW (-3.53±21.5) and 9mW groups (0.730±18.3), while 3mW group had a greater change in Zonal K_{max} (-1.18 ±1.9) and IS Value (-0.791±1.9) compared to 9mW (-0.43±1.4 and 0.154±1.11 respectively) or 30mW groups (-0.447±0.94 and 0.032±0.60 respectively). Disease severity worse overall in the 3mW population.

Conclusions

Conclusion: All three protocols were effective at halting disease progression and improving overall outcomes. Patients receiving CXL in the 3mW group had more statistically significant improvements in outcome indices, followed by the 30mW and 9mW groups. Disease severity was worse at baseline in the 3mW group.

Biography

Bradley Randleman, *University of Southern California*

Professor of Ophthalmology at the Keck School of Medicine of USC and Director of the Cornea & Refractive Surgery Service at the USC Roski Eye Institute in Los Angeles, California. A widely respected cornea specialist, his areas of expertise include: corneal and intraocular refractive surgical procedures including LASIK and premium laser-assisted cataract and IOL surgery, complicated cataract surgery, and the management of corneal ectatic disorders. His primary research focuses on identification and management of corneal ectatic diseases including keratoconus and postoperative ectasia after LASIK, and the avoidance, diagnosis, and management of refractive surgical complications.

Contact lens-assisted collagen cross-linking (CACXL).

Poster - Abstract ID: 11

Dr. elhaddi Mahfoudi [1], ***Dr. Nacima Benmerzouga-mahfoudi*** [2]

1. *private,* ***2.*** *university of Annaba*

Purpose

To evaluate epi-off cross-linking assisted by contact lens (CACXL) ; practiced on corneal thickness less than 420µm.

Materials and Methods

A retrospective study from December 2015 to may 2016; in 34 patients (59 eyes) with an progressive keratoconus with a corneal thickness between 370 and 420 µm, treated by epi-off crosslinking assisted by contact lens(Daily Disposable Soflens) : We studied:the per-operative thickness gain (pocket II), and analyzed at 6 and 12 months post-operative: Kmax (pentacamHR) , visual acuity , and endothelial counting (CEM 530).

Results

We noted: a preservation of UCVA in 52 eyes (0.12 +/ -0.05 to 6 and 12 months post-op), and BCVA in 51 eyes (0.50 +/ -0.21 at 6 and 12 months), stabilization of Kmax in 51 eyes (mean of 55.94 +/-2.73 vs 56.05 +/ - 2.80 to 6 and 12 months). The pre-op thikness gain was 93 to 118 µm. Endothelial loss was significant in one patient.

Conclusions

The only treatment currently showing an effectiveness to rigidify the corneal stroma and to slow the progression of the keratoconus is the crosslinking of the corneal collagen (CXL). When the cornea is fine the CACXL would be an interesting alternative increasing the chances of effectiveness of the treatment which limited by the absence of de-epithelialization. A greater cohort and a longer retreat would allow the validation of this protocol.

Biography

elhaddi Mahfoudi, *liber*

**** 1998***:MD thesis with very honorable mention and congratulations of the jury, entitled “Cancer chemotherapy”
**** 2003:***Diploma of specialized medical studies in ophthalmology.
**** 2013:***Accreditation for using the VISX STAR 4IR
**** 2003- 2007:*** Head of the department of ophthalmology, OKBI hospital, Guelma Algeria.
**** 2007-present:*** Private ophthalmology practice
**** 2013 –2016:*** Vice president of the Algerian society of ophthalmology(SAO) .

**** Member of*** : SAO : 2000-present . SFO: 2005- present.
SAFIR 2013-present.

****PRESENTATIONS AND POSTERS:***

- Annual congress SAO:Algiers (2005- present)
- Annual congress SAFIR: Paris (2013,2014,2016,2017)
- Annual congress STO: Tunis (2012, 2015)

- WOC: Tokyo 2014 .

Decreased UV Light Filtering Ability of the Corneal Epithelium: Is it the Cause of Stromal Pathologies in Keratoconus

Poster - Abstract ID: 56

Dr. Nurullah Cagil [1]***, Dr. Ozge Sarac*** [1]***, Mr. Serhat Sevli*** [2]***, Dr. Demet Eyidogan*** [1]***, Dr. Mehtap Caglayan*** [1]

1. *Ankara Ataturk Training and Research Hospital,* ***2.*** *Nehir Biotechnology*

Purpose

The purpose of this prospective study was to investigate the ultraviolet (UV) absorption of the human keratoconic corneal epithelium and compare it to normal corneal epithelium.

Materials and Methods

47 keratoconic and 28 healthy human corneal epithelium were studied. Epithelia were centrifuged and treated with collagenase to form a homogenous cell suspension. UV absorption of cell suspension was scanned by nanospectrophotometer. Absorption values of each sample at 280, 300, 320, 360 and 400 nm frequencies were recorded. UV absorption readings were divided by optic density of the cell suspension at 660 nm to obtain absorption value per unit cell.

Results

The UV absorbance levels at each recorded UV frequency were statistically significantly lower in keratoconic corneal epithelial cells when compared to the healthy subject's epithelial cells (p:<0.001, p:0.001, p:0.001, p:0.002, and p:0.002, respectively).

Conclusions

Our results indicated that human keratoconic cornea epithelium has weaker UV filtering ability compared to normal epithelium, which may lead to chronic over-exposure of the stroma with UV. We postulate that chronic UV-B″escape″ through the keratoconic cornea epithelium into the stroma may cause direct collagen breakdown, and may also be the cause of increased matrix metalloproteinases activity. Thus, primary pathology in keratoconus may be the epithelium instead of stroma.

Biography

Nurullah Cagil, *Ankara Ataturk Training and Research Hospital*

Nurullah Cagil is associate professor in ophthalmology in Yildirim Beyazit University Ankara Ataturk Training and Research Hospital, where he works as an academic member since 2004. He established Refractive Surgery and Keratoconus center in this institution, which became one of the major keratoconus centers of the country. His work is focused on cataract and refractive surgery, cornea, and keratoconus. He conducts clinical and basic research on keratoconus.

Distinguishing keratoconic eyes and healthy eyes using Ultrahigh-Resolution (UHR)-OCT based Corneal Epithelium Thickness Mapping

Poster - Abstract ID: 54

Dr. Niklas Pircher [1]***, Mr. Florian Schwarzhans*** [2]***, Dr. Stephan Holzer*** [2]***, Dr. Jan Lammer*** [2]***, Dr. Doreen Schmidl*** [3]***, Dr. Ahmed M. Bata*** [3]***, Prof. Renè M. Werkmeister*** [4]***, Dr. Gerald Seidel*** [5]***, Prof. Gerhard Garhöfer*** [3]***, Dr. Andreas Gschließer*** [6]***, Prof. Leopold Schmetterer*** [3]***, Prof. Gerald Schmidinger*** [6]

1. *Department of Ophthalmology, Medical University of Vienna,* ***2.*** *Department of Ophthalmology and Optometry, Medical University of Vienna,* ***3.*** *Department of Clinical Pharmacology, Medical University of Vienna, Austria,* ***4.*** *Center for Medical Physics and Biomedical Engineering, Medical University of Vienna, Austria,* ***5.*** *Department of Ophthalmology, Medical University of Graz, Austria,* ***6.*** *Department of Ophthalmology and Optometry, Medical University of Vienna, Austria*

Purpose

Discovering new predictive parameters in the diagnostics of Keratoconus (KC) has high priority. Aim of this trial was to find differences in epithelial thickness (ET) maps of eyes with KC and healthy eyes

Materials and Methods

Subjects were scanned wiht an UHR-OCT. Automated segmentation ET-maps with 17 subsectors were calculated. The thinnest (minET), the thickest (maxET), the thinnest point diagonally opposing the thickest point ($ET_{min-max}$) were additional parameters. Ratios were calculated as follows: minET/diagonally opposing point (R_1) and maxET/diagonally opposing point (R_2). Inferior temporal area/superior nasal area ($R_{TI/NS}$) and inferior/superior hemisphere ($R_{I/S}$). Furthermore, collected parameters were analysed regarding their diagnostic accuracy [Area under the curve (AUC)]

Results

40 keratoconic eyes and 76 healthy eyes were scanned. Statistically significant differences were (mean ET±standard deviation µm): central ET: 46.25±2.56 / 50.91±1.66, minET: 38.50±2.10 / 46.79±1.27, $ET_{min-max}$: 47.14±2.45 / 49.60±1.57 and temporal inferior area: 43.93±2.95 / 51.04±1.51. For R_1: 0.76±0.09 / 0.93±0.04, R_2: 1.08±0.04 / 1.21±0.16, $R_{TI/NS}$: 0.85±0.08 / 1.02±0.04 and $R_{I/S}$: 0.92±0.07 / 0.99±0.02. AUC-values were R_1: 0.979 (CI: 0.957-1.000), $R_{TI/NS}$: 0.977 (CI: 0.951-1.000) and minET: 0.928 (CI: 0.880-0.977)

Conclusions

Epithelial thickness maps could clearly visualize different ET-patterns. Parameters with the highest potential of diagnostic discrimination between eyes with KC and healthy eyes were in descending order: R_1, $R_{TI/NS}$ and minET. Consequently, epithelial thickness irregularity and asymmetry seem to be the most promising diagnostic factor in terms of discriminating between keratoconic eyes and healthy eyes

Biography

Niklas Pircher, *Department of Ophthalmology, Medical University of Vienna*

2013 - 2016 Clinical Scientific Assistant Medical University of Vienna

2016 - today Residency Ophtalmology, Department of Ophthalmology, Medical University of Vienna, Austria

EFFECTIVENES OF ACCELERATED CORNEAL COLLAGEN CROSSLINKING FOR KERATOCONUS PATIENTS : A COMPARISON OF TWO PROTOCOLS

Poster - Abstract ID: 65

Mrs. Reny Setyowati [1]***, Prof. Suhardjo .*** [1]

1. *Universitas Gadjah Mada*

Purpose

Accelerated Corneal Collagen Cross-Lingking (A-CXL) has been developed to shorten the duration of the procedure by increasing illumination intensity.

This study has a purpose to compare short term outcome of two different protocols of A-CXL for keratoconus patients.

Materials and Methods

Nonrandomized clinical control study at Dr Sardjito Hospital in Yogyakarta, Indonesia. Keratoconus patients were divided into two groups consecutively. Patients underwent a detailed ophthalmic and medical examination. Refraction and keratometric values are measured preoperatively and postoperatively. Four eyes were treated with 9 mW/cm2 for 10 minutes (group 1) and 12 eyes were treated with 18 mW/cm2 for 5 minutes (group 2). The data of the two groups were compared statistically.

Results

After 3 months, patients evaluation in group 1, minimum and maximum keratometry flattened by 2,33 diopters (p=0,465) and 2 diopters (p=0,715), respectively. In group 2, minimum and maximum keratometry flattened by 4,50 diopters (p=0,207) and 3,20 diopters (p=0,779), respectively. There were no inter-group differences in the changes in keratometry values between group 1 A-CXL and group 2 A-CXL at 3 months postoperatively (p=0,571)

Conclusions

Keratometric parameter results of both protocols A-CXL for the treatment of keratoconus in short time period were similar.

Biography

Reny Setyowati, *Universitas Gadjah Mada*

Born in Medan, North Sumatra, Indonesia at 1988

Now she is in her final year of Opthalmology Residency at Universitas Gadjah Mada

She is also a young staff at Corneal Division at the same institution.

Effects of Iontophoresis - UVA cross-linking and hypotonic riboflavin solution on the ultrastructural architecture of human corneal stroma

Poster - Abstract ID: 74

Prof. Saeed Akhtar [1]***, Mrs. Aljoharah Alkanaan*** [1]***, Mr. Adnan Khan*** [2]***, Prof. Turki Almubrad*** [1]

1. *Cornea Research Chair, Department of Optometry, King Saud University,,* ***2.*** *Cornea Research Chair, King Saud University,*

Purpose

To evaluate the effect of different UV-A treatment intensities on human corneas soaked through with an iontophoresis procedure performed with a specific solution 'Ricrolin + ®, Sooft, Montegiorgio, FM, Italy' on the ultrastructure of corneal stromal, collagen fibrils and proteoglycans.

Materials and Methods

Normal corneal samples were treated with 'Ricrolin + ® , Sooft, Montegiorgio, FM, Italy' using iontophoresis for 5 minutes and irradiated with 3 methods; ***Group 1:*** an irradiance at 3 mW/cm^2 power for 30 minutes; ***Group 2***: an irradiance at 10 mW/cm^2 power for 9 minutes; ***Group 3***: without irradiance power. Control Group: Three untreated cornea were used as a control. All cornea were processed for electron microscopy.

Results

The lamellae and CF were well organised in group 1 and better organised than all other groups. The mean CF diameter of 'Group 1' (24.43 ±3.08, n=814) was significantly ($p<0.001$) higher than 'Group 2' (22.34±3.48nm, n=769), 'Group 3' (22.48±2.84nm, n=708) and normal cornea (23.32±0.080nm, n=809). The mean PGs area of the 'Group 1' (111.80±1.53) was significantly ($p<0.001$) higher than Group 2 (103.17±1.20) and Group 3 (100.02±1.26) but not the control.

Conclusions

The application of CXL with iontophoresis showed an improvement in the collagen fibril diameter and their organisation in the Group 1. It is presumed than the treatment might affect the development of the microfibrils within the CF. In vivo studies are required to evaluate the effect of the Iontophoresis technique on the organisation of corneal stroma.

Biography

Saeed Akhtar, *Cornea Research Chair, King Saud University,*

Prof Saeed Akhtar has been working on the ultrastructure of normal and pathological cornea at Cornea Research Chair, King Saud University since 2007. His main research interests are investigating remodeling of collagen fibrils and proteoglycans in human and animal cornea affected by diseases such as keratoconus, post-LASIK cornea, cross-linked cornea, bullous keratopathy, granular dystrophy etc. These diseases cause the cornea to become opaque. Recently, he published a paper exploring the differences in the lamellar organization of the periphery and the center of the keratoconus cornea. This research showed that the origin of the undulating lamellae was above the Descemet's membrane.

Evaluating Efficacy in Varying Protocols of Customized Crosslinking (CXL)

Oral - Abstract ID: 86

Dr. Rajesh Rajpal [1], ***Dr. Grace Lytle*** [1], ***Dr. Alexandra Nicklin*** [1]

1. *Avedro, Inc*

Purpose

To evaluate the efficacy of varying treatment designs in customized crosslinking.

