กระทรวงสาธารณสุข
MINISTRY OF PUBLIC HEALTH
กรมการแพทย์
DEPARTMENT OF MEDICAL SERVICES

โรงพยาบาลราชวิถี
RAJAVITHI HOSPITAL

APTOS 2021

The 6th Asia Pacific Tele-Ophthalmology Society Symposium (APTOS 2021)

PROGRAM BOOK

APTOS
ASIA PACIFIC TELE-OPHTHALMOLOGY SOCIETY

DISCOVER HARMONY

TURNKEY SOLUTION. PEACE OF MIND.

VENDOR NEUTRAL CONNECTIVITY

TELEHEALTH

ARTIFICIAL INTELLIGENCE

INTEGRATIONS

REVIEW STATION

REPORTING AND ANALYTICS

Discover Harmony In Your Practice

Topcon Healthcare Solutions APAC
THSAP@topcon.com | topconhealthcare.sg

TOPCON Healthcare
SEEING EYE HEALTH DIFFERENTLY

DISCOVER HARMONY

TURNKEY SOLUTION. PEACE OF MIND.

KEY FEATURES AT A GLANCE

VENDOR NEUTRAL CONNECTIVITY

Connect all your devices regardless of their type and brand.

TELEHEALTH PORTAL

Secure portal for 2nd opinion consulting and referrals.

REVIEW STATION

Easy access and analysis of all patient examination data in one single viewer.

BROWSER-BASED

Browser-Based access to all data from any computer at any time.

ARTIFICIAL INTELLIGENCE

Integrations to automatic image analysis tools to support early detection and accurate diagnosis.

INTEGRATIONS

Seamless integration to examination devices, EMR' s and other information systems such as PACS and National Health Records.

REPORTING AND ANALYTICS

Tools for clinical analytics and business intelligence.

Discover Harmony In Your Practice

Topcon Healthcare Solutions APAC

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TOPCON Healthcare

SEEING EYE HEALTH DIFFERENTLY

DISCOVER HARMONY

TURNKEY SOLUTION. PEACE OF MIND.

Increase efficiency

Harmony's integrated workflow enables patient information to flow seamlessly from an EMR directly to the device, through Harmony and back, reducing human errors and enhancing practice efficiency.

Easy Access and Excellent Usability

Easily access and analyse all patient examination data through your browser from anywhere at any time. The intuitive and feature-rich software design facilitates your data analysis and clinical decision making.

Save Time

Save time through integrated Artificial Intelligence tools that provide fast automatic image analysis and second opinion support.

Improve Communication

Facilitate communication, shared care opportunities and enable social distancing through Harmony's telehealth platform.

Learn more

TOPCON Healthcare

SEEING EYE HEALTH DIFFERENTLY

CONTENTS

FOREWORD

From Director-General of the Department of Medical Services

Dear Friends & Colleagues,

It is our great honor that Thailand is hosting the virtual congress of the Asia Pacific Tele-Ophthalmology Society. I am pleased to welcome you all to the "6th Asia Pacific Tele-Ophthalmology Society Congress Symposium)APTOS 2021(." I would also like to express my special thanks to our distinguished guests and speakers who are joining us online today.

This year is really challenging – we are facing the nationwide lockdown due to the uncertain situation of the COVID-19 pandemic. As a result, we have to convert our Congress from a conventional physical meeting into an online one. Undeniably, the pandemic has changed the world and our way of living dramatically. We acknowledge that digital health, telemedicine, and artificial intelligence are important to us as we adjust to the new normal.

APTOS 2021 provides unique platform for ophthalmologists, health care professionals, and computer engineers to exchange knowledge and experience in digital health, telemedicine, artificial intelligence, and the future of AI-enabled healthcare. With the aim to strengthen the network of ophthalmologists and computer engineers, we believe that APTOS 2021 is where we connect and innovate to better serve our patients.

Finally, I would like to thank all Organizing Committee Members for making the 6th APTOS symposium possible.

I hope you will enjoy this symposium and wish you all good health and protection from any health threats.

Yours sincerely,

Somsak AKKSLIP, MD
Director-General
Department of Medical Services
Thai Ministry of Public Health

FOREWORD AND WELCOME MESSAGES

WELCOME MESSAGE

From Congress President

Dear Friends & Colleagues,

It is our great honor that Thailand has the opportunity to host the 6th Asia Pacific Tele-Ophthalmology Society Symposium (APTOS 2021), which is currently held as an online meeting scheduled for August 28, 2021 (Saturday).

Due to the yet uncertain situation of the COVID-19 pandemic, we have made a decision to convert this Congress, originally planned as a conventional physical meeting, into a completely online one. It is truly unfortunate that ophthalmologists, health care professionals, computer engineers, and those who are interested in digital health, telemedicine, and artificial intelligence, cannot meet physically in another APTOS Congress this year. However, this should not discourage us from learning, sharing and advancing our specialties. On the contrary, the situation may encourage us to learn more together.

We acknowledge that the APTOS Congress is a unique platform where multi-disciplinary professionals in digital health, telemedicine, and artificial intelligence can learn together. The scientific program this year is therefore aimed to strike a balance between ophthalmology and computer engineering in order to allow all the professionals to be part of the Congress.

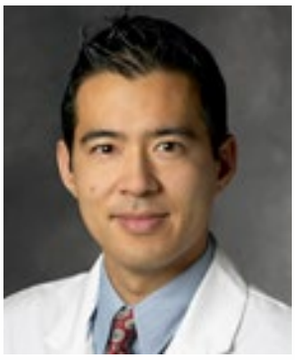
On behalf of the Organizing Committee, we are delighted to welcome you to this prestigious event and look forward to seeing you, though virtually, at the 6th Asia Pacific Tele-Ophthalmology Society Symposium (APTOS 2021).

Yours sincerely,

Paisan RUAMVIBOONSUK, MD
Congress President, APTOS 2021

WELCOME MESSAGE

From Scientific Program Committee Chair

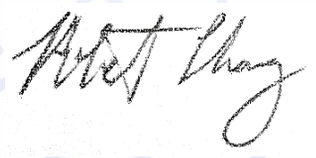


Dear Friends and Colleagues,

The field of telemedicine and AI is evolving as the pandemic continues to disrupt our lives. "Big Tech," from Google to Apple to Amazon, have all experienced the challenges of "Big Healthcare," and why aggregating real-world data itself to train AI cannot solve many of the big problems in healthcare and global health. This is because clinical data is not collected with intent to solve clear endemic problems such as reducing cost while increasing access or minimizing healthcare disparities while improving transparency. Thus, tackling smaller use cases, such as minimizing repetitive tasks via automated image analysis, has gained better traction. This year, we will continue to focus on AI users and various novel supporting technologies, as well as the push for bigger open-source data sets to weed out AI bias. Foundation AI models such as BERT and GPT-3 trained on broad data at scale may be adapted for other tasks. Interdisciplinary efforts will continue to be critical, especially in AI for healthcare, as many stakeholders can influence the societal implications of these algorithms.

This year's one-day online program, hosted by Thailand, will cover disease areas beyond retina and will include several important talks on the social perspective of AI in eye care. On behalf of the organizing committee, we warmly welcome you to the 6th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium. We will be launching our second APTOS Big Data competition, with the goal of predicting anti-VEGF treatment outcomes based on tens of thousands of OCT images of patients' eyes taken at baseline and at 6 months after the loading dose. Please join the competition!

Yours sincerely,



Robert CHANG, MD
Scientific Program Chair, APTOS 2021
Vice-President, Asia Pacific Tele-Ophthalmology Society

FOREWORD AND WELCOME MESSAGES

WELCOME MESSAGE
From President, Asia Pacific Tele-Ophthalmology Society

Dear Friends & Colleagues,

Welcome to the 6th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium co-hosted by the Thai Ministry Public Health and Rajavithi Hospital! Although we still can't meet again physically in 2021, we do appreciate the efforts made by all our faculty members to join us on the occasion and to share with us their latest research and findings. Not only is our annual symposium a showcase of recent advances in tele-ophthalmology, artificial intelligence (AI) and digital health, it is also a unique platform that encourages inter-disciplinary collaboration.