Materials and Methods

A review on the theory of customized crosslinking was performed to isolate the main parameters that have been used to model treatment design plans to date.Additionally, clinical studies involving customized crosslinking were studied to assess the change in K_{max} and BCVA in various protocols.

Results

Clinical studies demonstrated a greater ΔK_{max} in treatment designs that centered on the posterior float. When centration was based on the axial curvature, posterior float, and a hybrid of the two, the ΔK_{max} was −1.31 ± 1.52 D, -1.7 ± 2.0 D, and -1.29 ± 2.44 D, respectively. When centration was based on axial curvature and posterior float, the ΔBCVA [LogMar] was −0.16 ± 0.24 and -0.07 ± 0.20, respectively.

Conclusions

Clinical data supports theoretical modeling to date. However, further studies are needed in order establish a standardized approach to customized crosslinking.

Biography

Rajesh Rajpal, *Avedro, Inc*

Chief Medical Officer at Avedro Inc. Board certified eye doctor and the Founder of See Clearly Vision in Washington, DC.

High dose dietary riboflavin and sunlight treatment of keratoconus and ectasia - preliminary results

Oral - Abstract ID: 19

Dr. John Jarstad [1], ***Dr. Lindsey Mcdaniel*** [1], ***Dr. Marwa Taranissi*** [1]

1. *University of Missouri School of Medicine*

Purpose

The effects of high dose dietary riboflavin and direct sunlight exposure were studied in 11 patients over 6 to 48 months. Cross-linking occurred measured by improved acuity and a reduction in topographical & keratometric readings in all but one patient.

Materials and Methods

Eleven patients with progressive keratoconus or post-refractive ectasia were assigned 100mg or 400mg of dietary riboflavin daily accompanied by 15 minutes of sunlight exposure without sunglasses or contact lenses. Six female and 5 male patients were enrolled. Age ranged from 16 to 74. Pre-treatment Kmax readings were from 39.75 to 48.00. Patients were followed from 6 to 48 months. Pre and post operative BCVA, UCVA, topography and keratometry was evaluated.

Results

All but one patient showed corneal flattening at six months with average flattening of 1.3 diopters and ranging from zero to 2.50 diopters. One patient refused to remove hard contact lenses outside served as an unintentional control and had no effect from treatment. Average improvement in BCVA and UCVA measured two lines. Reduction in symptoms of glare, haloes and distortion were reported by several patients. No adverse effects were noted.

Conclusions

Collagen cross-linking using epithelial scraping and commercially available riboflavin extract with high dose, short duration ultra-violet exposure has been shown to be highly effective in treating keratoconus.

We present initial findings showing a beneficial effect using high dose dietary riboflavin and natural UV light from the sun over an extended time period that may provide a low-cost adjunctive or alternative method of treating keratoconus and post refractive corneal ectasia.

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Biography

John Jarstad, *University of Missouri School of Medicine*

Dr. John Steven Jarstad is Associate Professor and Director of Cataract & Refractive Surgery at University of Missouri.

He received his undergraduate degree at Brigham Young University in Provo, Utah, his M.D. at University of Washington, Seattle and was a research fellow at National Institutes of Health in Bethesda, Maryland.

Dr. Jarstad's contributions to ophthalmology include the Jarstad refractive cataract surgery marker, the one-handed IOL injector, a resident teaching head and low-cost capsulorrhexis surgery simulator and early femtosecond laser work.

He has been a visiting professor in Austria, England, Africa, Asia and North Korea with 70 publications/presentations and one book.

Hormonal effect on progression of corneal ectasia – case reports

Oral - Abstract ID: 27

Dr. Martina Vesela [1], ***Prof. Drahomira Barakova*** [1], ***Dr. Pavel Stodulka*** [1]

1. *Gemini Eye Clinic*

Purpose

The aim of the presentation is to highlight the possible relationship of keratoconus and hormonal disbalance due to the hormonal stimulation prior in vitro fertilization (IVF) treatment.

Materials and Methods

From 2007 to 2015, the number of IVF treatments in Czech Republic has increased from 17 682 to 35 875 per year. After a summary presentation of the effects of each hormone affecting the cornea, two case reports of corneal ectasia are presented in patients who have undergone hormonal stimulation before IVF.

Results

Case reports of 2 patients with keratoconus, who were underwent a several IVF treatments, after which visual acuity became worse due to progression of ectasia. They have also other diseases: thyroid gland hypofunction, hepatitis C, permanent colonostomy due to Crohn's disease. The corneal cross-linking was performed in both eyes to stop progression of keratoconus in the follow-up over the 15 months in one eye and 6 months in fellow eye.

Conclusions

Due to an increase in IVF treatment in Czech Republic, more careful monitoring of patients with increased risk of corneal ectasia and early treatment using the corneal cross-linking is required. A statistical comparison of the incidence of corneal ectasia in a larger group of women after hormonal stimulation during IVF treatment with a control group would be appropriate for assessing the risk ectasia induced by hormonal IVF stimulation.

Biography

Martina Vesela, *Gemini Eye Clinic*

Currently: Cataract and refractive surgeon, Consultant Ophthalmologist - refractive surgery, Geminy Eye Clinic, Prague, Czech Republic

- M.D. – 2000 , Medical Faculty of PJ Safarik University, Kosice, Slovak Republic
- FEBO – 5/2007 – Paris, France
- Ph.D. – 1/2016 – The treatment modification of progressive keratoconus using the collagen cross-linking with riboflavin and UVA irradiation, prof. Frederik Raiskup, M.D., Ph.D., FEBO, Charles University, Czech Republic
- MBA – 3/2017 – Management Soft Skills, Designing the communication strategy of clinic towards the patients based on segmenting patients by age, Prague Business Institut, Prague, Czech Republic

In vivo Brillouin frequency shifts of crosslinked and uncrosslinked corneas in keratoconus

Oral - Abstract ID: 83

Dr. Theo G. Seiler [1], ***Dr. Peng Shao*** [2], ***Dr. Amira Eltony*** [2], ***Dr. Valéry Wittwer*** [3], ***Dr. Tobias Koller*** [3], ***Prof. Seok-Hyun Yun*** [2], ***Prof. Theo Seiler*** [3]

1. *Universitätsklinik für Augenheilkunde, Inselspital Bern,* ***2.*** *Harvard Medical School,* ***3.*** *IROC AG*

Purpose

To investigate Brillouin frequency shifts of keratoconus corneas and the influence of CXL on corneal elastic modulus in vivo.

Materials and Methods

Brillouin frequency shift maps were acquired to determine corneal rigidity with a high spatial resolution using the BOSS-system. Eyes of patients suffering
from progressive keratoconus as well as eyes having received crosslinking (CXL)
more than 12 months ago were examined using Brillouin microscopy and
Scheimpflug tomography. Rigidity maps and corneal tomographies were analyzed
for possible correlations and compared between both groups.

Results

Brillouin maps in keratoconus demonstrate, that the cornea is not suffering from a uniform but rather a focal weakening with a peak Brillouin-shift of 5.67±0.02GHz in the ectatic region compared to a Brillouin-shift of 5.74±0.02GHz in the normal corneal periphery. Maximal corneal posterior float is significantly correlated with maximal weakening in corneal Brillouin maps. Brillouin frequency shifts were significantly lower (weaker) in uncrosslinked corneas compared to crosslinked corneas.

Conclusions

Keratoconus corneas suffer from a focal weakening. Corneal tomography, in particular the maximum posterior float might serve as an estimation for the weakest point. This may help to improve customized irradiation patterns in corneal
crosslinking in order to optimize visual outcome for patients with progressive
corneal ectasia

Biography

Theo G. Seiler, *Universitätsklinik für Augenheilkunde, Inselspital Bern*
Medical School Zurich
Resident at IROC, TU Munich, Inselspital Bern,
Research Fellow at Harvard Medical School, Wellman Center for Photomedicine
Currently Inselspital Bern

Intraoperative Corneal Thickness Changes during Pulsed Accelerated Corneal Cross-Linking Using Isotonic Riboflavin with HPMC

Poster - Abstract ID: 32

Dr. Nihal Elghryany [1], ***Prof. Yehia Mostafa*** [1]

1. *Cairo University*

Purpose

To evaluate corneal thickness changes during pulsed accelerated corneal cross-linking (CXL) for keratoconus using a new isotonic riboflavin formula.

Materials and Methods

In this prospective, interventional study patients with grades 1-2 keratoconus underwent pulsed accelerated CXL 1 sec. on/1 sec. off of UVA irradiation of 30 mW/cm2 (duration of 8 minutes and 40 seconds) after application of an isotonic riboflavin solution (0.1%) with HPMC for 10 minutes. Central corneal thickness (CCT) measurements were taken using ultrasound pachymetry before and after epithelial removal, after riboflavin soaking, and immediately after completion of UVA treatment.

Results

20 eyes of 11 patients were enrolled. Mean patient age was 26±3 years.No intraoperative or postoperative complications were observed. Mean CCT was 507 ±35 µm before and 475 ± 40 µm after epithelial removal. After 10 minutes of riboflavin instillation, there was a statistically significant decrease of CCT by 6.2% from 475±40 µm to 446±31 µm.There was no other statistically significant change of CCT during UVA irradiation.

Conclusions

A significant decrease of corneal thickness was demonstrated during the isotonic riboflavin with HPMC application while there was no significant change during the pulsed accelerated UVA irradiation.

Biography

Nihal Elghryany, *Cairo University*

Dr Nihal is an Anterior Segment surgeon specialized in corneal diseases and refractive surgery in eyeCare Center, Maadi, Cairo. She graduated from Cairo University in 2008 where she completed ophthalmology residency training in Cairo University Hospitals followed by a Masters degree in 2015 with a thesis discussion in Accelerated Pulsed CCXL and currently MD candidate in Cairo University. She has a special interest in corneal ectasia and CCXL with several publications and national and international conferences presentations (ESCRS, ARVO).

K Readings, Corneal Thickness and Demarcation Line 3 Months After Accelerated Pulsed Corneal Cross Linking

Poster - Abstract ID: 47

Dr. Nihal Elghryany [1], ***Prof. Yehia Mostafa*** [1]

1. *Cairo University*

Purpose

To evaluate demarcation line, K readings and corneal thickness 3 months after accelerated pulsed corneal cross linking in patients with keratoconus

Materials and Methods

In this prospective,interventional study, patients with grades 1-2 keratoconus underwent epithelium off pulsed accelerated(30mW/cm2) (Avedro Inc., Waltham, MS, USA) CXL for 8 minutes (1 second on/ 1 second off) after application of an isotonic riboflavin solution (0.1%) with HPMC (VibeX Rapid, Avedro Inc., Waltham, MS, USA) for 10 minutes. Scheimpflug imaging was done before and 3 months after the treatment. Anterior segment OCT was done 3 months after the treatment.

Results

This study included 20 eyes of 14 patients. Mean preoperative flattest K (K1) was 47.97 D while mean post operative K1 is 47.6 D. Mean preoperative steepest K (K2) was 51.15 D while mean post operative K2 is 50.7 D. Mean preoperative central corneal thickness (CCT) was 486 microns, postoperative CCT is 469.9 microns. Demarcation line is easily detected in 17 eyes of 12 patients, mean depth is 199.5 microns

Conclusions

Accelerated pulsed cross linking causes a decrease in the K readings and the central corneal thickness. Apoptotic effect demonstrated by corneal demarcation line can be detected at depth of 199.5 microns.

Biography

Nihal Elghryany, *Cairo University*

Dr Nihal is an Anterior Segment surgeon specialized in corneal diseases and refractive surgery in eyeCare Center, Maadi, Cairo. She graduated from Cairo University in 2008 where she completed ophthalmology residency training in Cairo University Hospitals followed by a Masters degree in 2015 with a thesis discussion in Accelerated Pulsed CCXL and currently MD candidate in Cairo University. She has a special interest in corneal ectasia and CCXL with several publications and national and international conferences presentations (ESCRS, ARVO).

Laser Induced Ionization Field Crosslinks Biological Media in Absence of Photosensitizers

Oral - Abstract ID: 85

Dr. Mikhail Fomovsky [1], Mr. Chao Wang [1], Dr. Stephen Trokel [2], Dr. Sinisa Vukelic [1]

1. *Columbia University,* ***2.*** *Columbia University Medical Center*

Purpose

Spatially resolved crosslinking of collagenous biological media has been achieved in absence of photosensitizers via utilization of ultrafast lasers. The treatment is being investigated for its potential to produce geometrically defined volumes of crosslinked corneal tissue for therapeutic purposes.

Materials and Methods

Novel laser-tissue interaction paradigm has been achieved by confining lasing regime below the optical breakdown threshold, thus restricting the treatment to photochemical effects. As such, the treatment omits thermal accumulation, which would denature collagen fibrils. Careful tailoring of processing parameters confines induced ionization field to the focal volume, resulting in ability to control the crosslinking process, and thus limit the alterations to desired region of the irradiated media.

Results

Findings obtained from Electron Paramagnetic Resonance Spectroscopy and Fluorescence Microsocopy have confirmed our hypothesis. The process has then been applied onto porcine and rabbit eyes, and post-treatment characterization has shown changes in crosslink density, mechanical properties as well as overall geometry of corneal tissue. Temperature increase during the procedure is well below denaturation threshold, and histology has confirmed absence of thermal damage. Complementary results have been observed in articular cartilage.

Conclusions

By carefully tailoring of the laser-induced amendments in the target tissue, which could be ocular tissue, tendon or articular cartilage, one has ability to induce structural modification that further triggers alteration of its mechanical properties as well as overall geometry. Therefore, the proposed laser-tissue interaction method has potentially tremendous therapeutic value. Specifically, this technique has allowed us to change the mechanical properties and the geometry of exposed corneal stroma.

Biography

Sinisa Vukelic, *Columbia University*

Dr. Vukelic has obtained his PhD from Columbia University in 2009 and was appointed as Assistant Professor at Bucknell University. In 2013 he has joined Columbia University faculty. Dr. Vukelic's research interests include investigation of underlying phenomena behind the interaction of lasers with biological media. In addition to basic science, Dr. Vukelic's research projects include translational research in which fundamental concepts are applied onto practical clinical problems such as correction of refractive errors, treatment of corneal ectasias, as well as development of novel treatment for early osteoarthritis.

Long-term results of mechanical epithelial removal versus phototherapeutic keratectomy followed by accelerated corneal cross-linking for pediatric keratoconus

Poster - Abstract ID: 25

Dr. Ozge Sarac [1], ***Dr. Pinar Kosekahya*** [2], ***Dr. Mehtap Caglayan*** [1], ***Dr. Guzin Taslipinar*** [1], ***Dr. Burak Tanriverdi*** [1], ***Dr. Nurullah Cagil*** [1]

1. *Ankara Ataturk Training and Research Hospital,* ***2.*** *Ankara Ulucanlar Egitim ve Arastirma Hastanesi*

Purpose

Tocompare the long-term outcomes of pediatric keratoconus patients treated witheither mechanical epithelial removal or transepithelial phototherapeutickeratectomy (PTK) before accelerated corneal cross-linking (CXL).

Materials and Methods

40 eyes of 35 consecutive keratoconus patients under 18 years oldwith 36 month follow-up period following accelerated (9 mW/cm^2, 10min) CXL were included. Eyes that had undergone CXL following manual epithelial debridement (group 1, n=15) or transepithelial PTK (group 2, n=20) were evaluated preoperatively and at 12, 24,and 36 months postoperatively for uncorrected (UDVA) and corrected (CDVA), spherical equivalent (SE), manifest astigmatism (MA), corneal topographic and aberrometric values.

Results

The improvement in the UDVA (group 1:p=0.001, group 2:p=0.002) and the decrease in the K-max, and TCT (group 1:p<0.001and p<0.001, respectively; group 2:p=0.007 and p<0.001,respectively) were statistically significant in both groups. The changes in K-max, topographic astigmatism, and spherical aberration in group 2 at 12 months postoperatively was greater than group 1 (p=0.03, p=0.01, and p=0.04,respectively). After 12 months postoperatively, these differences were present but not statistically significant.

Conclusions

Combined transepithelial PTK and accelerated CXL was effective and safe in pediatric keratoconic patients over a long-term follow-up. The initial visual and topographic effects of transepithelial PTK epithelium removal was superior than the mechanical epithelium removal.

Biography

Ozge Sarac, *Ankara Ataturk Training and Research Hospital*

Ozge Sarac is an associate professor in ophthalmology at Ankara Ataturk Training and Research Hospital, Ankara, where she has been a faculty member since 2009. She had research experience at Wilmer Eye Institute at Johns Hopkins Hospital, Baltimore and also has been working as an adjunct associate professor at Australian National University in Canberra, Australia. She is specialized in the field of cornea and external diseases, refractive surgery, and neuro-ophthalmology. Her research is mainly based on keratoconus, pediatric keratoconus, and corneal collagen cross-linking.

Measuring Corneal Haze with OCT after Epithelial Disruption Corneal Collagen Cross-linking (CXL) with Trans-epithelial Riboflavin (TE) in patients with Keratoconus.

Poster - Abstract ID: 4

Dr. Dhwni Shahanand [1]***, Dr. Ashish Nagpal*** [1]

1. *Cornea Services, Retina Foundation, Ahmedabad*

Purpose

To quantitatively measure CXL (Corneal CollagenCrosslinking) associated corneal haze by Anterior Segment (Spectral Domain) OCT in patients with keratoconus undergoing CXL by epithelial disruption with Riboflavin TE (0.25%).

Materials and Methods

Retrospective, interventional, cohort study. 10 eyes of 9 patients with keratoconus, who underwent CXL with epithelial disruption and Riboflavin TE (0.25%) were analyzed on basis of serial post-operative OCT (Spectral Domain) and Topography (Sirius Tomography) done pre-operatively, post-operative day 1, 1 month, 3 months and 6 months. Clinical correlation of haze on OCT was done with the haze on slit-lamp examination on each examination.

Results

Initial increase in pachymetry on 1stpostoperative day by 53.13 microns seen. Diffuse central haze (mean depth -279.66),tapering in periphery observed. Initial compaction of corneal stroma over post-operative 1-3 months with compaction of haze compared to postoperative day 1 is observed. Stromal thickness returned to preoperative values at 3 months, depth and density of haze had gradually reduced from 3-6 months.

Conclusions

Corneal haze after CXL is considered indirect measure of the depth of crosslinking and has been quantitatively measured on OCT. It shows initial increase in corneal thickness followed by gradual compaction and decrease in haze over a period of 6 months in eyes undergoing CXL with epithelial disruption with Riboflavin TE. The parameters of keratoconus like visual acuity and topographic K-max values remained stable in these patients.

Biography

Dhwni Shahanand, *Cornea Services, Retina Foundation, Ahmedabad*

Dr Dhwni Shahanand, former Fellow of Cornea Services at Retina Foundation, Ahmedabad, India, currently practicing as a Corneal and Refractive Surgeon in India. She has special interest diseases like Keratoconus and corneal biomechanics.

Need of explantation of an intrastromal titan ring after penetrating keratoplasty in two patients with keratoconus

Poster - Abstract ID: 37

Ms. Kassandra Xanthopoulou [1]***, Dr. Georgia Milioti*** [1]***, Prof. Berthold Seitz*** [1]

1. *Department of Ophthalmology, Saarland University Medical Center, 66424 Homburg, Germany*

Purpose

The most severe complications after penetrating keratoplasty (PKP) include high astigmatism and immunological graft failure. The introduction of the corneal intrastromal titan ring twenty years ago by Krumeich, implanted during PKP was supposed to reduce the incidence of both complications.

Materials and Methods

We present two patients with keratoconus who were referred in our department after each having undergone a PKP in one eye with simultaneous implantation of the intrastromal titan ring. The first patient suffered from excessive bulbar pain and persistent headaches 18 months after surgery. For the second patient was already the second graft and he suffered from postoperative high myopia, irregular astigmatism and was contact lens intolerant.

Results

In the first patient we recognised a forward movement of the titan ring inside the corneal stroma without penetration of the epithelium. We decided to remove the intracorneal ring and soon after operation the symptoms disappeared. The second patient was found to have extreme bulging of the transplant in the operated eye which explained the high postoperative refractive error. We removed the implanted intracorneal ring and sequentially performed a re-re-PKP.

Conclusions

In both cases the implantation of the intracorneal titan ring failed to decrease the postoperative astigmatism and caused symptoms that affected the patients' everyday life on significant level. To relieve the patients' symptoms we had to remove the titan ring in both cases. It remains doubtful if Krumeich's ring is beneficial in PKP.

Biography

Kassandra Xanthopoulou, *Department of Ophthalmology, Saarland University Medical Center, 66424 Homburg, Germany*

I graduated from Medical School of Aristotle University of Thessaloniki in Greece in July of 2016. After the completion of my studies I completed a hospitation of 5 months in the University Eye Department of Papageorgiou Hospital in Thessaloniki, Greece . Since Februar 2017 I am working as a resident at the Ophthalmology Department in Saarland University of Germany. I am currently working on my Master concerning a prospective study on Crosslinking. I speak English, German, French and Italian.

Non-contact technique for direct corneal strength measurement

Oral - Abstract ID: 29

Dr. Dimitri Chernyak [1]

1. *Intelon Optics, Inc.*

Purpose

Multiple techniques have emerged in recent years for measuring corneal biomechanics. While useful, these devices are influenced by IOP and corneal geometry. Extracting data from such measurements relies on assumptions and modeling, doesn't provide spatial aspect of elasticity across cornea.

Materials and Methods

Brillouin Spectroscopy has been recently shown to measure corneal biomechanical strength directly and to provide spatial mapping of the strength modulus in tissue. It uses low-power laser to determine elastic modulus of ocular tissue by analyzing the return signal spectrum. The laser is within published safety limits of exposure for ocular tissues. Unlike Raman scattering, Brillouin spectroscopy involves low frequency scatter that directly relates to elastic bulk properties of material.

Results

Laboratory measurements of various polymers have shown close correlation with published elastic modulus data for these reference materials. Human clinical studies have demonstrated significant difference in the elastic modulus of normal corneas versus corneas diagnosed with keratoconus condition. Clinical data has also shown statistically significant changes associated with corneal crosslinking treatment for keratoconus patients in the anterior cornea, where crosslinking was applied.

Conclusions

Brillouin Spectroscopy data provides unique and direct measurement of corneal elastic properties across tissue volume. Access to such information may allow physicians to customize refractive surgery nomograms as well as crosslinking treatment parameters for controlling keratoconus progression.

Biography

Dimitri Chernyak, *Intelon Optics, Inc.*

Dimitri has 15+ years of experience in developing diagnostic and surgical devices in ophthalmology and has been Scientific Advisor to several companies in medical software and data analytics.

Dimitri earned a PhD in Vision Science at UC Berkeley in 2001. His research was centered on modeling of attention, eye movements and object recognition. Born in Moscow, Russia, he attended the Biology Department of Moscow State University, and in 1992 received a BA degree from Brandeis University, Waltham, MA, in Mathematics and Biology. In 1994, he was awarded an MA degree in Cognitive and Neural Systems from Boston University.

Optimizing Genipin concentration for corneal collagen cross linking: An ex-vivo model.

Oral - Abstract ID: 39

Prof. Jorge Alió [1], Dr. Almutez Gharaibeh [1], Dr. Jorge Alió del Barrio [1]

1. *Vissum Corporación*

Purpose

To optimize the crosslinking effect caused by Genipin at different concentrations, duration of treatment and delivery methods as a pharmacological substance for corneal collagen crosslinking (CXL) with the purpose of approving its clinical human application.

Materials and Methods

100 corneas treated withdifferent Genipin concentrations (0.1%, 0.5% and 1%) and treatment durations (15 minutes, 30 minutes, 40 minutes, 1 hour, 2 hours and 8 hours) through different methods of delivery (soaking or topical drops of 140 µl) were compared to 10 controls corneas treated with Riboflavin and UV. Histology exam, enzymatic digestion with collagenase and Thermal Differential Scanning Calorimetry (DSC) were performed on the different samples.

Results

Corneas soaked 15 minutes in 0.5% Genipin (0.5G) are less crosslinked than control. Higher soaking time did not increase the crosslinking effect. Topical application of 0.5G every hour for 2 hours showed 7% crosslinking effect. Drops of 0.5G applied for 30 minutes, 1 and 2 hours showed lower enzymatic degradation compared to control. Drops of 0.5G applied during 1, 2 and 8 hours showed higher thermal denaturation resistance than control.

Conclusions

This experimental study demonstrates that 140 µl drops of Genipin 0.5% applied hourly for 2 hours isan efficient CXL treatment. Further tests to optimize the concentration ofGenipin, the duration of treatment and the penetration in the cornea will becarried out before the application in humans.

Biography

Jorge Alió del Barrio, *Vissum Corporación*

Jorge L. Alió del Barrio MD, PhD specialised in Ophthalmology at the Ramón y Cajal University Hospital (Madrid, Spain) and he has completed Cornea Fellowships at Guy's and St Thomas' Hospital and Moorfields Eye Hospital (London, UK). He is currently working as a surgeon in the Cornea, Cataract and Refractive Surgery Service of Vissum Corporación (Alicante, Spain).He is also a Professor "ad Honorem" at Universidad Miguel Hernández(Alicante, Spain) School of Medicine. He is a PhD at the Surgery Department of Universidad de Alcalá (Madrid, Spain), with a Cum Laude Qualification.

Predicting cross-linking outcomes and infiltrates using molecular biomarkers – implications for point of care diagnostics

Oral - Abstract ID: 58

Dr. Natasha Pahuja [1]***, Dr. Rohit Shetty*** [1]***, Dr. Arkasubhra Ghosh*** [1]***, Dr. Pooja Khamar*** [1]***, Dr. Swaminathan Sethu*** [1]

1. *Narayana Nethralaya*

Purpose

To identify molecular factors that would aid in predicting favorable and adverse clinical cross-linking outcomes in keratoconus (KC).

Materials and Methods

The gene expression of lysyl oxidase (LOX), matrix-metalloproteinase 9 (MMP9), tissue inhibitor of metalloproteinase (TIMP1) and collagens were measured by Q-PCR in the epithelium (cone and periphery) of 37 KC patients undergoing CXL. Post-op visual acuity, refraction and keratometric outcomes were correlated with the expression of these molecular factors. Pre-op tears cytokine profiles (30 analytes) of the two patients who developed unilateral sterile infiltrates were analyzed using cytometric bead array.

Results

Pre-operative levels of cone specific LOX expression in cases of positive outcome were significantly higher. COL IVA1, TIMP1 gene expression was reduced in the cones of the subjects with sub-optimal outcome. The pre-op tear inflammatory markers (IL-1a, IL-9, ICAM-1, MCP-1, MIG, RANTES, bFGF, VEGF) were >1.5 fold higher in the eyes that developed sterile infiltrate as compared to the contralateral eyes (which also underwent cross-linking in both the patients.

Conclusions

Pre-operative levels of tissue factors and/or tear inflammatory cytokine profile aide in prediction of cross-linking outcomes. We are now developing a rapid point of care kit to detect these biomarkers in pre-operative tears for improved and evidenced based prediction of cross-linking outcomes and patient selection.

Biography

Natasha Pahuja, *Nar*

Dr Natasha Pahuja is a Cornea Refractive surgeon and a clinician scientist. She did herCornea Refractive fellowship at Narayana Nethralaya. She is also a PhD scholar at the Maastricht University. Her area of interest is keratoconus, advance imaging and basic science to understand molecular pathways driving diseases

She has many publications to her credit. She also servers as a member of editorial board of many international peer reviewed publications. She is a clinical and research scientist at the GROW laboratories. She has received many awards including the most prestigious Col. Rangachari Award at the All India Ophthalmic congress

Prolonged Iontophoresis-assisted Transepithelial Corneal Cross-linking for Pediatric Keratoconus: Three Years Results

Oral - Abstract ID: 18

Dr. Zhirong Lin [1]***, Mrs. Shunrong Luo*** [1]***, Dr. Nuo Dong*** [1]***, Dr. Xumin Shang*** [1]***, Mr. Xie Fang*** [1]***, Mr. Zhiwen Xie*** [1]***, Mrs. Lei Yan*** [1]***, Prof. Zuguo Liu*** [1]***, Prof. Huping Wu*** [1]

1. *Eye Institute & Affiliated Xiamen Eye Center of Xiamen University*

Purpose

To assess the long-term (three years) efficacy and safety of prolonged iontophoresis-assisted transepithelial corneal cross-linking (I-CXL) in pediatric patients with keratoconus.

Materials and Methods

Pediatric patients with keratoconus who underwent prolonged I-CXL (10 mins for iontophoresis) were included. Slit lamp examination, corneal epithelial fluorescein staining,uncorrected distance visual acuity (UCVA), best corrected distance visual acuity (BCVA), spherical equivalent and cylinder refraction, Scheimpflug tomography (Pentacam), anterior segment optical coherence tomography (AS-OCT),endothelial cell count and in vivo confocal laser scanning microscopy were assessed at baseline and at 3 days, 1 month, 1 year and 3 years postoperatively.