This year, with full support from the Department of Medical Services of the Thai Ministry of Public Health, we are launching our 2nd Big Data Competition focusing on the prediction of DME patients' response to anti-VEGF treatment. As we all know, a substantial number of patients with diabetic macular edema do not respond to this therapy or do so to an inadequate degree. Even ophthalmologists cannot tell which patients will respond. The good news is while we cannot make an accurate prediction, AI can. I'm really excited about a future where ophthalmologists will make greater use of AI in their practice to deliver speedy, timely and effective treatment for their patients.

We have learnt during the pandemic that where there is a need, there is a way. Tele-ophthalmology has helped both the physicians and the patients in our need of the hour and proven to be an effective way for disease management. We believe telemedicine and AI will play an increasingly important role in 21st-century healthcare, which may well be digitized. Thanks to the support from Google and Sirindhorn International Institute of Technology (SIIT), Thammasat University, we are organizing a pre-meeting of four AI workshops, each with a different focus. Whether you are new to AI and tele-ophthalmology or have been in the field for some time, there should be something at APTOS 2021 that you will find intriguing. I hope you will enjoy APTOS 2021, our second virtual meeting.

Yours sincerely,

Mingguang HE, MD, PhD
President, Asia Pacific Tele-Ophthalmology Society

WELCOME MESSAGE

From Secretary-General, Asia-Pacific Tele-Ophthalmology Society

Dear Friends & Colleagues,

Welcome to APTOS 2021, the 6th Asia Pacific Tele-Ophthalmology Society Symposium, hosted by Thailand.

Lots has changed in the past couple of years. As the healthcare sector deals with the unprecedented COVID-19 pandemic, the way services are delivered has rapidly changed and the sector has quickly adapted to a new model of care. We learned that telehealth is an important and highly effective tool in caring services while keeping patients and health providers safe.

These developments put the spotlight on the work of APTOS. Eye care is fast catching up with telehealth innovations, and in response, APTOS sees its role not only as a network of professionals but as an educator. The APTOS monthly webinars have seen an ever-growing number of participants since they were launched last year. Expanding our role as educators even further, we will soon be announcing some exciting news about setting up a more formal training opportunity in digital health.

This year's symposia span all the way from the evolution of telemedicine to its role in a post-COVID 19 world. I hope you will find the presentations stimulating and enjoyable and encourage you to be an active participant.

Yours sincerely,

Andreas MÜLLER, MPH, PhD
Secretary-General, Asia-Pacific Tele-Ophthalmology Society

COUNCILS AND COMMITTEES

HOST

Asia-Pacific Tele-Ophthalmology Society

(APTOS)

Founded by a group of outstanding tele-ophthalmology specialists in the Asia-Pacific region in May 2016, the Asia Pacific Tele-Ophthalmology Society (APTOS) aims to bring together clinicians, researchers, technicians, institutes and organizations to form an alliance that promotes communication, exchange and collaboration in tele-ophthalmology. It provides a platform on which eye care or tele-medical professionals can share knowledge and collaborate to deliver efficient, accessible and quality universal eye care throughout the region.

Contact us:
APTOS Secretariat
c/o State Key Laboratory (Ophthalmology)
Zhongshan Ophthalmic Center, Sun Yat-Sen University
1/F, No. 7 Jinsui Road
Zhujiang New Town, Tianhe District
Guangzhou, Guangdong, P.R. China
Webiste: www.asiateleophth.org
Email: secretariat@asiateleophth.org

CO-HOSTS

กรมการแพทย์
DEPARTMENT OF MEDICAL SERVICES

Department of Medical Services,

Thai Ministry of Public Health

The Department of Medical Services (MSD) of the Thai Ministry of Public Health is one of the leading health networks in Thailand. As the leader and gold standard medical and public health service provider, MSD has expertise in providing a vast array of services including disease prevention, health promotion, emergency medical treatment, quality medical care, medicine and urban development. The management of MSD focuses on achievements and teamwork to promotes research and learning and to encourage public participation in the development of healthcare services.

MSD has five major goals:

1. Achieving excellence in medical service provision to become a healthcare gateway in the Asia-Pacific region;
2. Providing expertise in urban medicine;
3. Brand-building to become an excellent medical service provider;
4. Modernizing medical management and education; &
5. Uniting the BMA network for better quality of life.

Contact us:
Medical Service Department 514 Luang Road, Pom Prap Sattru Phai District Bangkok
Thailand 10100
Website: www.msdbangkok.go.th/HOMEENG.html
Email : dmsbma@msdbangkok.go.th

COUNCILS AND COMMITTEES

CO-HOSTS

Rajavithi Hospital

Established on 16 April 1951, Rajavithi Hospital was initially the first special hospital for women and children in Thailand. Reliable and well-known to the public for its capable team of management professionals and medical doctors, it is where the first successful operation to separate Siamese twins (Wandee and Sriwan) was conducted to our great pride. On 2 May 1976, the hospital was renamed from "Women's Hospital" t "Rajavithi Hospital" and the role of the hospital was changed ever since to provide general healthcare services for all patients nationwide.

Nowadays, Rajavithi Hospital is a modern, fully-equipped institution with a staff of dedicated medical professionals who are ready to serve. As the largest hospital in the network of the Thai Ministry of Public Health, Rajavithi Hospital has a strong reputation for excellence and aspires to become a leading institute in the academic arena internationally.

Contact us:
2, Phayathai Road, Ratchathewi District, Bangkok 10400, Thailand
Website: www.rajavithi.go.th
Email : webmaster@rajavithi.go.th

ORGANIZING COMMITTEE

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Paisan RUAMVIBOONSUK, MD

Honorary Advisor
Thanaruk THEERAMUNKONG, PhD

Vice-Chairs
Supaporn SRITHAWATPONG, MD
Dungdao THATSNARONG, MD

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Teeravee HONGYOK, MD

Abstract & Registration
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Natsuda KAOTHANTHONG, PhD
Warapat WONGSAWAD, MD
Warin SMITTHIMATHIN, MD

Secretary
Somporn CHANTRA, MD

Secretary Assistants
Wanida KHEMPHUKIEO
Pitchamon YODRAT
Petchada WATCHARAWUTPATTANA

Members
Kanokporn CHUCHERD
Tanwarat KUMKIET
Vipavee PASURIYUN

Big Data Competition – Thailand
Dr. Anyarak AMORNPETCHSATHAPORN
Dr. Warisara PATANAPONGPAIBOON
Dr. Panisa SINGHANETR

Big Data Competition – China
Wei MENG
Guankai PENG
Dr. Xiaohu TING

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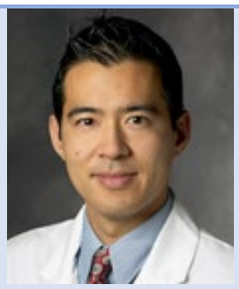
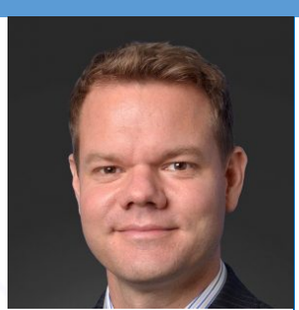
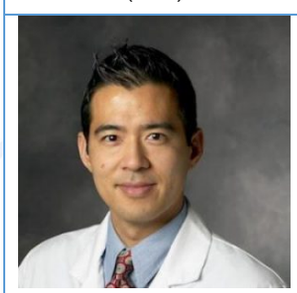
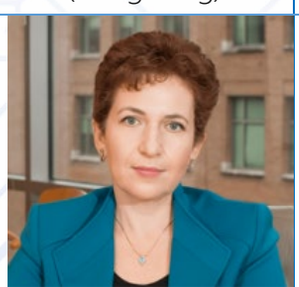
Florence CHUNG
Bill WONG

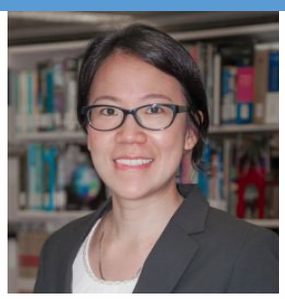
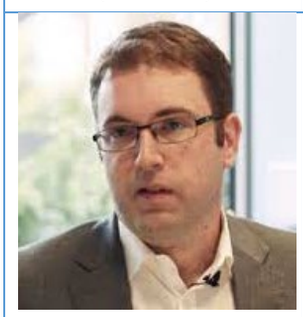
Local Secretariat
Wilasinee BUNDHAM
Taraporn (Goy) SAIPOW
Warapa SAIPOW
Chowmonta THANUTAMO

THE 6TH ASIA PACIFIC
TELE-OPHTHALMOLOGY SOCIETY CONGRESS
2021
APTOS

SCIENTIFIC PROGRAM COMMITTEE & FACULTY

Chair:	Co-Chair:
	
Robert CHANG (U.S.)	Paisan RUAMVIBOONSUK (Thailand)

Invited Speakers			
			
Michael ABRAMOFF (U.S.)	Lama AL-ASWAD (U.S.)	Marten BRELEN (Hong Kong)	Peter CAMPBELL (U.S.)
			
Robert CHANG (U.S.)	**Carol CHEUNG (Hong Kong)**	**Malvina EYDELMAN (U.S.)**	Joelle HALLAK (U.S.)

Invited Speakers			
			
Mingguang HE (Australia)	Nicolas JACCARD (United Kingdom)	Natsuda KAOTHANTHONG (Thailand)	Ryo KAWASAKI (Japan)
			
Pearse KEANE (United Kingdom)	Haotian LIN (China)	Yao LIU (U.S.)	Dan MILEA (Singapore)
			
Andreas MÜLLER (Australia)	Louis PASQUALE (U.S.)	Kim RAMASAMY (India)	Paisan RUAMVIBOONSUK (Thailand)
			
Ngamkae RUNGVARAVATE (Thailand)	**Dawn SIM** **(United Kingdom)**	**Gavin TAN** **(Singapore)**	Thanaruk THEERAMUNKONG (Thailand)

COUNCILS AND COMMITTEES

Invited Speakers			
			
Daniel TING (Singapore)	Sunny VIRMANI (United States)	Warapat WONGSAWAD (Thailand)	Sangchul YOON (South Korea)

THE APTOS COUNCIL

Office Bearers

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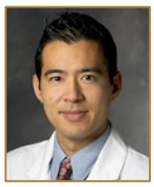
Mingguang HE
(Australia)

Secretary-General
Andreas Müller
(Australia)



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RASEN
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Gavin TAN
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Raba
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Tien-Yin
WONG
(Singapore)

Sangchul
YOON
(Korea)

PROGRAM AT A GLANCE

PROGRAM OVERVIEW

Date: August 28, 2021 (Saturday)
Time: 08:30 – 16:45 (GMT+7)
Online via Zoom

08:30 – 09:00	***Opening Remarks & Launch of 2nd APTOS Big Data Competition***
09:00 – 10:30	***Symposium 1: Evolution of Telemedine, AI & Digital Health in Ophthalmology***
10:30 – 10:45	***Coffee Break***
10:45 – 12:00	***Symposium 2:What's New in AI & Digital Health Alogrithms in Ophthalmic Subspecialities***
12:00 – 13:15	***Symposium 3: Regulatory & Social Perspectives of Telemedicine, AI & Digital Health in Ophthalmology***
13:15 – 13:45	***Lunch Symposium***
13:45 – 15:00	***Symposium 4: Telemedicine, AI & Digital Health in Ophthalmology in the Post-COVID-19 World***
15:00 – 16:30	***Free Papers***
16:30 – 16:45	***Social Program & Closing Remarks***

SCIENTIFIC SESSIONS

PRE-MEETING – AUGUST 27, 2021 (Friday)

Time	Venue	Language	Theme
09:00 – 10:30	Online via Zoom	Thai	Basic AI & Digital Technology in Medicine
10:30 – 12:00	Online via Zoom	Thai	Advanced AI & Digital Technology in Medicine
13:00 – 14:15	Online via Zoom	English	Google Session 1: Overview of Google FHIR APIs and Common Use Cases
14:15 – 15:30	Online via Zoom	English	Google Session 2: Let's build! Hands-On qwiklab Session

AUGUST 28, 2021 (Saturday)

Time	Venue	Type	Theme
09:00 – 10:30	Online via Zoom	Invited	Evolution of Telemedine, AI & Digital Health in Ophthalmology
10:45 – 12:00	Online via Zoom	Invited	What's New in AI & Digital Health Alogrithms in Ophthalmic Subspecialities
12:00 – 13:15	Online via Zoom	Invited	Regulatory & Social Perspectives of Telemedicine, AI & Digital Health in Ophthalmology

PROGRAM AT A GLANCE

Time	Venue	Type	Theme
13:45 – 15:00	Online via Zoom	Invited	Telemedicine, AI & Digital Health in Ophthalmology in the Post-COVID-19 World
15:00 – 16:30	Online via Zoom	Free Paper	Tele-Ophthalmology Challenge

CONGRESS INFORMATION

Name of Event
The 6th Asia Pacific Tele-Ophthalmology Society Symposium (APTOS 2021)

Venue
Online via Zoom

Registration
Free

Time
08:30 – 16:45 (GMT+7)

E-Poster & Video Platform
Please scan the QR code below for poster and video viewing. Whenever you see a QR code with in the bottom right-hand corner of an e-poster, you can always scan the QR code in the e-poster or click anywhere on the e-poster to activate the multimedia provided by the e-poster presenter.

SOCIAL PROGRAM

Ophthalmology Fun Quiz
Date: August 28, 2021
Time: 16:30 – 16:40 (GMT+7)
Venue: Online via Zoom
Format: 10 Multiple-Choice Questions

Scan the QR code below to get started. The game PIN will be provided during the fun quiz.

DID YOU KNOW?

EACH EYE CONTAINS 107 MILLION CELLS, ALL OF WHICH ARE LIGHT SENSITIVE!

AI WORKSHOPS

We will be conducting **AI workshops** online as a pre-meeting of APTOS 2021 on August 27. Details are given as follows:

Date: August 27, 2021
Time: 09:00 – 15:30 (GMT+7)
Venue: Online via Zoom
Theme: Ingest, Manage and Analyze Healthcare Data in Google Cloud

There will be 4 workshops, each with a different focus. The morning sessions will be conducted in Thai while the afternoon sessions in English.

Time	Session	Registration
09:00 – 10:30	Basic AI & Digital Technology in Medicine (Thai)	
10:30 – 12:00	Advanced AI & Digital Technology in Medicine (Thai)	
13:00 – 14:15	**Google Session 1: Overview of Google FHIR APIs and Common Use Cases** (English) Google Cloud's Healthcare API bridges the gap between care systems and applications built on Google Cloud. The Healthcare API offers a fully-managed cloud FHIR service with capabilities to ingest, transform, and access healthcare data in FHIR (Fast Healthcare Interoperability Resources) format. This talk will present an overview of the Google Cloud FHIR APIs and highlight new functionality in the context of ingesting, transforming, and managing patient data.	
14:15 – 15:30	**Google Session 2: Let's build! Hands-On qwiklab Session** (English) Self-paced qwiklab that will walk you through a step-by-step process to create an FHIR server in Google Cloud, import healthcare dataset into FHIR Store, enable application access to healthcare data stored in FHIR Store, export healthcare data to Google Cloud storage and analyze data using BigQuery and Looker.	