Results

21 eyes of 18 patients were included with mean age of 14.3 years. Mild punctate epithelial defect and mild discomfort was observed within three days postoperatively. Significant improvement of BCVA, mean SPH and K_{max} were observed within 1 year postoperatively but no significant improvement at 3 years. Confocal microscopy showed increased fiber links in the anterior stroma within 240 μm depth. Three patients (14.3%) showed progression at 3 year postoperatively.

Conclusions

Our long-term results up to 3 years postoperatively revealed that prolonged I-CXL is both effective and safe in stabilizing the progression of pediatric keratoconus presented with significant improvement of BCVA and K_{max}. Prolonged I-CXL has the advantage for pediatric patients with reduced postoperative pain, low risk of infection, and short surgery time. However, progression occurred in 14.3% of the treated eyes.

Biography

Zhirong Lin, *Eye Institute & Affiliated Xiamen Eye Center of Xiamen University*

Zhirong Lin received his M.D degree in Shanghai Medical College of Fudan University in 2008, and received his Ph.D degree in Zhongshan Ophthalmic Center of Sun Yat-sen University in 2011. After post-doctoral research, he worked in the Affiliated Xiamen Eye Center of Xiamen University. In recent years, he has devoted himself in the clinical and basic research related to keratoconus, dry eye, keratitis and keratoplasty, etc. He is now in charge of 2 NSFC grants and 6 provincial grants. He has published one book on CXL in China and several articles in international journals such as IOVS etc.

Reproducibility and repeatability of corneal OCT cross-linking demarcation line measurement by human operators compared to a novel automated detection software.

Oral - Abstract ID: 30

Dr. Shady Awwad [1]***, Dr. Ahmad R. Dhaini*** [2]***, Dr. Maamoun Abdul Fattah*** [1]***, Ms. Manal Chokr*** [2]

1. *American University of Beirut Medical Center,* ***2.*** *American University of Beirut*

Purpose

To evaluate the role of an automated detection software as compared to human operators in assessing the presence and depth of stromal demarcation line on OCT in keratoconus eyes post cross-linking

Materials and Methods

Two independent operators and an image analysis software examined 128 central corneal OCT cuts of 25 eyes of 25 patients post corneal cross-linking using the Dresden protocol, at 1 and 3 months postoperatively. Operators evaluated the presence of the demarcation line and measured its depth. The operators were blinded to patients' name, other examiners' results (human or software), and their own previous results. Repeatability and reproducibility were calculated and compared.

Results

The mean 3-month demarcation line was301.5±59.4, 301±31.7, and 324.6±48.7 microns as computed by the software and the operators, respectively. The Intraclass correlation coefficients (ICC) and pearson correlation coefficients between software and operators #1 and #2, were 0.957 and 0.909, and 0.843 and 0.918, respectively (P<0.001). The inter-operators ICC(1-month)=0.941, ICC(3-months)=0.799, intra-operator ICC=0.892 and 0.955, and intra-software ICC=1. The average operator time/OCT exam=31 seconds, compared to 1 second by the software.

Conclusions

With so many different iterations of the cross-linking technique being constantly developed, an objective, standardized, and fast success measurement tool is key to evaluating aggregate results. Detection of the demarcation line by human operators is repeatable and reproducible, but it can be further optimized and standardized by an ultrafast, objective, and accurate automated software detection tool, providing a reliable indicator for treatment success.

Biography

Shady Awwad, *American University of Beirut Medical Center*

Dr. Shady Awwad obtained his medical degree with the Alpha Omega Alpha award, completed an internship in general surgery, and a residency in ophthalmology at the American University of Beirut Medical Center (AUBMC). He pursued a fellowship in cornea and refractive surgery, and a fellowship in ophthalmic pathology, all at the University of Texas Southwestern Medical Center in Dallas. He is currently an associate professor and head of the cornea and refractive surgery division at AUBMC. He received the AAO achievement award and has 59 peer-reviewed publications. His research focuses on refractive surgery, keratoconus, IOL calculations, and corneal measurements.

Riboflavin concentration during crosslinking at the endothelial level

Oral - Abstract ID: 78

Dr. Theo G. Seiler [1], ***Dr. Ana Batista*** [2], ***Prof. Karsten König*** [2], ***Prof. Beatrice Früh*** [1]

1. *Universitätsklinik für Augenheilkunde, Inselspital Bern,* ***2.*** *Universität des Saarlandes*

Purpose

To determine the riboflavin concentration in the posterior stroma, Descemet´s membrane and endothelium.

Materials and Methods

Five human de-epithelialized cadaver corneas were mounted into artificial anterior chambers. After the establishment of stable physiological hydration, 0.1% riboflavin in 15% dextran was applied for 10 minutes onto the anterior surface. Multiphoton microscopy was used to determine 2-photon-fluorescence intensity and SHG-signals throughout each cornea with a step size of 2.5µm. To determine the absolute concentration, corneas were saturated with 0.1% riboflavin and measured a second time by multiphoton microscopy.

Results

Riboflavin concentration is decreasing in the posterior stroma down to 0.03%. Inside Descemet´s membrane the riboflavin concentration drops substantially, reaching only about 0.003% just anterior of the endothelium.

Conclusions

Theoretically calculated (0.02%) and experimentally measured (0.003%) endothelial riboflavin concentration shows a huge discrepancy. This implicates new, higher safety thresholds for human application of CXL.

Biography

Theo G. Seiler, *Universitätsklinik für Augenheilkunde, Inselspital Bern*
Medical School Zurich
Resident at IROC, TU Munich, Inselspital Bern,
Research Fellow at Harvard Medical School, Wellman Center for Photomedicine
Currently Inselspital Bern

Safe CXL of thin corneas: light attenuation (RF/UVA) versus limited photosensitizer penetration (WST-D/NIR) protecting the endothelium in corneas below 400µm.

Oral - Abstract ID: 36

Mr. Jurriaan Brekelmans [1]***, Mrs. Alexa Goz*** [2]***, Dr. Alexander Brandis*** [3]***, Dr. Mor Dickman*** [1]***, Prof. Avigdor Scherz*** [2]***, Prof. Rudy Nuijts*** [1]***, Dr. Arie Marcovich*** [2]

1. *University Eye Clinic Maastricht, Maastricht University Medical Center,* ***2.*** *Dept. Plant Science and Environmental Heatlh, Weizmann Institute of Science,* ***3.*** *Dept. Biological Services, Weizmann Institute of Science*

Purpose

Different CXL modalities or protocols achieve different chromophore concentrations at the endothelium. This results in different photodynamic activity and thus risk on endothelial damage. This study set out to experimentally assess human corneal endothelial cell safety in different CXL modalities.

Materials and Methods

Stromal RF and WST-D distribution was imaged by confocal fluorescence microscopy of ex vivo chromophore impregnated pig eyes (n=40). For both RF and WST-D CXL, a standard curve for endothelial toxicity was determined in vitro (HCEC-12, DSMZ, Germany) using combinations of different chromophore concentrations and light intensities.

Results

RF showed full stromal penetration in all corneas, whilst WST-D penetrated to variable depths, negatively related to the concentration of added Dextran. No WST-D was seen at the endothelium in any cornea. The in vitro study showed cellular toxicity linearly related to RF concentration and UVA intensity. For WST-D, a threshold around a concentration of 0.01mg/mL was seen for all NIR intensities. NIR alone did not cause endothelial toxicity.

Conclusions

In RF/UVA CXL, full stromal RF impregnation is needed to meet safety requirements, which results in potentially toxic photodynamic activity at the endothelium. The safe nature of NIR light allows effective stiffening without full stromal WST-D impregnation, excluding the risk of any photodynamic toxicity at the endothelial level. Control of chromophore penetration depth may allow safe CXL by WST-D/NIR of corneas thinner than 400µm.

Biography

Jurriaan Brekelmans, *Maas*

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Stromal Demarcation Lines in Corneal Crosslinking (CXL): What We Know about Supplemental Oxygen

Poster - Abstract ID: 81

Dr. Alexandra Nicklin [1], ***Dr. Rajesh Rajpal*** [1], ***Dr. Grace Lytle*** [1]

1. *Avedro Inc.*

Purpose

To evaluate the addition of supplemental oxygen on stromal demarcation line depth in corneal crosslinking. Updated peer-reviewed literature will be studied comparing the depth of demarcation lines with various crosslinking protocols, and will end in a review of case reports.

Materials and Methods

Articles discussing stromal demarcation (SD) line depth from the peer-reviewed literature from 2006 to present were studied to assess the correlation between treatment parameters and stromal demarcation (SD) line depth. Additionally, OCTs from protocols utilizing supplemental oxygen were evaluated to determine the effect on demarcation line.

Results

Data from the peer-reviewed literature on stromal demarcation line depth demonstrated that SD line depth varied depending on crosslinking treatment parameters. The range seen was 150 ± 18 μm to 300 ± 37 μm. Additionally, in reviewing OCTs of protocols utilizing supplemental oxygen, it was noted that epi-on protocols, which yield a shallower SD line depth, will increase by approximately 50 microns with the addition of supplemental oxygen.

Conclusions

In assessing stromal demarcation lines in varying treatment time and irradiation intensity settings, it is evident that epi-on protocols affect efficacy; however, the addition of supplemental oxygen can have a significant effect on the SD line depth. Ongoing research is still needed in order to best understand how the addition of supplemental oxygen can increase the efficacy in corneal crosslinking.

Biography

Alexandra Nicklin, *Avedro, Inc*

Director of Professional Education at Avedro, Inc in Waltham, MA.

Structural differences of the collagen fibrils (CFs) and proteoglycans (PGs) between the peripheral and central part of the keratoconus cornea (KC) – Ultrastructure and 3D transmission electron tomography

Oral - Abstract ID: 79

Prof. Saeed Akhtar [1]***, Mrs. Aljoharah Alkanaan*** [2]***, Mr. Adnan Khan*** [1]***, Prof. Turki Almubrad*** [2]

1. *Cornea Research Chair, King Saud University,,* ***2.*** *Cornea Research Chair, Department of Optometry, King Saud University,*

Purpose

To investigate the organization of collagen fibrils and proteoglycans in the lamellae of keratoconus corneal (KC) stroma. Three-dimensional electron tomography was carried out to understand the structure and arrangement of the CFs and PGs.

Materials and Methods

KC corneas were fixed in 2.5% glutaraldehyde and processed for electron microscopy. The ultrathin sections were observed under JEOL 1400 TEM, and digital images were taken with a bottom-mounted 11-megapixel Quamisa camera, using the iTEM software. In total, 120 digital images were taken from -60° to +60° angles to construct individual 3D images by using the software program "Composer-x64, version 3.4.2.0". Statistical analysis was performed using SPSS software.

Results

The mean CF diameter of central-anterior stroma was significantly (p‹0.001) larger than the peripheral-central stroma. The center to center distance of CFs was significantly smaller in the central-anterior stroma than in the peripheral-anterior stroma. The 'border to border distance of CFs' of the central stroma was significantly larger than the peripheral stroma. 3D imaging showed the degeneration of microfibrils within the CFs and disturbance in the attachment of the PGs.

Conclusions

The present study revealed that the peripheral stroma play an important role in the pathogenicity of the KC cornea. The presence of degenerated CFs in the undulated lamellae above the Descemet's membrane suggested that the keratoconus disease might be started from the pre-Descemet's stroma.

Biography

Saeed Akhtar, *Cornea Research Chair, King Saud University,*

Prof Saeed Akhtar has been working on the ultrastructure of normal and pathological cornea at Cornea Research Chair, King Saud University since 2007. His main research interests are investigating remodeling of collagen fibrils and proteoglycans in human and animal cornea affected by diseases such as keratoconus, post-LASIK cornea, cross-linked cornea, bullous keratopathy, granular dystrophy etc. These diseases cause the cornea to become opaque. Recently, he published a paper exploring the differences in the lamellar organization of the periphery and the center of the keratoconus cornea. This research showed that the origin of the undulating lamellae was above the Descemet's membrane.

The analysis of early safety and stability after Corneal collagen cross-linking in keratoconus

Poster - Abstract ID: 6

Dr. Wei Shengsheng [1]***, Prof. Liu Jianguo*** [1]

1. *Xi'an Fourth Hospital*

Purpose

To assess the early safety and efficacy of the corneal collagen cross-linking operation in keratoconic eyes.

Materials and Methods

In 18 cases (18 eyes), the rapid corneal collagen cross linking of the cornea was performed in patients with keratoconus. The examination results, including of naked eye sight, Km, the cornea thickness, corneal endothelial cell count, corneal biomechanics etc, were carried out in front of the operation, 1 week, 1 month, 1 month, 1 month, 3 months after operation.

Results

There was no statistically significant difference for Km, corneal endothelial cell counts and cornea thickness between the preoperative and postoperative. The pre-operative UCVA was 0.16±0.12. There was no statistically significant difference compared to 1 week, 1month and 3month postoperative. The Corvis ST's Radius and P.D ist improved in 1 week, 1month and 3month postoperative compared to pre-operative, but no statistically significant difference.

Conclusions

The rapid corneal collagen cross-linking operation of the interepithelium is associated with better safety and stability in the early stages of the treatment. Postoperative corneal biomechanics showed improvement.

Biography

Wei Shengsheng, *Xi'an Fourth Hospital*

Wei shengsheng: master of ophthalmology, Member of Chinese academy of ophthalmology, The main research direction is laser correction refractive and keratoconus diagnosis and treatment. In 2016, carrying out the rapid corneal collagen cross-linking operation at firstly in the northwest region of China. Its research results published in "Graefes Arch Clin Exp Ophthalmol", "Current Eye Research" and "Chinese journal of ophthalmology". The research on corneal biomechanics of keratoconus cornea has been conducted in many domestic and provincial ophthalmological meetings, and has conducted academic exchanges with experts and scholars at domestic and abroad.

The application of Transepithelial Phototerapeuthic Kerathectomy and Collagen Cross-linking in Pellucid Marginal Degeneration/PMD/ , case report.

Poster - Abstract ID: 23

Dr. Beata Sawicka Wojtiuk [1]

1. *Gabinety Okulistyczne*

Purpose

The aim of this report was to introduce the six months results of Transepithelial PTK + collagen cross-linking in two eyes of two patients with PMD.