CORPORATE PARTNERS

Big Data Competition Sponsor:

Alibaba Cloud | TIANCHI 天池

Founded in 2009, Alibaba Cloud is a global leader in cloud computing and artificial intelligence providing services for thousands of enterprises, developers, governments and organizations in more than 200 countries and regions. Alibaba Cloud Tianchi is a global platform for technology competitions focusing on big data. We have a community of more than 600,000 data scientists from 98 countries and regions worldwide. The platform is designed with the goal to train and to foster practical skills essential to the field of big data. We offer tutorials in a practical learning environment to enable anyone to get started in the data-mining world on a step-by-step basis.

Website: https://tianchi.aliyun.com/

CONGRESS INFORMATION

Diamond Sponsor:

TOPCON Healthcare Solutions

About Topcon Healthcare:
Topcon Healthcare sees eye health differently. Our vision is to empower providers with smart and efficient technologies for enhanced patient care. Keeping pace with the ever-changing landscape of the healthcare industry, we offer the latest integrated solutions, including advanced multimodal imaging, vendor-neutral data management, and ground-breaking remote diagnostic technology.

A globally oriented business, Topcon is focused on developing solutions towards solving societal challenges in the mega-domains of healthcare, agriculture, and infrastructure. In healthcare, these challenges include increasing eye disease, rising medical costs, access to healthcare, and physician shortages. By investing in value-driven innovations, Topcon works to enable people to enjoy good health and high quality of life.

About Topcon Healthcare Solutions Asia Pacific:
Topcon Healthcare Solutions Asia Pacific, a solution arm of Topcon in Asia, is dedicated to providing a world-class software solution for the eye-care industry and beyond in APAC region. Our products enable the collection and visualization of a wide range of imaging data from multiple devices with vendor-neutral connectivity on the cloud service. We also have an integrated service that connects practitioners to an extensive network of reading services to assist in the detection of sight-threatening eye diseases.

Products of Topcon Healthcare Solutions:

- Harmony RS
  Solve your data management and communication challenges, and streamline your practice workflow, with Topcon Harmony Referral Systems (Harmony RS), the next-generation software application. Harmony allows you to connect all of your diagnostic instruments, regardless of manufacturer, in one secure, web-based platform, while providing a variety of features to fit your needs.

1. Minimize Errors & Save Time
   With Harmony's integrated workflow, patient information flows seamlessly from an EMR directly to the device. It also reduces human errors and time spent on entering patient information at the instrument.

2. Unlimited Device Connections & Reduced Costs
   Harmony supports connectivity to a variety of instruments, regardless of device type and brand, allowing you to centrally view relevant data on a single screen and eliminating the need for third party software.

- RDx
  Now more than ever, you need to grow your practice beyond your physical location and deliver quality eye exams from virtually anywhere. Topcon RDx® is an innovative ocular telehealth platform that allows you to connect to your office remotely and conduct comprehensive eye exams, without sacrificing the quality care you provide.

1. Remote Access to Quality Care
   Topcon's CV-5000 automated phoropter integrates with RDx remotely, allowing you to perform refractions from anywhere.
2. Patient Convenience
   Deliver quality eye exams for your patients at a time and place that is convenient and safe for them.
3. Automation and Practice Efficiency
   Utilize the benefits of integrated remote video conferences between you, your staff and patients while connecting and controlling the devices within your practice; in real-time.

Contacts:
Topcon Healthcare Solutions Asia Pacific Pte. Ltd.
1 Jalan Kilang Timor, #09-01 Pacific Tech Centre, Singapore 159303
Website: https://topconhealth.eu/
Email: THSAP@topcon.com

KEYNOTE LECTURES & AWARDS

BEST PAPER & BEST POSTER AWARDS

The Best Paper Award and the Best Poster Award are set up to encourage innovations in ophthalmology. The abstracts (one free paper and one poster) that score the highest in the respective categories will be chosen for the Awards. Abstracts are reviewed and rated based on their originality and scientific importance. The Best Paper presenter will receive **US$200** while the Best Poster presenter will receive **US$100** in addition to a certificate of appreciation. All the submitted abstracts do stand a chance to win.

Best Paper Award:

Ganesh B. JONNADULA, Jayanth RASAMSETTI, Samrat SAH, Rathnam THAYGARAJAN, Padmaja K. RANI, LV Prasad Eye Institute

The Diagnostic Accuracy of an Artificial Intelligence Tool for Diabetic Retinopathy Using Nonmydriatic Fundus Images

Dr Ganesh B. JONNADULA
(India)

Best Poster Award:

Chi Lik AU, Callie KO, Tung Wah Eastern Hospital

Correlation of Ocular Imagings with Visual Prognosis in Hyperbaric Oxygen Treated Acute Central Retinal Artery Occlusion Eyes - the HORA study report

Dr Sunny AU
(Hong Kong)

BIG DATA COMPETITION

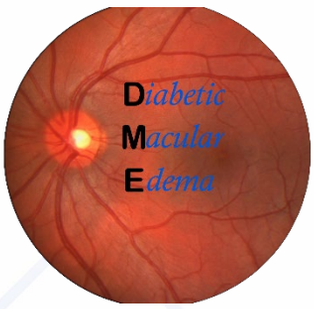
The Asia Pacific Tele-Ophthalmology Society is organizing its 2nd Big Data Competition with the support from the Department of Medical Services of the Thai Ministry of Public Health, Rajavithi Hospital, Rhaiking Hospital, Zhongshan Ophthalmic Center and Tianchi, a subsidiary of Alibaba Group. This year, we will focus on the prediction of anti-VEGF treatment outcomes based on tens of thousands of OCT images of DME patients' eyes taken at baseline and at 6 months after the loading treatment.

Description:

Anti-VEGF treatments are a group of medicines which reduce new blood vessel growth or swelling and can be used to treat a number of eye conditions that cause neovascularization or edema under the macular area of your retina at the back the eyes. However, a substantial number of patients do not respond to this therapy or do so to an inadequate degree. Those calculations have been reported to range from 10% to 50% depending on the study, despite receiving monthly injections of anti-VEGF therapies. Imagine you can identify non-responders before treatment and tailor individualized treatment plans for them.

In this synchronous competition, you will build a machine learning model to predict treatment response of patients with **diabetic macular edema (DME)**. You will work with thousands of images collected in hospital settings to help predict patients' response to anti-VEGF treatments.

Timeline:



- **August 28, 2021** – Launch of Competition
- **October 31, 2021** – Entry Deadline, Merger Deadline & Preliminary Round Submission Deadline
- **November 17, 2021** – Final Submission Deadline ***(Only the top 100 teams in the preliminary can get through to the final.)***
- **December 4, 2021** – Prize Presentation

Cash Prizes:

Participants with the best scores on the private leaderboard are eligible to receive:

- 1st Place – **US$8,000**
- 2nd Place – **US$5,000**
- 3rd Place – **US$2,000**

Additional Opportunities:

Winners in this competition will be invited to contribute to the joint APTOS-ZOC AI Seminar, a sequel of the 6th Asia Pacific Tele-Ophthalmology Society Symposium, on **December 4, 2021**. All winners must present in the "Share & Tell" session on December 4 in order to become eligible for the cash prizes.

KEYNOTE LECTURES & AWARDS

Acknowledgment:

We thank Rajavathi Hospital, Rhaiking Hospital and Zhongshan Ophthalmic Center for providing the images for the 2nd APTOS Big Data Competition.