Materials and Methods

Two eyes of two patients with PMD were enrolled to Transepithelial PTK + collagen cross-linking after general ophthalmic examination , tomography of the cornea with TMS 5, OCT- pachymetry and evaluation of epithelium's thikness with Spectralis SOCT HRA Transephthelial PTK with Schwind Amaris 500HZ Smart Surf was decentered 1mm lower, Hypotonic solution of ryboflavine was used to soak cornea and then collagen cross-linking was performed 9 minutes 10mW/cm□ .

Results

After 6 months Higher Order Aberrations in both patients were reduced in 3mm and in 6mm zone .Best corrected visual acuity was better in one patient from 0,09 logMar to 0,04 with lower correction , the second from 0,69 logMar to 0,15. K min has changed from 37,4D to 38,6 D and from 34,0 D to 36,7D.

Conclusions

In our two patients with PMD Transephithelial PTK + Collagen cross-linking was able to reduce HOA, and improve vision in 6 months of observation. Interestingly in those cases we observe the change in K min not K max .This result is different in PMD then in keratoconus . We need more patients and more time to establish the risk and observe the results of the procedure in this rare disease.

Biography

Beata Sawicka Wojtiuk, *Gabinety Okulistyczne*

I was studing in Medical University of Lublin, Poland, from 1983 to 1989.I finished an ophtalmology training and passed an exam in1998.I work as consultant -ophtalmologist in Gabinety Okulistyczne in Lublin. I deal with general ophtalmology, different types of contact lens fitting, refractive surgery and cross-linking.

The role of oxygen in corneal cross-linking (CXL) reactions

Oral - Abstract ID: 84

Dr. Grace Lytle [1]***, Dr. Alexandra Nicklin*** [1]***, Dr. Rajesh Rajpal*** [1]

1. *Avedro, Inc*

Purpose

The expansion of CXL into the refractive domain requires that the procedure be predictable and customizable. We aim to elucidate the role of oxygen in the amount and distribution of cross-link bonds formed, and demonstrate the impact on corneal curvature.

Materials and Methods

In a series of pre-clinical studies, fresh whole porcine eyes were brought to 37°C in a humidity chamber and maintained at an IOP of 15mmHg. Corneas were saturated with riboflavin, irradiated with constant or pulsed irradiance in the ambient atmosphere or in a chamber with 100% oxygen concentration. Mechanical, fluorometric and topometric analyses were used to measure increases in corneal stiffness, formation of cross-linked bonds, and change in corneal curvature.

Results

Mechanical analysis showed an increase in corneal stiffness and fluorometric analysis showed a higher response for cross-linking performed in an oxygen rich environment or with pulsed UVA. The combination of pulsed UVA and an oxygen rich environment produced the most corneal stiffening and the highest fluorometric response. Greater corneal flattening is observed under conditions resulting in greater corneal stiffening.

Conclusions

Both pulsing and performing irradiation in an oxygen rich environment increased the amount of cross-linking achieved for the same UVA energy dose. When combined they have an additive effect. The addition of supplemental oxygen during CXL procedures has the potential to increase the magnitude of the treatment effect for the same total UVA energy dose, and has implications for improving the efficiency of epithelium-on procedures.

Biography

Grace Lytle, *Avedro, Inc*

Grace Lytle, OD, MS is an optometrist and the vice president of Medical Affairs at Avedro, inc. She received her doctorate in optometry from the New England College of Optometry, continuing on to complete a research masters degree in vision science in the area of ocular growth mechanisms and the development of myopia. After completing advanced residency training in cornea and contact lens at the New England Eye Institute, Grace practiced optometry in clinical practice and served as an instructor in the contact lens laboratory course at the New England College of Optometry before joining Avedro in 2012.

Tomographic and refractive characteristics of pediatric first degree relatives of Keratoconus patients

Poster - Abstract ID: 73

Dr. Shady Awwad [1]***, Dr. Carl Joe Mehanna*** [1]***, Dr. Madeleine Yehia*** [1]***, Dr. Maamoun Abdul Fattah*** [1]***, Dr. Alain Saad*** [1]

1. *American University of Beirut Medical Center*

Purpose

To evaluate the tomographic and refractive characteristics of pediatric first degree relatives of newly diagnosed Keratoconus patients

Materials and Methods

A prospective study identifying the first degree relatives, aged 6-19 years, of newly diagnosed keratoconus patients at the American University of Beirut Medical Center. Scheimpflug tomography, manifest and cycloplegic refraction, and slit lamp and dilated fundus exam were performed on all participants. Outcome measures included anterior curvature indices, posterior elevation values, refractive and topographical astigmatism, pachymetry and SimK. Two experienced cornea and refractive surgeons independently evaluated the participants topographical outputs.

Results

181 first-degree relatives were recruited. Topographic evaluation assessed by two independent cornea specialists revealed 17.7% (32 patients) with keratoconus (9.9% of patients aged<= 11 years, 16.7% of aged 12-15 years, and 26.5% of patients aged 16-19 years). The mean SimK, thinnest pachymetry, mean topographic and refractive astigmatism were 43.72±1.78 D, 537.9±41.21 microns, 1.31±1.20 D, and 0.92±1.30 D, respectively. 11.6% and 7.8 % of eyes had a thinnest pachymetry<500 and<490 microns.

Conclusions

The incidence of Keratoconus in pediatric first degree relatives of diagnosed Keratoconus patients is high and warrants screening in the clinical setting. The findings of marginal tomographic parameters in the absence of Keratoconus in many patients suggest a potential for progression or a variable clinical penetrance of the disease, pending environmental or genetic predisposition.

Biography

Shady Awwad, *American University of Beirut Medical Center*

Dr. Shady Awwad obtained his medical degree with the Alpha Omega Alpha award, completed an internship in general surgery, and a residency in ophthalmology at the American University of Beirut Medical Center (AUBMC). He pursued a fellowship in cornea and refractive surgery, and a fellowship in ophthalmic pathology, all at the University of Texas Southwestern Medical Center in Dallas. He is currently an associate professor and head of the cornea and refractive surgery division at AUBMC. He received the AAO achievement award and has 59 peer-reviewed publications. His research focuses on refractive surgery, keratoconus, IOL calculations, and corneal measurements.

Topo-guided removal of epithelium in keratoconus eyes (TREK): A novel tissue saving customised ablation strategy.

Oral - Abstract ID: 50

Dr. Pooja Khamar [1], ***Dr. Rohit Shetty*** [1], ***Dr. abhijit sinha roy*** [1]

1. *Narayana Nethralaya*

Purpose

To evaluate the treatment outcome of customised topo-guided epithelium removal (TREK) and corneal crosslinking in the management of keratoconus (KC) in terms of mean stromal ablation, visual outcome, mean keratometry, and aberrations.

Materials and Methods

40 KC eyes (grade II, III) underwent TREK executed on PTK-CAM module of Schwind-Sirius topographer(SCHWIND eye-tech-solutions GmbH, Germany), with a customised zone according to the cone size (centred on the cone apex) to a depth 20µm greater than epithelial thickness (RTVue®, Optovue Inc., Fremont, CA). After TREK, surrounding 5 mm epithelium was manually removed followed by accelerated collagen crosslinking. Visual acuity, keratometry and aberrations were evaluated 6 months after surgery.

Results

TREK resulted in significantly lesser mean stromal ablation (23.11±0.42 µm) as compared to published topography guided PRK data (48.09±9.6 µm). There was a statistically significant difference ($p < 0.05$) between The Pre and Post- operative mean keratometry (2.069±0.441D), defocus (1.055±0.220 µm), spherical aberration (0.219 ± 0.046µm) and RMS of higher order aberration (0.37 ± 0.077 µm).

Conclusions

Visual outcomes in the novel topography guided removal of epithelium are similar to topography guided PRK and has the additional advantage of minimising the stromal ablation in KC.

Biography

Pooja Khamar, *Narayana Nethralaya*

Clinical and Translational Scientist at Genes, Repair and Regeneration in Ophthalmic Workstation(GROW) Laboratory and Imaging, Biomechanics and Mathematical Solutions (IBMS), Narayana Nethralaya. Current areas of work include Epithelium, biomechanics and tear biomarker in keratoconus, Dry eye and biomarker, Autophagy and ectasia, Artificial Intelligence & Crosslinking. Presented in various national and international conferences

Transepithelial Versus Epithelium-off Corneal Cross-Linking for Progressive Corneal Ectasia: A Meta-Analysis of Randomized Controlled Trials

Poster - Abstract ID: 10

Dr. Hidenaga Kobashi [1]***, Dr. Shi Song Rong*** [2]***, Prof. Joseph Ciolino*** [1]

1. *Schepens Eye Research Institute,* ***2.*** *Massachusetts Eye and Ear Infirmary*

Purpose

To compare the efficacy and safety of transepithelial corneal collagen cross-linking (CXL) to epithelium-off CXL in progressive corneal ectasia by summarizing randomized controlled trials (RCTs) using a meta-analysis.

Materials and Methods

A comprehensive search was performed using Cochrane Collaboration methodology to evaluate the clinical outcomes of transepithelial CXL and epithelium-off CXL. The outcome parameters included maximum keratometry, corneal thickness, visual acuity, spherical equivalent refraction, cylindrical refraction, and adverse events one year after each technique. Estimates were evaluated by weighted mean difference (WMD) and 95% confidence interval (CI) for absolute changes of the efficacy outcomes during 1-year observation periods.

Results

We identified five RCTs involving 322 eyes for this meta-analysis. Epithelium-off CXL group showed significant better outcome in postoperative changes in maximum keratometry (WMD=1.11; 95% CI: 0.98 to 1.24; $p<0.0001$), whereas transepithelial CXL represented significant better in corneal thickness (WMD=5.02; 95% CI: 0.30 to 9.74; $p=0.04$) and best spectacle-corrected visual acuity (WMD=-0.05; 95% CI: -0.09 to -0.01; $p=0.01$). There was no significant difference between the two groups in other parameters.

Conclusions

Although subjects in the transepithelial CXL demonstrated a greater improvement in best spectacle-corrected visual acuity compared with subjects in the epithelium-off CXL at 1 year follow-up, transepithelial CXL has less impact on halting progressive corneal ectasia in terms of maximum keratometry than epithelium-off CXL.

Biography

Hidenaga Kobashi, *Schepens Eye Research Institute*

Hidenaga Kobashi used be a Postdoctoral fellow at Harvard Medical School and an Investigator at Massachusetts Eye and Ear Infirmary, Boston, Massachusetts. His main focus of work and research is contact lens drug delivery and corneal cross-linking.

Update on successful corneal crosslinking without epithelial removal

Oral - Abstract ID: 15

Dr. Doyle Stulting [1], ***Dr. Willliam Trattler*** [2], ***Dr. Jonathan Woolfson*** [1], ***Dr. Roy Rubinfeld*** [3]

1. *Woolfson Eye Institute,* ***2.*** *Center for Excellence in Eye Care,* ***3.*** *Georgetown University Medical Center*

Purpose

To investigate the effect of riboflavin-UVA corneal crosslinking without epithelial removal (epi-on CXL) on keratoconus and ectasia after LASIK.

Materials and Methods

592 eyes with keratoconus or ectasia after LASIK were treated with a novel riboflavin formulation, then exposed to a UVA light system with on-off cycling for 30 minutes. Most were bilateral, simultaneous treatments. Uncorrected visual acuity (UCVA), corrected distance visual acuity (CDVA), maximum corneal curvature (Kmax), total high-order aberrations (HOA), and coma were measured preoperatively and at 3, 6, 12, and 24 months postoperatively.

Results

UCVA and CDVA improved 0.5-1.5 Snellen lines at 1 and 2 years ($p<0.0001$). Kmax decreased 0.48 D at 2 years ($p=0.0002$). Total HOA and coma decreased 36% ($p<0.0001$) and 37% ($p=0.0002$) at 1 and 2 years, respectively. Three times more eyes had a reduction of >1 D Kmax than those that had an increase in Kmax ($p<0.0001$). No eyes had >1D increase in Kmax and lost >1 line of CDVA.

Conclusions

Epi-on CXL using this novel protocol halts the progression of keratoconus and ectasia after LASIK for at least 2 years. It is safer and provides more rapid visual recovery than traditional CXL with removal of the epithelium (epi-off CXL), allowing routine bilateral, simultaneous treatment with minimal patient inconvenience.

Biography

Doyle Stulting, *Woolfson Eye Institute*

Dr. Stulting is Director of the Stulting Research Center at Woolfson Eye Institute, having served as a faculty member and Professor of Ophthalmology at Emory University for 29 years. He has published over 230 papers in the peer-reviewed literature, received the Lifetime Achievement Award from the American Academy of Ophthalmology, the Payton Award from the Eye Bank Association of America, and the Binkhorst Award from the American Society for Cataract and Refractive Surgery. He is Past President of the American Society for Cataract and Refractive surgery and previous Editor-In-Chief of the journal Cornea.

CXL in refractive laser surgery

Biomechanical analysis of different re-treatment options after SmILE refractive surgery

Oral - Abstract ID: 44

Dr. Bogdan Spiru [1]***, Dr. Sabine Kling*** [2]***, Prof. Farhad Hafezi*** [3]***, Prof. Walter Sekundo*** [1]

1. *Department of Ophthalmology, Philipps University of Marburg,* ***2.*** *Ocular Cell Biology Lab, CABMM, University of Zurich,* ***3.*** *ELZA Institute, Dietikon/Zurich; University of Southern California, Los Angeles, CA, USA*

Purpose

To determine the corneal weakening induced by different re-treatment options after SmILE, and to investigate the potential of corneal cross-linking (CXL) to re-establish the original corneal stress resistance.

Materials and Methods

96 porcine corneas were used. The initial refractive correction was -11D, the enhancement -3D. Three re-treatment options were analyzed: (i) Re-SmILE, (ii) PRK and (iii) cap-to-flap conversion with excimer ablation ("LASIK"). The (iv) control group received no treatment. Subsequently, accelerated CXL (9mW/cm2, 10min) was performed in two groups with currently common enhancement techniques: (v) in "LASIK" and (vi) in controls. Biomechanical properties were measured with stress-strain extensometry (1.27 to 12.5N).

Results

The Re-SmILE and PRK enhancement did not significantly reduce the overall elastic

modulus of the cornea compared to controls (24.7+/-2.23 MPa and 22.7+/-2.61 MPa versus 23.8+/-3.35 MPa, p=0.176), while LASIK enhancement did (22.2+/-3.37 MPa, p=0.048). CXL treatment significantly increased the elastic modulus compared to all non-cross-linked conditions (p=0.001). Refractive surgery decreased the overall elastic modulus by 7%, while CXL increased it by 20%.