AUG 27, 2021 (FRI)

AI WORKSHOPS

Basic AI & Digital Technology in Medicine (Thai)
09:00 - 10:20 Venue: Online via Zoom
09:00 ***Basic deep learning for ophthalmologists***
Boonsong ***WANICHWECHARUNGRUANG***
09:10 ***AI for DR Screening***
Mongkol ***TADARATI***
09:20 ***AI for AMD & Other Retinal Diseases***
Jirawut ***LIMWATTANAYINGYONG***
09:30 ***AI for ROP***
Atchara ***AMPORNPRUET***
09:40 ***AI for Analysis Glaucoma Optic Neuropathy***
Kasem ***SERESIRIKACHORN***
09:50 ***AI for Corneal Ectasis Diagnosis & Investigations***
Teeravee ***HONGYOK***
10:00 ***AI in Cataract Detection & Management***
Somporn ***CHANTRA***
10:10 ***AI in Radiology, Pathology & Dermatology***
Paisan ***RUAMVIBOONSUK***
10:20 ***Q&A***

Advanced AI & Digital Technology in Medicine (Thai)
10:30 - 12:30 Venue: Online via Zoom
10:30 ***Advanced AI & Digital Technology in Medicine***
Natsuda ***KAOTHANTHONG***

Google Session 1: Overview of Google FHIR APIs and Common Use Cases (English)
13:00 - 14:15 Venue: Online via Zoom
Dharmesh ***PATEL***

Google Session 2: Let's build! Hands-On qwiklab Session (English)
14:15 - 15:30 Venue: Online via Zoom
Dharmesh ***PATEL****, Chee Weng* ***HEY***
Boon Ping ***TEO,*** *Shao-Horng* ***YONG***
Tanawin ***REINMANOROM***

AUG 28, 2021 (SAT)

ARTIFICIAL INTELLIGENCE

Evolution of Telemedicine, AI & Digital Health in Ophthalmology

09:00 - 10:30 Venue: Online via Zoom
Chair(s): Mingguang ***HE,*** *Thanaruk* ***THEERAMUNKONG***

09:00 ***Code-Free Deep Learning – the Next Phase of AI-Enabled Healthcare***
Pearse ***KEANE***
09:15 ***Virtual Reality & Augmented Reality in Ophthalmology***
Lama ***AL-ASWAD***
09:30 ***Blockchain Technology in Healthcare***
Marten ***BRELEN***
09:45 ***Generalizability and Translation of AI Systems***
Joelle ***HALLAK***
10:00 ***Natural Language Processing in Healthcare***
Thanaruk ***THEERAMUNKONG***
10:15 ***AI in Ophthalmology and Translation to Healthcare Products***
Sunny ***VIRMANI***

What's New in AI & Digital Health Algorithms in Various Ophthalmic Subspecialties

10:45 - 12:00 Venue: Online via Zoom
Chair(s): Robert ***CHANG****, Paisan* ***RUAMVIBOONSUK****, Sangchul* ***YOON***

10:45 ***New Digital Models of Care in the Post COVID-19 Era for Retinal Diseases***
Gavin ***TAN***
11:00 ***Using AI to Gain New Insights Regarding Primary Open Angle Glaucoma***
Louis ***PASQUALE***
11:15 ***AI and Digital Innovation in Cataract and Anterior Segment Diseases***
Haotian ***LIN***
11:30 ***Neuro-Ophthalmology***
Dan ***MILEA***
11:45 ***Retinopathy of Prematurity***
Peter ***CAMPBELL***

SCIENTIFIC PROGRAM SCHEDULE

Regulatory and Social Perspectives of Telemedicine, AI & Digital Health in Ophthalmology

12:00 - 13:15 Venue: Online via Zoom
*Chair(s): Andreas **MÜLLER**, Ngamkae **RUNGVARAVATE***

12:00 ***Expediting Ophthalmic AI Globally: FDA's Impact***
*Malvina **EYDELMAN***
12:15 ***Ethical AI in Healthcare: Creation of an Industry***
*Michael **ABRAMOFF***
12:30 ***Beyond 'Bench to Bookshelf:' Leveraging Implementation Science to Improve Public Health Using Teleophthalmology and Artificial Intelligence***
*Yao **LIU***
12:45 ***Equitable Access to AI in Eye Care***
*Nicolas **JACCARD***
13:00 ***Interpretable AI in Ophthalmology***
*Natsuda **KAOTHANTHONG***

TELE-OPHTHALMOLOGY

Telemedicine, AI & Digital Health in the Post-COVID-19 World

13:45 - 15:00 Venue: Online via Zoom
*Chair(s): Carol **CHEUNG**, Daniel **TING**, Warapat **WONGSAWAD***

13:45 ***Teleophthalmology in India and its Adaptation in the COVID-19 Era***
*Kim **RAMASAMY***
14:00 ***Tele-Ophthalmlogy: A Moorfield Experience***
*Dawn **SIM***
14:15 ***Tele-Ophthalmology in Japan***
*Ryo **KAWASAKI***
14:30 ***AI in Ophthalmology: Sky is the Limit***
*Daniel **TING***
14:45 ***The Tele-Ophthalmology Experience in Thailand***
*Warapat **WONGSAWAD***

SUBMITTED PROGRAM- FREE PAPERS

AUG 28, 2021 (SAT)

FREE PAPER SESSION

15:00 - 16:30 Venue: Online via Zoom
*Chair(s): Mingguang **HE**, Paisan **RUAMVIBOONSUK***

15:00 ***3D Convolutional Neural Network (CNN) based abnormality classification in Optical Coherence Tomography (OCT) images***
Krunalkumar R. ***PATEL***
15:09 ***Development & Validation of an Offline Deep Learning Algorithm for Detecting Vitreoretinal Abnormalities on Ocular Ultrasound***
Krishna ***VENKATESH***
15:18 ***Capsule Network Based Classification of Age-Related Macular Disease Using Optical Coherence Tomography Images***
Ali ***CELEBI***
15:27 ***The Diagnostic Accuracy of an Artificial Intelligence Tool for Diabetic Retinopathy Using Nonmydriatic Fundus Images***
Ganesh ***JONNADULA***
15:36 ***COVID-19 Lockdown: Not a Barrier for Retinopathy of Prematurity Screening***
Ashwin ***SEGI***
15:45 ***Anterior Segment Imaging Using a Simple Universal Smartphone Attachment for Patients***
Vineet ***JOSHI***
15:54 ***Assessment of Referable Diabetic Retinopathy by Tele-ophthalmology Versus Fundus Examination by Retina Specialist in Diabetes Care Clinics in India***
Ramachandran ***RAJALAKSHMI***
16:03 ***Agreement and Diagnostic Test Accuracy of Diabetic Retinopathy Grading Using Fundus Photographs as Compared to Indirect Ophthalmoscopy at a Primary Eye Care Setting in Nepal: The Bhaktapur Retina Study***
Raba ***THAPA***
16:12 ***Comparative Assessment of Tear Function Tests, Tear Osmolarity, and Conjunctival Impression Cytology between Patients with Pterygium and Healthy Eyes***
Nader ***NASSIRI***
16:21 ***Evaluation of SARS-COV2 Virus via Tears and Conjunctival Secretions of COVID-19 Patients and its Effectiveness as Diagnostic Tool***
Ambreen ***GUL***

SUBMITTED PROGRAM- E-POSTER

ARTIFICIAL INTELLIGENCE

Comparison of Visual Estimation of Cupping by Human Ophthalmologist to a Machine Learning Algorithm
First Author: John D. ***AKKARA***
Co-Author(s): Anju ***KURIAKOSE***

Detection and Grading Diabetic Retinopathy Using Artificial Intelligence in a Portable Fundus Camera
First Author: John D. ***AKKARA***
Co-Author(s): Anju ***KURIAKOSE***

Development of Robotic Unmanned Remote Controlled Slit Lamp during COVID Pandemic
First Author: Anuj ***KODNANI***
Co-Author(s): Sulatha ***BHANDARY****, V. S.* ***VENKATESH****, Premjith* ***MENON****, Nayan* ***PRAKASH***

Improving Screening for Early Glaucoma: Feasibility of Using Style-Transfer to Predict Retinal Nerve Fiber Layer Thickness Distribution in the Ocular Fundus
First Author: Henry ***CHEN***
Co-Author(s): Guan-An ***CHEN****, Jhen-Yang* ***SYU****, Jian-Ren* ***CHEN****, Su-Chen* ***HUANG.*** *Wei-Wen* ***SU***

Plateau Iris Prediction Using Loss Value of Neural Style Transfer as Classification Feature
First Author: Natsuda ***KAOTHANTHONG***
Co-Author(s): Boonsong ***WANICHWECHARUNGRUANG****, Warisara* ***PATANAPONGPAIBOON****, Pantid* ***CHANTANGPHOL****, Paisan* ***RUAMVIBOONSUK****, Thanaruk* ***THEERAMUNKONG***

Problems of processing of ophthalmological images for DICOM
First Author: Kazim H. ***OR***

CATARACT

Evaluation of Ocular Biometry by Two Swept Source ASOCT Devices
First Author: Boonsong ***WANICHWECHARUNGRUANG***
Co-Author(s): Anyarak ***AMORNPETCHSATHAPORN****, Wisakorn* ***WONGWIJITSOOK****, Peranut* ***CHOTCOMWONGSE****, Kittipong* ***KONGSOMBOON****, Somporn* ***CHANTRA***

Nd:YAG Capsulotomy - Induced IOL Position Changes
First Author: Martin ***FUS***
Co-Author(s): Sarka ***PITROVA***

Posteriorly Luxated Cystalline Cataract Imaged Using Inexpensive Portable Smartphone Fundus Camera
First Author: Anju ***KURIAKOSE***
Co-Author(s): John D. ***AKKARA***

CLINCAL & EPIDEMIOLOGIC RESEARCH

Biological Importance of Sciadopitysin on Different Fungal Strains: Biological Role in the Medicine
First Author: Dinesh K. ***PATEL***

Data Review and a Pilot Study for Possible Screening in Ethambutol Optic Neuropathy: 7-Year Review in Rajavithi hospital, Bangkok, Thailand
First Author: Pareena ***CHAITANUWONG***
Co-Author(s): Akechanok ***WATCHARAPANJAMART****, Supaporn* ***SRITHAWATPONG***

CORNEA

Burden of Ocular Chemical Burn at Tertiary Eye Care Centre of Central India
First Author: Shweta ***WALIA***
Co-Author(s): Sapna ***SABNANI****, Vijay* ***BHAISARE****, Neetu* ***KORI***

Partial versus Full Thickness Limbal Relaxing Incisions during Phacoemulsification for Treatment of with-the-rule Astigmatism in Senile Cataract Patients
*First Author: Nader **NASSIRI***
*Co-Author(s): Kourosh **SHEIBANI***

Screening for MIR184 Mutations in Iranian Patients with Keratoconus
*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

The Effect of Topical Betamethasone Eye Drops on Postoperative Haze among Patients Undergoing Corneal Collagen Cross-Linking: a Randomized, Double Blind Placebo Controlled Study
*First Author: Nader **NASSIRI***
*Co-Author(s): Kourosh **SHEIBANI***

GLAUCOMA

Diagnostic Performance of Anterior Segment Optical Coherence Tomography for Detecting Plateau Iris
*First Author: Boonsong **WANICHWECHARUNGRUANG***
*Co-Author(s): Warisara **PATANAPONGPAIBOON**, Nucharee **PARIVISUTT**, Kasem **SERESIRIKACHORN**, Kornkamol **ANNOPAWONG**, Wararee **SRIYUTTAGRAI***

Is Post-Trabeculectomy Serous Choroidal Detachment a Risk Factor for Failure in the Long Term?
*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

Short, Intermediate and Long-Term Results of Ahmed Glaucoma Valve Implantation
*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

GENERAL OPHTHALMOLOGY

Impact of the Lockdown on Ocular Emergency Cases Spectrum and Outcome
*First Author: Shweta **WALIA***
*Co-Author(s): Vijay **BHAISARE**, Sapna **SABNANI**, Neetu **KORI**, Preeti **RAWAT**, Bhupendra **SHARMA***

Ophthalmic Findings in Rhinoorbital Mucormycosis Following SARS-CoV-2 Infection
*First Author: Rajwinder **KAUR***

LENS

Visual Acuity, Endothelial Cell Density and Polymegathism after Iris-Fixated Lens Implantation
*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

OCULAR IMAGING

A Comparison between Manual Counting and Customized Software Analysis of Lens Epithelial Cell Density
*First Author: Poramaporn **LUANGPRASERT***
*Co-Author(s): Chaiwat **TEEKHASAENEE**, Thunchanok **THAMMASANYA**, Yanin **SUWAN**, Apichat **TANTRAWORASIN**, Sipat **TRIUKOSE***

Anterior Segment Characteristics in Normal and Keratoconus Eyes Evaluated with a Combined Scheimpflug/Placido Corneal Imaging Device
*First Author: Nader **NASSIRI***
*Co-Author(s): Kourosh **SHEIBANI***

Central Corneal Thickness in Highly Myopic Eyes: Inter-Device Agreement of Ultrasonic Pachymetry, Pentacam and Orbscan II before and after Photorefractive Keratectomy
*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

Comparison of Choroidal Thickness Measuremen ts between Spectral- Domain Optical Coherence

SUBMITTED PROGRAM- E-POSTERS & VIDEOS

Tomography and Swept-Source Optical Coherence Tomography in Children: Hong Kong Children Eye Study
*First Author: Chun On **LEE***
*Co-Author(s): Xuijuan **ZHANG**, Shumin **TANG**, Lijia **CHEN**, Carol **CHEUNG**, Jason **YAM***

Correlation of Ocular Imagings with Visual Prognosis in Hyperbaric Oxygen Treated Acute Central Retinal Artery Occlusion Eyes - the HORA Study Report
*First Author: Chi Lik **AU***
*Co-Author(s): Callie **KO***

Optical Coherence Tomography to Detect Pre-Clinical Retinal Changes in Patients with Mild Cognitive Impairment
*First Author: Anju **KURIAKOSE***
*Co-Author(s): John D. **AKKARA***

RETINA & VITREOUS

HbA1c as a predictor for response of Bevacizumab in patients with Diabetic Macular Edema
*First Author: Sadhana **SHARMA***
*Co-Author(s): Pratap **KARKI**, Sagun **JOSHI**, Sanket **PARAJULI***

OCT Patterns of Diabetic Macular Edema and Treatment Response to Bevacizumab
*First Author: Sadhana **SHARMA***
*Co-Author(s): Pratap **KARKI**, Sagun **JOSHI**, Sanket **PARAJULI***

Outcomes of Vitreoretinal Complications Requiring Surgery after Abusive Head Trauma
*First Author: Yasmin **ISLAM***
*Co-Author(s): Syed K. **GIBRAN***

TELE-OPHTHALMOLOGY

Anaglyph Glasses and Virtual Reality Headsets for Watching 3D Ophthalmic Content
*First Author: John D. **AKKARA***
*Co-Author(s): Anju **KURIAKOSE***

Comparison of Two 3D Printed Smartphone Fundus Cameras
*First Author: Anju **KURIAKOSE***
*Co-Author(s): John D. **AKKARA***

Feasibility Study of Home Vision Testing by the Caregivers for Tele-Ophthalmology
*First Author: Navya D. **DAVARA***
*Co-Author(s): Padmaja K. **RANI**, Pravin K. **VADAVALLI**, Raghava C. **CHINTOJU**, Neelima **MANCHIKANTI**, Chodup **THINLEY***