Conclusions

In enhancement, the corneal biomechanical integrity is less affected with both, Re-

SMILE and PRK enhancement. Corneal weakening through laser refractive surgery is small compared to the stiffening effect after CXL.

Biography

Bogdan Spiru, *Universitäts-Augenklinik Bonn*

Dr. B. Spiru is in the final year of residency (FEBO, May 2017) at the Univ. Eye Clinic of Marburg, Prof. Sekundo.

CXL+ is it safe?

Oral - Abstract ID: 70

Prof. joseph frucht pery [1]

1. *Hadassah Univ Hospital*

Purpose

To present complications of combined CXL and PRK.

Materials and Methods

Presentation of 4 cases with unexpected outcomes post CXL+ procedure, 4 months to 4 years after the combined procedure in and out of Israel.

Results

2 cases had severe corneal scars requiring corneal transplants. 2 other cases had unstable changes with decrease of CDVA.

Conclusions

Risks of combined PRK and CXL should be clearly explained prior to each procedure. It should not be offered to patients with good UCVA and/or DCVA.

Biography

joseph frucht pery, *Hadassah Univ Hospital*

Director of cornea and refractive surgery unit. Department of Ophthalmology, 1989 - 2016.

EFFECTIVENES OF ACCELERATED CORNEAL COLLAGEN CROSSLINKING FOR KERATOCONUS PATIENTS : A COMPARISON OF TWO PROTOCOLS

Poster - Abstract ID: 65

Mrs. Reny Setyowati [1]***, Prof. Suhardjo .*** [1]

1. *Universitas Gadjah Mada*

Purpose

Accelerated~ Corneal Collagen Cross-Lingking (A-CXL) has been developed to shorten the duration of the procedure by increasing illumination intensity.~ This study has a purpose to~compare short term outcome of two different protocols of A-CXL for keratoconus patients.

Materials and Methods

Nonrandomized clinical control study at Dr Sardjito Hospital in Yogyakarta, Indonesia. Keratoconus patients were divided into two groups consecutively. Patients underwent a detailed ophthalmic and medical examination. Refraction and keratometric values are measured preoperatively and postoperatively. Four eyes were treated with 9 mW/cm2 for 10 minutes (group 1) and 12 eyes were treated with 18 mW/cm2 for 5 minutes (group 2). The data of the two groups were compared statistically.

Results

After 3 months, patients~evaluation in group 1, minimum and maximum~keratometry flattened by 2,33 diopters (p=0,465) and~2 diopters (p=0,715), respectively. In group 2, minimum and maximum~keratometry flattened by 4,50 diopters (p=0,207) and~3,20 diopters (p=0,779), respectively. There were no inter-group differences in the changes in keratometry values between group 1 A-CXL and group 2 A-CXL at 3 months postoperatively (p=0,571)

Conclusions

Keratometric parameter results of both protocols A-CXL for the treatment of keratoconus in short time period were similar.

Biography

\textbf{Reny Setyowati}\emph{, Universitas Gadjah Mada} Born in Medan, North Sumatra, Indonesia at 1988 Now she is in her final year of~Opthalmology Residency at Universitas Gadjah Mada She is also a~young staff at Corneal Division at the same institution.

Epithelial corneal mapping in keratoconus: to do or not to do ?

Poster - Abstract ID: 80

Prof. mouhcine EL BAKKALI [1]***, Ms. asmaa sami*** [1]

1. *Clinique de la vision de Rabat*

Purpose

Our aim is to demonstrate the usefulness or not of an epithelial mapping practice in Keratoconus while attempting to respond to the following questions:

- Is there a place in diagonosing of infra clinic, evolving forms , before and after crossliking?

Materials and Methods

24 eyes aged: 21 and 37 years, suffering from evolving keratoconus has had a topography and a corneal OCT before 1, 3 and 6 months on average after crossliking.

We have analysed the following factors :

The thickness of the corneal epithelium before and after crossliking on the cone, around the cone, the thinnest point of the epithelium in relation to the thinnest point, and the mapping stability after crossliking.

Results

- There is an epithelium mapping variation in regard to the cone as well as to the bulging of the posterior side.
- There is an epithelium mapping variation after crossliking.
- The modifications of the epithelium thickness are constant in the Keratoconus.
- The thickness of the corneal epithelium is different from a normal cornea.

Conclusions

The rapid turnover and the easy access of the corneal epithelium to the modern OCT makes us think suppose that :

the epithelium mapping could uncover some unknown aspects in the diagnosis of infra clinic aspect and in the establishment of a reliable criteria for evolving forms or Keratoconus stability.

Biography

mouhcine EL BAKKALI, *Clinique de la vision de Rabat*

Professor on ophtalmology , actualy director of Clinique de la vision de Rabat

graduate of the University of Medicine of Rabat and Bordeaux

specializing in corneal pathology and refractive surgery.

Epithelium-on Photorefractive Intrastromal Corneal Cross-linking (PiXL) with Supplemental Oxygen for the Treatment of Low Myopic Refractive Error: 6 Month Results of a Prospective Clinical Study

Poster - Abstract ID: 72

Dr. Matthias Elling [1]***, Ms. Sarah Hauschild*** [1]***, Prof. Burkhard Dick*** [1]

1. *Universitäts-Augenklinik Bochum*

Purpose

To evaluate the safety and efficacy of a new method for reduction of low myopic refractive error in healthy myopic eyes through the targeted application of high dose, pulsed, accelerated corneal cross-linking in a circular spot pattern.

Materials and Methods

This 6-month, single center, prospective study included healthy eyes with myopia. Epithelium-on PiXL with supplement oxygen was performed on 21 study eyes using the Mosaic System and riboflavin eye drops. Efficacy was assessed by UCVA, MRSE, and the mean change in corneal curvature (Kmean, K Flat, and K Steep) from baseline. Safety was determined by loss of BCVA, slit lamp biomicroscopy, endothelial cell count and incidence of adverse events.

Results

6-month analysis included 21 eyes. The mean change in MR and MRSE from baseline to 6 months was 1.6 diopters and 1.8 diopters. The mean change in UCVA from baseline to 6 months was 4 lines. There were significant reductions in Kmean, Kflat and Ksteep at all follow-up visits versus baseline (all $p<0.05$). An endothelial cell count performed at 1 month postoperative showed no significant changes.

Conclusions

Epithelium-on PiXL procedure with supplemental oxygen is a promising method for reducing low myopic refractive error in healthy eyes without ablation or removal of stromal tissue. This method may be evaluated as an alternative to conventional refractive surgery. Additional studies are needed to refine treatment parameters and confirm long term stability of the approach.

Biography

Matthias Elling, *univ*

Head physician and co-chair at University Eye Hospital Bochum

Special interest in anterior segment and refractive surgery

First PiXL treatment in October 2014

In vivo Brillouin frequency shifts of crosslinked and uncrosslinked corneas in keratoconus

Oral - Abstract ID: 83

Dr. Theo G. Seiler [1]***, Dr. Peng Shao*** [2]***, Dr. Amira Eltony*** [2]***, Dr. Valéry Wittwer*** [3]***, Dr. Tobias Koller*** [3]***, Prof. Seok-Hyun Yun*** [2]***, Prof. Theo Seiler*** [3]

1. *Universitätsklinik für Augenheilkunde, Inselspital Bern,* ***2.*** *Harvard Medical School,* ***3.*** *IROC AG*

Purpose

To investigate Brillouin frequency~shifts of keratoconus corneas and the influence of CXL on corneal elastic modulus in vivo.

Materials and Methods

Brillouin~frequency~shift maps were acquired~to determine corneal rigidity with~a high spatial resolution using the BOSS-system. Eyes of patients suffering\\from progressive keratoconus as well as eyes having received crosslinking (CXL)\\more than 12 months ago were examined using Brillouin microscopy and\\Scheimpflug tomography. Rigidity maps and corneal tomographies were analyzed\\for possible correlations and compared between both groups.

Results

Brillouin~maps in keratoconus demonstrate, that the cornea is not suffering from a uniform~but rather a focal weakening with a peak Brillouin-shift of 5.67±0.02GHz in the ectatic region compared to a Brillouin-shift~of 5.74±0.02GHz in the normal corneal periphery. Maximal~corneal posterior float is significantly correlated with maximal weakening in~corneal Brillouin maps. Brillouin frequency~shifts were significantly lower (weaker) in~uncrosslinked corneas compared to crosslinked corneas.\\

Conclusions

Keratoconus~corneas suffer from a focal weakening. Corneal tomography, in particular the~maximum posterior float might serve as an estimation for the weakest point.~This may help to improve customized irradiation patterns in corneal\\crosslinking in order to optimize visual outcome for patients with progressive\\corneal ectasia

Biography

\textbf{Theo G. Seiler}\emph{, Universitätsklinik für Augenheilkunde, Inselspital Bern} Medical School Zurich Resident at IROC, TU Munich, Inselspital Bern,~ Research Fellow at Harvard Medical School, Wellman Center for Photomedicine Currently Inselspital Bern

Laser Induced Ionization Field Crosslinks Biological Media in Absence of Photosensitizers

Oral - Abstract ID: 85

Dr. Mikhail Fomovsky [1], Mr. Chao Wang [1], Dr. Stephen Trokel [2], Dr. Sinisa Vukelic [1]

1. *Columbia University,* ***2.*** *Columbia University Medical Center*

Purpose

Spatially resolved crosslinking of collagenous biological media has been achieved in absence of photosensitizers via utilization of ultrafast lasers. The treatment is being investigated for its potential to produce geometrically defined volumes of crosslinked corneal tissue for therapeutic~purposes.

Materials and Methods

Novel laser-tissue interaction paradigm has been achieved by confining lasing regime below the optical breakdown threshold, thus restricting the treatment to photochemical effects. As such, the treatment omits thermal accumulation, which would denature collagen fibrils. Careful~tailoring of processing~parameters confines induced~ionization field to~the focal volume, resulting in ability to control the crosslinking process, and thus limit the alterations to desired region of the irradiated media.~

Results

Findings obtained from~Electron Paramagnetic Resonance Spectroscopy and Fluorescence Microsocopy have confirmed our hypothesis. The process~has then been applied onto porcine and rabbit eyes, and post-treatment characterization~has shown~changes in crosslink density, mechanical properties as well as overall geometry of corneal tissue.~Temperature increase during the procedure is~well below denaturation threshold, and histology has confirmed absence of thermal damage.~Complementary results have been observed in articular cartilage.~

Conclusions

By carefully tailoring of the laser-induced amendments in the target tissue, which could be ocular tissue, tendon or articular cartilage, one has ability to induce structural modification that further triggers alteration of its mechanical properties as well as overall geometry. Therefore, the proposed laser-tissue interaction method has potentially tremendous therapeutic value. Specifically, this technique has allowed us to change the mechanical properties and the geometry of exposed corneal stroma.~\\

Biography

\textbf{Sinisa Vukelic}\emph{, Columbia University} Dr. Vukelic has obtained his PhD from Columbia University in 2009 and was appointed as Assistant Professor at Bucknell University. In 2013 he has joined Columbia University faculty. Dr. Vukelic's research interests include~investigation of underlying phenomena behind the interaction of~lasers with biological media. In addition to basic science, Dr. Vukelic's research projects include translational research in which fundamental concepts are applied onto practical clinical problems such as correction of refractive errors, treatment of corneal~ectasias, as well as development of novel treatment for early osteoarthritis.~~\\

Non-contact technique for direct corneal strength measurement

Oral - Abstract ID: 29

Dr. Dimitri Chernyak [1]

1. *Intelon Optics, Inc.*

Purpose

Multiple techniques have emerged in recent years for measuring corneal biomechanics. While useful, these devices are~influenced by IOP and corneal geometry. Extracting data from such measurements relies on assumptions and modeling,~doesn't provide spatial aspect of elasticity across cornea.

Materials and Methods

Brillouin Spectroscopy has been recently shown to measure corneal biomechanical strength directly and to provide spatial mapping of the strength modulus in tissue. It uses low-power laser to determine elastic modulus of ocular tissue by analyzing the return signal spectrum. ~The laser is~within published safety limits of exposure for ocular tissues. Unlike Raman scattering, Brillouin spectroscopy involves low frequency scatter that directly relates to elastic bulk properties of material.

Results

Laboratory measurements of various polymers have shown close correlation with published elastic modulus data for these reference materials. Human clinical studies have demonstrated significant difference in the elastic modulus of normal corneas versus corneas diagnosed with keratoconus condition. Clinical data has also shown statistically significant changes associated with corneal crosslinking treatment for keratoconus patients in the anterior cornea, where crosslinking was applied.

Conclusions

Brillouin Spectroscopy data provides unique and direct measurement of corneal elastic properties across tissue volume. Access to such information may allow physicians to customize refractive surgery nomograms as well as crosslinking treatment parameters for controlling keratoconus progression.

Biography

\textbf{Dimitri Chernyak}\emph{, Intelon Optics, Inc.} Dimitri has 15+ years of experience in developing diagnostic and surgical devices in ophthalmology and has been Scientific Advisor to several companies in~medical software and data analytics. Dimitri earned a PhD in Vision Science at UC Berkeley in 2001. His research was centered on modeling of attention, eye movements and object recognition. Born in Moscow, Russia, he attended the Biology Department of Moscow State University, and in 1992 received a BA degree from Brandeis University, Waltham, MA, in Mathematics and Biology. In 1994, he was awarded an MA degree in Cognitive and Neural Systems from Boston University.~

Photorefractive intrastromal cross-linking (PiXL) for the treatment of low myopia

Poster - Abstract ID: 71

Dr. Gitansha Sachdev [1], ***Dr. Shreyas Ramamurthy*** [1]

1. *The Eye Foundation*

Purpose

To evaluate the safety and efficacy of Photorefractive Intrastromal Cross-linking (PiXL) for the treatment of low myopia. To evaluate the treatment parameters impacting the efficacy of treatment in reduction of myopic refractive error

Materials and Methods

PiXL was performed in 40 eyes of patients seeking refractive correction,using the Mosaic system with accelerated CXL. Epithelium-on approach with supplemental oxygen was used. The efficacy was determined by the mean change in manifest refraction spherical equivalent (MRSE), uncorrected distance visual acuity (UDVA) and corneal curvature from baseline. Safety was demonstrated by endothelial cell loss (specular microscopy) and visually significant corneal haze. Follow-up period was 4-6 months.

Results

The mean change in MRSE from baseline was 1.08 +/-0.3D at 1 month with a change in UDVA of 0.56 +/- 0.24. The mean change in corneal curvature was 0.82 +/- 0.45 D. None of the eyes showed regression during 6-month follow-up. No significant endothelial cell count or loss of best corrected visual acuity due to corneal haze was noted.