Identifying Undetected Prevalent Disease: The First Pass Effect in Diabetic Retinopathy Screening Programs
*First Author: Recivall **SALONGCAY***
*Co-Author(s): Lizzie A. **AQUINO**, Claude M. **SALVA**, Lloyd P. **AIELLO**, Tunde **PETO**, Paolo **SILVA***

Impact of Implementing Tele-Ophthalmology Referral Guidelines Using the eyeSmart EMR App in Rural India
*First Author: Padmaja K. **RANI***
*Co-Author(s): Anthony V. **DAS**, Niranjan **KUMAR**, Rohit **KHANNA***

Impact of Teleophthalmology during COVID-19 Lockdown in a Tertiary Care Centre in South India
*First Author: Ashwin **SEGI***
*Co-Author(s): Meenakshi **RAVINDRAN**, Fathima **ALLAPITCHAI**, Syed **MOHIDEEN**, Ramakrishnan **RENGAPPA***

Improvising Tele-Ophthalmology – Novel Use of Google Hangouts for Vision Center Tele-consultation in India
*First Author: Bharat **GURANI***
*Co-Author(s): Rengaraj **VENKATESH**, Kirandeep **KAUR***

Innovative Solutions for Effective Tele-Ophthalmology in Primary Eye Care
*First Author: Padmaja K. **RANI***
*Co-Author(s): Ranganath **VADAPALLI**, Anthony V. **DAS**, Rohit **KHANNA**, Anand K. **PANAGANTI**, Pravin K. **VADAVALLI***

Is Tele-Ophthalmology Different in Urban and in Rural Areas?
*First Author: Ankita **SANGLE***
*Co-Author(s): Sulatha **BHANDAR**, Priyanka **RAMESH***

Role of Vision Centers in Eliminating Avoidable Blindness Caused Due to Uncorrected Refractive Error in Rural South India
*First Author: Ranitha G. **SELVI***
*Co-Author(s): Ramakrishnan **RENGAPPA**, Shivkumar **CHANRASHEKHARAN**, Mohammed **SITHIQ**, Meenakshi **RAVINDRAN**, Mohideen A. **KADER***

Setting up Asynchronous Virtual Glaucoma Clinics in Orkney
*First Author: Elewys **HEARNE***
*Co-Author(s): Susan **LIGHTMAN***

Synchronous Tele-Ophthalmology – A Hidden Boon for Rural Population in Pre-Corona Era
*First Author: Sanjay **THAKUR***
*Co-Author(s): Sagar **KARMAKAR**, Biswarup **RAY**, Soumen **CHAKRABORTY***

Tele-Rehabilitation for Persons with Vision Impairment during COVID 19: Experiences and Lessons Learned
*First Author: Beula **CHRISTY***
*Co-Author(s): Padmaja K. **RANI**, Anthony V. **DAS***

Tele-Screening of Vision Threatening Conditions by Non-Ophthalmologists during COVID-19 Lockdown – a Pilot Study
*First Author: Abhishek **ONKAR***
*Co-Author(s): Rashmi **KUMARI**, Manish **KUMAR**, Nishit **RANJAN**, **SUMMET***

User Acceptability of Home Monitoring of Macular Disease – Do our patients approve?
*First Author: Meriam **ISLAM***
*Co-Author(s): Stafford **SAMSONE**, Lucas **BACHMANN**, Dawn **SIM***

SUBMITTED PROGRAM- VIDEOS

ARTIFICIAL INTELLIGENCE

Automated Screening Algorithm for Detection of Retinal Conditions referable to Ophthalmologists
*First Author: Mansi **GUPTA***
*Co-Author(s): Ganesh **BABU**, Krunal **PATEL***

RETINA & VITREOUS

Intra-Operative Overlooked Mistakes not Always a One-Way Ticket
*First Author: Sriharanathan **POOPALARATNAM***

TELE-OPHTHALMOLOGY

Creating the Eye Grader App for Clinical Grading in Ophthalmology
*First Author: John D. **AKKARA***

ABSTRACTS- FREE PAPERS

FREE PAPERS

ARTIFICIAL INTELLIGENCE

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

3D Convolutional Neural Network (CNN) based abnormality classification in Optical Coherence Tomography (OCT) images

First Author: Krunalkumar R. ***PATEL***
Co-Author(s): Sumukha ***MANJUNATH****, Ganesh B.* ***CHANDRA***

Objective: The advancement of OCT technology and increasing number of requirements of patient reviews has created a need for an automated algorithm that improves the workflow efficiency. In this study, we developed 3D CNN based abnormality detection algorithm for macular OCT cubes.
Methods: A total of 4193 macular cubes (1024x512x32), acquired from 2388 patients using PRIMUS 200 (ZEISS, Dublin, CA), were used for training the abnormality detection algorithm. 3D variant of Inception_Resnet_V2 CNN was trained using classification_models_3D TensorFlow based library. All the macular OCT cubes were labelled as either normal or abnormal with one or more of the four macular diseases, Age-related Macular Degeneration (AMD), Diabetic Macular Edema (DME), Retinal Vein Occlusion (RVO) and Other Vitreo Retinal Diseases (OVRD). For pre-processing, the region of interest (ROI), containing only the retinal layers was extracted for each B-scan.
Results: The performance of the algorithm was evaluated on 1347 (639 Abnormal and 418 Normal) macular OCT cubes. For the abnormality, 135, 214, 143 and 357 cubes were having AMD, DME, RVO and OVRD respectively. The model achieved 91% AUC, 83% equal sensitivity and specificity, 86% F1-score and 88% precision. The algorithm was 79% accurate for AMD, 94% for DME, 97% for RVO and 78% for OVRD to classify as abnormal.
Conclusions: In this study, we developed a 3D CNN based algorithm for abnormality detection in macular OCT cubes, that can be used to support in making clinical decision for improvement of workflow efficiency.

Keywords: Deep Learning, OCT, 3D CNN, Disease Classification

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

Capsule Network Based Classification of Age-Related Macular Disease Using Optical Coherence Tomography Images

First Author: Ali R. ***CELEBI***
Co-Author(s): Erkan ***BULUT****, Aysun* ***SEZER***

Objective: With the aid of spectral domain optical coherence tomography (SD-OCT), it has become easy to detect age related macular disorder (AMD). Classification of SD-OCT images of the AMD can be achieved with the use of Capsule Networks (CapsNet). It is aimed to improve the accuracy of proposed CapsNet architecture trained on speckle noise reduced OCT images based on an optimized Bayesian non-local mean (OBNLM) filter.
Methods: We have collected SD-OCT images and region of interest (ROI) was identified in order to reduce background effect and image complexity. Speckle noise in OCT images were reduced based on OBNLM filter. A total of 726 SD-OCT images were collected and labelled as 159 drusen, 145 dry AMD, 156 wet AMD and 266 normal. The processed images were fed to proposed capsule network architecture to classify OCT images. Accuracy rates were calculated in both local and public Kaggle dataset.
Results: Accuracy rate of classification of local SD-OCT image dataset was achieved to a value of 96.39% after performing data augmentation and speckle noise reduction with OBNLM. The performance of CapsNet was evaluated on the public Kaggle dataset under the same pre-processing procedures and the accuracy rate was calculated as 98.07%.
Conclusions: The classification success of CapsNet may be improved with robust pre-processing steps like; determination of ROI and denoised SD-OCT images based on OBNLM. These impactful image preprocessing steps yielded higher accuracy rates for determining AMD types on the both local and public dataset with proposed CapsNet architecture.