Conclusions

The epithelium on protocol with supplemental oxygen showed reduction in myopic refractive error utilizing PiXL

Biography

Gitansha Sachdev, *The Eye Foundation*

The author is currently working as the Academic Coordinator and Consultant - Cataract and Refractive Services at The Eye Foundation, Coimbatore. During her residency training she received the prestigious Indian Council of Medical Research (ICMR) grant for her work in corneal collagen cross-linking. She has authored various chapters in books on refractive surgery and has multiple publications to her credit. She is currently the assistant editor of refractive surgery for the Indian Journal Of Ophthalmology (IJO).

Phototherapeutic intrastromal corneal collagen cross-linking (PiXL) with two different UV irradiation protocols for treatment of low-grade myopia

Oral - Abstract ID: 34

Ms. Anneli Fredriksson [1], ***Ms. Anna Alm*** [1], ***Prof. Anders Behndig*** [2]

1. *Department of Clinical Sciences/Ophthalmology, Umeå University, Umeå,* ***2.*** *Department of Clinical Sciences/Ophthalmology, Umeå University, Umeå,*

Purpose

To compare the efficacy and safety of PiXL for low-grade myopia with UV irradiation in a central 4 mm zone (protocol A; group A) and in a central 4 mm ring-shaped zone (protocol B; group B).

Materials and Methods

Low-grade myopic participants were treated with PiXL in a high-oxygen environment (95±2%O_2). Participants were randomized to receive protocol A (total dose of 1.9 Joule (J)) in one eye and B (total dose of 1.0 J) in the other. Corrected (CDVA) and uncorrected visual acuities (UDVA), refractive spherical equivalents (SE), endothelial cell count (ECC), patient reported vision and discomfort, as well as adverse events were analyzed pre- and postoperatively

Results

In group A (n=15 eyes), the UDVA of 0.65±0.25 (mean±SD) LogMAR and SE of -1.47±0.58D improved to 0.15±0.29 LogMAR (p=0.001) and -0.46±0.53D (p=0.003) at 6 months (n=7 eyes). Group B (n=15 eyes) displayed similar results with a change in UDVA from 0.67±0.24 to 0.09±0.27 LogMar (p<0.001), and SE from -1.47±0.47D to -0.32±0.47D (p<0.001) at 6 months (n=7 eyes). The ECC and CDVA remained unchanged. No adverse events occurred.

Conclusions

Early results indicate that both PiXL protocols are promising non-invasive alternatives to refractive surgery for low-grade myopic patients. However, participants reported better vision at 1 week and 1 month after treatment in eyes treated according to protocol B. The results of this ongoing study are preliminary, and more complete follow-up visits are needed to evaluate the stability of the results.

Biography

Anneli Fredriksson, *Department of Clinical Sciences/Ophthalmology, Umeå University, Umeå*

Medical intern at Västerås hospital and PhD student at the department of Clinical Sciences/Ophthalmology at Umeå University. Publications:

"Measurement centration and zone diameter in anterior, posterior and total corneal astigmatism in keratoconus." Fredriksson A, Behndig A. Acta Ophthalmol. 2017 Jul 10. doi: 10.1111/aos.13517. [Epub ahead of print]

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"Eccentric small-zone ray tracing wavefront aberrometry for refraction in keratoconus." Fredriksson A, Behndig A. Acta Ophthalmol. 2016 Nov;94(7):679-684. doi: 10.1111/aos.13183. Epub 2016 Aug 6

Riboflavin concentration during crosslinking at the endothelial level

Oral - Abstract ID: 78

Dr. Theo G. Seiler [1], ***Dr. Ana Batista*** [2], ***Prof. Karsten König*** [2], ***Prof. Beatrice Früh*** [1]

1. *Universitätsklinik für Augenheilkunde, Inselspital Bern,* ***2.*** *Universität des Saarlandes*

Purpose

To determine the riboflavin concentration in the posterior stroma, Descemet´s membrane and endothelium.

Materials and Methods

Five human de-epithelialized cadaver corneas were mounted into artificial anterior chambers. After the establishment of stable physiological hydration, 0.1\% riboflavin in 15\% dextran was applied for 10 minutes onto the anterior surface. Multiphoton microscopy was used to determine 2-photon-fluorescence intensity and SHG-signals throughout each cornea with a step size of 2.5µm. To determine the absolute concentration, corneas were saturated with 0.1\% riboflavin and measured a second time by multiphoton microscopy.

Results

Riboflavin concentration is decreasing in the posterior stroma down to 0.03\%. Inside Descemet´s membrane the riboflavin concentration drops substantially, reaching only about 0.003\% just anterior of the endothelium.

Conclusions

Theoretically calculated (0.02\%) and experimentally measured (0.003\%) endothelial riboflavin concentration shows a huge discrepancy. This implicates new, higher safety thresholds for human application of CXL.

Biography

\textbf{Theo G. Seiler}\emph{, Universitätsklinik für Augenheilkunde, Inselspital Bern} Medical School Zurich Resident at IROC, TU Munich, Inselspital Bern,~ Research Fellow at Harvard Medical School, Wellman Center for Photomedicine Currently Inselspital Bern

The role of oxygen in corneal cross-linking (CXL) reactions

Oral - Abstract ID: 84

Dr. Grace Lytle [1]***, Dr. Alexandra Nicklin*** [1]***, Dr. Rajesh Rajpal*** [1]

1. *Avedro, Inc*

Purpose

The expansion of CXL into the refractive domain requires that the procedure be predictable and customizable. We aim to elucidate the role of oxygen in the amount and distribution of cross-link bonds formed, and demonstrate the impact on corneal curvature.\\

Materials and Methods

In a series of pre-clinical studies, fresh whole porcine eyes were brought to 37°C in a humidity chamber and maintained at an IOP of 15mmHg. Corneas were saturated with riboflavin, irradiated with constant or pulsed irradiance in the ambient atmosphere or in a chamber with 100\% oxygen concentration. ~Mechanical, fluorometric and topometric analyses were used to measure increases in corneal stiffness, formation of cross-linked bonds, and change in corneal curvature.

Results

Mechanical analysis showed an increase in corneal stiffness and fluorometric analysis showed a higher response for cross-linking performed in an oxygen rich environment or with pulsed UVA. The combination of pulsed UVA and an oxygen rich environment produced the most corneal stiffening and the highest fluorometric response. Greater corneal flattening is observed under conditions resulting in greater corneal stiffening.

Conclusions

Both pulsing and performing irradiation in an oxygen rich environment increased the amount of cross-linking achieved for the same UVA energy dose. When combined they have an additive effect. The addition of supplemental oxygen during CXL procedures has the potential to increase the magnitude of the treatment effect for the same total UVA energy dose, and has implications for improving the efficiency of epithelium-on procedures.

Biography

\textbf{Grace Lytle}\emph{, Avedro, Inc} Grace Lytle,~OD, MS is an optometrist and the vice president~of Medical Affairs at Avedro, inc.~She received her doctorate in optometry from the New England College of Optometry, continuing on to complete a research masters degree in vision science~in the area of ocular growth mechanisms and the development of myopia.~ After completing advanced residency training in cornea and contact lens at the New England Eye Institute, Grace practiced optometry in clinical practice and served as an instructor in the contact lens laboratory course at the New England College of Optometry before joining Avedro in~2012.~~

Topography and pachymetry guided customised tissue saving epithelial ablation in cross-linking of thin cornea : the SAVE protocol

Oral - Abstract ID: 61

Dr. Ashima Bajaj [1], ***Dr. Rohit Shetty*** [1], ***Dr. Pooja Khamar*** [1]

1. *Narayana Nethralaya*

Purpose

To study the efficacy of corneal collagen cross-linking (CXL) in thin corneas after topography and anterior segment optical coherence tomography (ASOCT) assisted localized selective epithelial removal by excimer laser ablation.

Materials and Methods

10 eyes of progressive keratoconus with corneal thickness between 400 to 320 microns were included in the study and underwent corneal topography, ASOCT, confocal microscopy and corvis. Topoguided Epithelial removal was planned with customised sparing of corneal epithelium over thin cornea (<400 microns) followed by accelerated corneal collagen crosslinking. Post-operatively patients were examined clinically followed by ultra-high resolution ASOCT(UHT-ASOCT) and corneal topography at 1,3 and 6 months.

Results

Stability of keratoconus was observed at six months. Increased reflectance and demarcation line was noted in anterior stroma which continued beneath the spared epithelium on UHR-ASOCT. Confocal Imaging also showed changes suggestive of CXL in the region where epithelium was spared.

Conclusions

This technique of crosslinking with selective sparing of epithelium is easy to perform and may help us extend the advantage of crosslinking even in patients with thin corneas.

Biography

Ashima Bajaj, *Narayana Nethralaya*

Currently working at Narayana Nethralaya Eye Hospital, Bangalore , India - in Cataract-Refractive department.

WIDE AREA SURFACE ABLATION LASER GUIDED BY CORNEAL WAVEFRONT COMBINED WITH accelerated cross-linking in the treatment of keratoconus

Poster - Abstract ID: 3

Dr. safwan albayati [1]

1. *New Vision Eye Center Dubai*

Purpose

To present the outcomes of transepithelial photorefractive keratectomy (tPRK)with wide optical zone(OZ) guided by corneal wave-front combined simultaneously with accelerated corneal cross-linking (A-CXL)(wide ablation protocol)for keratoconus treatment.

Materials and Methods

This clinical cases series included 32 eyes of 18 keratoconic patients. All patients underwent(wide ablation protocol).Visual, refractive and keratometric outcomes as well as high order aberrations(HOAs)were evaluated preoperatively and at 1, 3, 6, 12, 24 and 36 months postoperatively.

Results

All study parameters showed a statistically significant improvement at 3,6,12,24 and 36months over preoperative values. At 36months postoperatively, UDVA improved to 20/32 (0.2±0.2logMAR) from 20/125 (0.8±0.39) preoperatively (P<0.0001), while CDVA improved to 20/25 (0.1±0.09) from 20/40 (0.3±0.2) preoperatively(P<0.0001). spherical equivalent(SEQ) improved from (-5.2±2.74D) to (-1.43±1.74D) at 36months postoperatively (P<0.0001). Mean root square (RMS) of coma improved from (1.56±1.17) preoperatively to (0.53±0.52) at last follow-up (P<0.0001).

Conclusions

wide ablation protocol seems to be a safe, effective and promising procedure for treatment of keratoconus, regularizing and stabilizing the ectatic corneal surface and improving visual outcome with neither over correction nor increasing existing myopic astigmatism.

Biography

safwan albayati, *New Vision Eye Center Dubai*

Specialist ophthalmologist, had his FRCS in Ophthalmology from the Royal College of Physician and Surgeons of Glasgow (UK).

medical college from Baghdad Medical College. In 1998

finished first ophthalmic fellowship from Iraqi Commission of Medical Specialization (FICMS).

member of the American Society of Retina Specialists(ASRS).

Member of the American Society of Catarct and Refractive Surgeons(ASCRS).

member of the American Academy of Opthalmology(AAO).

consultant in Phaco-Vitrectomy. fellowship training in phaco-vitrectomy under Dr. Frank Koch from Frankfurt University, Ophthalmic Department, Germany.

Had done his training in LASIK from Munich, Germany (Bausch & Lomb).

Pilot evaluation of photorefractive corneal collagen crosslinking for the treatment of low myopia: 6 month results

Poster - Abstract ID: 42

Dr. safa EL HOUT [1]***, Dr. Myriam Cassagne*** [1]***, Prof. Pierre Fournié*** [1]***, Prof. François Malecaze*** [1]

1. *purpan hospital*

Purpose

A prospective study to evaluate the safety and efficacy of a new photorefractive application of transepithelial corneal collagen cross linking (TE-CXL) to treat myopic error on non-keratoconic eyes with low myopia.

Materials and Methods

The inclusion criteria was having myopia with manifest refraction spherical equivalent (MRSE) of -1.00 to -2.50 D. The surgical protocol involves applying an oxygen mask on the eye, then soaking with riboflavin and finally initiating UVA pupil centered irradiation. Outcomes measured were uncorrected and best corrected visual acuity (UCVA and BCVA), mean change in MRSE, in mean keratometry, endothelial cell count (ECC) and stromal demarcation line. Adverse events was evaluated.

Results

19 eyes were treated with epi-on photorefractive CXL. At 6 months, UCVA increased by 0.35 ± 0.21 logMAR ($p<0.001$). MRSE was reduced by 0.72 ± 0.42D ($p<0.001$). Mean keratometry decreased by 0.74 ± 0.54 D ($p<0.001$), Moderate haze was observed in all patients, maximal at 1 month. The mean depth of stromal demarcation line was 366.1 ± 104.8 mm. There were no other side effects, ECC and BCVA were unchanged.

Conclusions

Transepithelial photorefractive intrastromal CXL (TE-PiXL) reduces refractive error in patients with low myopia. It is a non invasive method without tissue ablation suitable for patients with thin corneas. Efficacity could be improved in the future by optimizing UVA delivery and including topography data.

Biography

safa EL HOUT, *purpan hospital*

Fifth-year resident in ophthalmology department at Toulouse hospital.

PACK-CXL for infectious keratitis

Assessment of UV-A/riboflavin corneal cross-linking efficacy for the treatment of experimentally induced corneal lesions in an ex vivo animal model

Oral - Abstract ID: 8

Dr. Anna Perazzi [1], ***Dr. Antonella Peruffo*** [1], ***Dr. Chiara Gomiero*** [1], ***Mrs. Roberta Contin*** [1], ***Dr. Livio Corain*** [1], ***Dr. Enrico Grisan*** [1], ***Dr. Marco Lombardo*** [2], ***Dr. Giuseppe Lombardo*** [2], ***Dr. Gianni Salvalaio*** [3], ***Prof. Marco Patruno*** [1], ***Prof. Ilaria Iacopetti*** [1], ***Dr. Tiziana Martinello*** [1]

1. *University of Padua,* ***2.*** *Vision Engineering Italy srl,* ***3.*** *FBOV*

Purpose

The aim of this pilot study was to evaluate the histological and immunohistochemical changes induced by UV-A/riboflavin corneal cross-linking in experimentally induced corneal lesions in an *ex vivo* animal model.

Materials and Methods

Three groups of 1 week cultured porcine corneas were used, such as the control group, the injured group (alkali-induced corneal stromal melting) and the injured and then cross-linking treated group (Vetuvir, 30 mW/cm^2 for 3 min). After 1 week all samples were processed for histological analysis and immunohistochemical characterization. To analyze the corneal sections, image analysis of digitized hematoxylin-eosin corneal sections, computational anatomy, statistical models and inferential methods were performed.

Results

Statistically significant differences were found in the mean "density" (the measure of the relative extension of the injured areas in the corneal stroma) among the tree groups (ANOVA, $P<0.001$). Specifically, the treated group showed a significant effect on the repair process after cross-linking treatment in comparison with the injured group and an intermediate level of repair placed between those of control (Tukey's tests, $P<0.001$) and injured groups (Tukey's tests, $P<0.001$).

Conclusions

The results obtained suggest an interesting effect of cross-linking on the repair process from a cellular and molecular point of view. One of the future aspects of this project could be the implementation of clinical trials of cross-linking on small domestic animals since this technique may provide an excellent alternative and /or complement conventional therapy.

Biography

Anna Perazzi, *University of Padua*

Anna Perazzi graduated in Veterinary Medicine in 2006 at the University of Padua (Italy). From January 2008 she started a PhD program working on the clinical application of platelet rich plasma and mesenchimal stem cells for the orthopaedic disease. From October 2012 she began 2 Fellowship program at the University of Padua working about regenerative medicine. She is interested in small animal surgery and ophthalmology. Since October 2015 she is a researcher of the University of Padua working about regenerative medicine. Dr. Perazzi published n.42 scientific papers, attended numerous congresses and course of continuing education about ophthalmology and regenerative medicine.

Blue-light activation of riboflavin for possible use in PACK-CXL

Oral - Abstract ID: 48

Dr. Karim Makdoumi [1]

1. *Örebro University Hospital*

Purpose

Evaluation of blue-light riboflavin photoactivation for elimination of MRSA in vitro.

Materials and Methods

Two different light sources were use withwavelengths, 412 nm and 450 nm respectively. Bacterial suspensions ($4x10^5$ CFU/ml) withand without riboflavin (0.01%) in fluid layers (thickness of 0.4 mm) were illuminatedusing two different dosages (5.4 J/cm and 28.5 J/cm2). Experiments were repeated 8 times. After incubation the degree of microbialelimination was compared. Assessment of MRSA eradication was also done forbacterial suspensions with thickness of 1.2 mm.

Results

Exposure of both blue-light wavelengths with the lower dose only resulted in a significant elimination with riboflavin, with a more extensive reduction using the lower wavelength. At the higher dose blue light alone eliminated 70-80% of bacteria in solutions, however, with riboflavin a near complete eradication of pathogens was achieved (98-99%). In the thicker fluid layer model illumination combined with riboflavin was considerably more efficacious than blue light alone.

Conclusions

Blue light and riboflavin is more efficient than blue light alone and could possibly be used to treat deeper corneal infiltrates. However, higher light dosages, compared with UVA, are required to achieve a similar reduction of pathogens. Future research will need to elucidate the benefits and limitations of blue light in PACK-CXL.

Biography

Karim Makdoumi, *Örebro University Hospital*

Karim Makdoumi, MD, PhD.

Consultant Ophthalmic Surgeon/Head of Surgical Unit at the Örebro University Hospital, Sweden. Specialized in Cataract and Vitreoretinal Surgery.

Affiliated Researcher at the Örebro University.

PhD thesis on Ultraviolet light A (UVA) photoactivation of riboflavin as a potential therapy for infectious keratitis.

Ongoing research in the field of PACK-CXL.

Inhibitory effect of photodynamic antimicrobial therapy (PDAT) on healthcare- and community-acquired methicillin resistant Staphylococcus aureus (MRSA) isolates of ocular origin

Oral - Abstract ID: 69

Ms. Heather Durkee [1], ***Mrs. Mariela Aguilar*** [1], ***Mr. Alejandro Arboleda*** [1], ***Dr. Nidhi Relhan*** [1], ***Mr. Nicholas Nolan*** [1], ***Ms. Anna Martinez*** [1], ***Mr. Karam Alawa*** [1], ***Mr. Mercury Sawatari*** [1], ***Dr. Jaime Martinez Martinez*** [2], ***Dr. Harry W. Flynn, Jr.*** [2], ***Dr. Guillermo Amescua*** [2], ***Dr. Darlene Miller*** [3], ***Prof. Jean-Marie Parel*** [1]

1. *Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine,* ***2.*** *Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine,* ***3.*** *Ocular Microbiology Laboratory, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine*

Purpose

Increased prevalence and diversity of MRSA species pose a significant problem to ophthalmologists. Available antibiotics are ineffective against these isolates. This study investigates the inhibitory effect of an alternative treatment, PDAT on healthcare- and community-acquired MRSA isolates of ocular origin.

Materials and Methods

MRSA species (1 healthcare- and 1 community-acquired) were isolated from corneal scrapings of patients with infectious keratitis and made into suspension of concentration of $1.5x10^8$ CFU per mL. Serial dilutions (0.2%, 0.1%, 0.05%) of rose bengal and riboflavin solutions were mixed with each of the MRSA suspensions, inoculated onto blood agar plates, and exposed to different irradiation conditions. Plates were incubated and photographed 48 hours later for percent growth analysis.

Results

Within the irradiation zones, both strains of MRSA were inhibited by all concentrations of rose-bengal with green light, while riboflavin with UV-A light demonstrated minimal inhibition. Rose bengal in low light conditions had inhibitory effect on both MRSA species. The healthcare-acquired MRSA species showed larger inhibitory effect to both the rose bengal and riboflavin PDAT when compared to the community-acquired species.

Conclusions

This study demonstrates that rose bengal PDAT has an inhibitory effect on both healthcare- and community-acquired MRSA species. Inhibitory effect was greater in the rose bengal groups than the riboflavin groups. The strong inhibitory effect of PDAT against MRSA suggests that rose bengal PDAT may be a promising adjunct treatment for MRSA keratitis.

Biography

Heather Durkee, *Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine*

Heather Durkee received her B.S. and M.S. degrees in Biomedical Engineering in 2013 at the University of Miami, Coral Gables. After graduation, she was awarded a Whitaker International Fellowship and she worked at the Institute of Applied Physics – CNR, Florence, Italy. In 2014, she began pursuing her Ph.D. at the Ophthalmic Biophysics Center at Bascom Palmer Eye Institute under the mentorship of Drs. Parel and Manns. Heather's

research interests include photodynamic antimicrobial therapy for the treatment of corneal infections, the role of biofilm in ocular prosthetics, visual photosensitivity, optical imaging techniques, and the age-related changes of the crystalline lens.

Rose Bengal Photodynamic Antimicrobial Therapy as an Adjunct Treatment for Infectious Keratitis

Poster - Abstract ID: 82

Dr. Jaime Martinez Martinez [1]***, Mr. Alejandro Arboleda*** [1]***, Ms. Heather Durkee*** [1]***, Mrs. Mariela Aguilar*** [1]***, Dr. Nidhi Relhan*** [1]***, Dr. Neda Nikpoor*** [2]***, Dr. Harry W. Flynn, Jr.*** [2]***, Dr. Darlene Miller*** [3]***, Dr. Guillermo Amescua*** [2]***, Prof. Jean-Marie Parel*** [1]

1. *Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine,* ***2.*** *Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine,* ***3.*** *Ocular Microbiology Laboratory, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine*

Purpose

To report clinical outcomes of rose bengal photodynamic antimicrobial therapy (RB-PDAT) in patients with severe infectious keratitis.

Materials and Methods

A retrospective study of 15 patients (median age = 44 years, range, 17- 77 years) who underwent RB-PDAT as an adjunct treatment for severe cases of infectious keratitis, that did not respond to the standard medical treatment. *Procedure*: Rose bengal solution (0.1%-0.2% RB in BSS) was applied to a de-epithelized cornea for 30 minutes and then irradiated with a 6mW/cm^2 custom-made green LED source for 15 minutes (5.4J/cm^2).

Results

Positive microbial cultures in 13 (86%) patients:*Acanthamoeba* (n=7), *Fusarium spp.* (n=2), *Pseudomonas aeruginosa* (n=2), *Curvularia spp.* (n=1). One patient had the presence of multiple microorganisms: *Candida, Staphylococcus Aureus*, and *Acanthamoeba.* The resolution of the infection was within 38 days post RB-PDAT. A therapeutic corneal transplantation was avoided in 73% of the patients.

Conclusions

Our *case study*results provides evidence that rose bengal PDAT is a good alternative for the treatment of patients with severe infectious keratitis, secondary to aggressive and/or resistant organisms. RB-PDAT prevented the need for therapeutic corneal transplant in patients.

Biography

Jaime Martinez Martinez, *Ophthalmic Biophysics Center, Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine*

Jaime D. Martinez is an Ophthalmologist. He completed his ophthalmology residency in 2017 at the Asociacion para Evitar la Ceguera in Mexico City. Currently he is completing a a research cornea fellowship at Bascom Palmer Eye Institute under mentorship of Drs. Parel and Amescua. Jaime´s research interests include: photodynamic therapy for the treatment of infectious keratitis, dry eye, keratoprotheses, and corneal transplants.

The Effect of Accelerated Photoactivated Chromophore for Keratitis-Corneal Collagen Cross-Linking as Adjuvant Therapy on Il-6 Level of Corneal Ulcer Patient

Poster - Abstract ID: 66

Prof. Suhardjo . [1]***, Mrs. Reny Setyowati*** [1]***, Mr. Marzarendra Erlangga*** [1]

1. *Universitas Gadjah Mada*

Purpose

Previous study have suggested that IL-6 is cytokine involved in immune- induced corneal damage.
This study evaluate the effect of Accelerated Photoactivated Chromophore for Keratitis-Corneal Collagen Cross-Linking (PACK-CXL) on IL-6 level and clinical improvement in microbial corneal ulcer patient

Materials and Methods

Nonrandomized clinical control study at Dr Sardjito Hospital in Yogyakarta, Indonesia. Patient with microbial corneal ulcer treated with clinical guideline for microbial corneal ulcer and underwent accelerated PACK-CXL 18 mW/cm^2 for 5 minutes. This study used ELISA to detect IL-6 level . This study analysed the change of IL-6 expression and blepharospasm clinically, pre and 7 days post accelerated PACK-CXL. The pre and post data were compared statistically.

Results

Among 21 patients, IL-6 level comparison between moderate and severe corneal ulcer were 452,00±169,65 pg/mL and 5881,33±2306,25 pg/mL, respectively. Post accelerated PACK-CXL mean of IL-6 level was 197,11±293,52 pg/mL and 3105,68±1950,09 pg/mL on moderate and severe corneal ulcer patients (p=0,001), respectively. There were 28,57% and 33,33% grade 4 and grade 3 blepharospasm, respectively. Post treatment there were no grade 4 blepharospasm and only 23,80% had grade 3 blepharospasm (p=0,011).

Conclusions

There were clinically significant result of IL-6 level post treatment and accelerated PACK CXL as an adjuvant therapy. Blepharospasm as clinical parameter was improved. Accelerated PACK-CXL has been successfully showed immunology and clinical improvement in microbial corneal ulcer patient

Biography

Suhardjo ., *Universitas Gadjah Mada*

Born in Yogyakarta, Indonesia

He is the opthalmology professor who are interested in corneal dan refractive surgery at Universitas Gadjah Mada

He has a lot of publications, one of them is CXL prior to photorefractive keratectomy

The Therapeutic Effect of Accelerated Photoactivated Chromophore Corneal Cross-linking (PACK-CXL) compare to the standard antibiotic therapy in Infectious Keratitis.

Oral - Abstract ID: 51

Dr. Boris Knaizer [1], ***Dr. Yonit Krakauer*** [1], ***Prof. Tova Lifshitz*** [1], ***Mr. Muhammad Abu Tailakh*** [1], ***Prof. Farhad Hafezi*** [2]

1. *Soroka University Medical Center, Beer-Sheva,* ***2.*** *Ocular Cell Biology Lab, CABMM, University of Zurich*

Purpose

To evaluate the therapeutic effect of PACK-CXL on therapy-resistant infectious keratitis and to compare it to the effect of standard topical antibiotic therapy.

Materials and Methods

Retrospective interventional comparative study. 75 eyes of 74 patients who were treated with therapy-resistant infectious keratitis. Patients were either treated using our standard antimicrobial protocol (32 eyes) or received an additional accelerated PACK-CXL(hypo-osmolaric 0.1% riboflavin solution and UV-A(365nm) irradiance of 30mW/cm^2 for 3 minutes) treatment (45 eyes). The size of the epithelial defect, period until healing, corrected and uncorrected visual acuity were recorded on admission and during the follow- up.

Results

Therapeutic keratoplasty was performed in 6 patients (18.8%) of the control group and in one patient (2.3%) of the PACK-CXL group($P<0.01$). The mean time to re-epithelialization was 7±1.5 days in the PACK group and 12±2.6 days($P<0.002$). The short follow up period has been found in PACK group 2.6 months vs 4.4 months($P<0.001$). Multivariate logistic regression model revealed the PACK-CXL treatment has accelerated effect to healing process in therapy-resistant infectious keratitis.

Conclusions

We found a beneficial effect of accelerated PACK-CXL as an additional treatment modality for therapy-resistant infectious keratitis. The PACK-CXL treatment may halt the infectious process and accelerate healing intracorneal process and may help avoiding emergency keratoplasty. Further research is needed to better understand the beneficial effect of this new treatment for infective keratitis.

Biography

Boris Knaizer, *Assuta*

I was born in Russia in 1972 and immigrate to Israel in 1990.

1998-2005 Graduating in Goldman Medical School, Beer-Sheva, Israel

2006-2011 Residency in Department of Ophthalmology, Soroka University Medical Center, Ben-Gurion University of the Negev, Beer-Sheva, Israel.

2011-till today. Lecturer in Ben-Gurion University of the Negev, Beer-Sheva, Israel.

2013-2014 cataract, corneal transplantation and refractive surgery fellowship.

2015-2017.Ophthalmic Outpatient Clinic Director. Soroka University Medical Center

2017. Head of cornea and cataract service in Assuta Ashdod Medical Center.

Research interest: Keratoconus, corneal crosslinking, hormonal changes and influence on human cornea and cornea's bio-mechanics, infectious keratitis, PACK-CXL.

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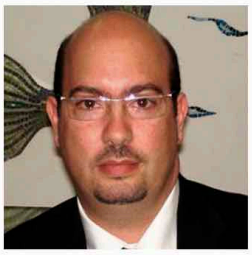


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