Keywords: Capsule network, SD-OCT, AMD, OBNLM, Deep Learning

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

Development & Validation of an Offline Deep Learning Algorithm for Detecting Vitreoretinal Abnormalities on Ocular Ultrasound

First Author: Krishna A. ***VENKATESH***
Co-Author(s): Prabu ***BASKARAN****, Aruna* ***S****, Arthi* ***MOHANKUMAR****, Jean P.* ***HUBSCHMAN****, Aakriti G.* ***SHUKLA***

Objective: We describe the development of an offline deep learning algorithm (DLA) and validation of its diagnostic ability for identifying vitreoretinal abnormalities (VRA) on ocular

ABSTRACTS- FREE PAPERS

ultrasound (OUS). Ours is a prospective study involving consecutive patients at Aravind Eye Hospital at Chennai and Pondicherry, India seen between January-2018 and December-2019.
Methods: Enrolled participants underwent OUS. All images were assessed and classified as normal or abnormal by two fellowship-trained vitreoretinal specialists. A dataset consisting of 4850 OUS images was collected and 4740 images of satisfactory quality were used. Of this, 4319 were processed for further training of DLA, and 421 images were used for validation. We trained an Inception-ResNet-V2 model (DLA) for classify normal and abnormal OUS.
Results: Our algorithm demonstrated high sensitivity and specificity in identifying VRA on OUS ([90.8%; 95 % confidence interval (CI): 86.1% to 94.3%] and [97.1% (95% CI: 93.7% to 98.9%], respectively). PPV and NPV of the algorithm were also high ([97.0%; 95% CI 93.7% to 98.9%] and [90.8%; 95%CI 86.2 % to 94.3%], respectively). The AUROC was also high at 0.939, and the inter-grader agreement was nearly perfect with Cohen's kappa of 0.938. The model demonstrated high sensitivity in predicting abnormalities in OUS images with vitreous hemorrhage (100%), retinal detachment (97.4%), and choroidal detachment (100%).
Conclusions: Our offline DLA software demonstrated reliable performance for predicting VRA on OUS. Such an offline system may improve eye care standards overall, and especially at centers where human resources and internet access are limited.

Keywords: Deep Learning, Artificial Intelligence, Ultrasound; Vitreo-Retinal, Retina, Vitreous

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

The Diagnostic Accuracy of an Artificial Intelligence Tool for Diabetic Retinopathy Using Nonmydriatic Fundus Images

First Author: Ganesh B. ***JONNADULA***
Co-Author(s): Jayanth ***RASAMSETTI****, Samrat* ***SAH****, Rathnam* ***THAYGARAJAN****, Padmaja K.* ***RANI***

Objective To validate the accuracy of ScreenRad™, an Artificial Intelligence (AI) tool for the detection of diabetic retinopathy (DR) from non-mydriatic fundus images.
Methods: In total, 66,957 background images were collected through a DR screening program and a tertiary eye care center. Training of the ScreenRad™ model (a machine-based model developed based on a convolutional neural network) was done using quality classifiers (7,306), gradability classifier (43,167), DR classifier (2,820), and Diabetic macular edema (DME) classifier (3,081) fundus images obtained from a nonmydriatic fundus camera (3 metro Forus Royal). DR and DME validation data included 1,109 background images. The classification of DR was based on the international severity scale of clinical DR and DME. Diagnosis of moderate/severe nonproliferative DR, proliferative DR, moderate /severe DME was considered referable DR and DME. Sensitivity, specificity, and area under curve (AUC) were calculated.
Results: The Screen Rad AI tool sensitivity and specificity for any DR was 89% and 93% and for referable DR was 91% and 95%. The AUC was 0.94 and 0.95 for any DR and referable DR, respectively. The sensitivity and .specificity were 79% and 90% for any DR and 82 and 94% for referable DR. The AUC was 0.81 and 0.84 for any DME and referable DME, respectively.
Conclusions: The Screen Rad AI tool has shown optimal accuracy in detecting referable DR and DME from non-mydriatic fundus images. In addition, the model results promise integration into the non-mydriatic fundus imaging workflows at the primary care and physician clinics.

Keywords Artificial Intelligence, Diabetic Retinopathy Screening, Fundus Photographs, Machine Learning; Non Mydriatic Images

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CLINCAL & EPIDEMIOLOGIC RESEARCH

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

Agreement and Diagnostic Test Accuracy of Diabetic Retinopathy Grading Using Fundus Photographs as Compared to Indirect Ophthalmoscopy at a Primary Eye Care Setting in Nepal: The Bhaktapur Retina Study

First Author: Raba ***THAPA***
Co-Author(s): Shankar ***KHANAL****, Hendra S.* ***TAN****, Suman S.* ***THAPA****, Gerardus H.* ***VAN RENS***

Objective: Diabetic retinopathy (DR) is a leading cause of visual impairment globally. Study aimed to assess the agreement and diagnostic test accuracy of DR grading using fundus photographs as compared to indirect ophthalmoscopy at a primary eye care setting in Nepal.
Methods: Bhaktapur Retina Study is a population based cross-sectional study. Five fundus photographs of each eye under mydriasis were taken using canon digital fundus camera (CRX, Canon Company). Retina specialist were involved in grading of DR both in fundus photography and indirect

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ophthalmoscopy using 90 Diopter lens. Agreement using kappa coefficient, sensitivity, specificity, positive predictive, and negative predictive value were assessed.
Results: Two hundred forty-two eyes of people with diabetes with gradable fundus photographs were included in the study. Agreement for any DR was substantial (kappa (k) value, 95% CI: 0.80 (0.71 – 0.89) with 84.31% sensitivity and 95.81% specificity. The agreement for mild non-proliferative diabetic retinopathy (NPDR) was moderate (k value, 95% CI: 0.60 (0.39 – 0.80), 58.82% sensitivity and 97.77% specificity. Agreement for severe NPDR and proliferative diabetic retinopathy (PDR) each was almost perfect (k value: 1.00), 100% sensitivity and 100% specificity. Agreement for clinically significant macular edema (CSME) was also almost perfect (k value: 0.94), 100% sensitivity and 99.17% specificity.
Conclusions: The agreement of DR grading on fundus photography as compared to indirect ophthalmoscopy was almost perfect for severe NPDR, PDR and CSME. The agreement was substantial for any DR and moderate for grading mild NPDR. This highlights the important role of tele-ophthalmology in DR screening.

Keywords: Agreement, Diabetic Retinopathy Grading, Fundus Photography, Sensitivity, Specificity

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

Comparative Assessment of Tear Function Tests, Tear Osmolarity, and Conjunctival Impression Cytology between Patients with Pterygium and Healthy Eyes

*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

Objective: To compare histologic abnormalities of tear film and tear osmolarity between normal eyes and eyes with pterygium.
Methods: This was a prospective, hospital-based, case-control study involving 95 patients (65 men, 30 women) with unilateral pterygium. The tear meniscus height (TMH), Schirmer's test-1 (SCH-1) score, Rose Bengal staining (RBS) score, tear film breakup time (TBUT), tear osmolarity (TO), and conjunctival impression cytology (CIC) were assessed in both eyes.
Results: The mean patient age was 50.9 years, with the largest age group being the 45-55 year-old bracket across both genders. Most patients (82.1%) had nasal pterygium, and 80% were involved in outside activities. The mean assessment values in the case and control groups were as follows: TMH, 0.21 vs. 0.24 mm; SCH-1, 13.2 vs. 17.8 mm; RBS, 4.38 vs. 2.51 points; TBUT, 8.7 vs. 13.2 seconds; TO, 306 vs. 299 mOsm/L ($P < 0.001$ in all cases). The proportions of abnormal assessment values in the case and control groups were as follows: TMH, 82.1% vs. 3.16%; SCH-1, 20% vs. 2.1%; RBS, 30.53% vs. 4.22%; TBUT, 61.05% vs. 6.3%; TO, 10.52% vs. 1.05%; CIC, 33.7% vs. 7.37% ($P < 0.05$ for all comparisons).
Conclusions: This study showed that the quantity and quality of tear film, as well as the number of goblet cells, decreased, but the tear osmolarity increased in eyes with pterygium. Furthermore, the TMH, RBS results, TBUT, and CIC have more precise state of the patient's tear condition with the disease of the pterygium.

Keywords: Conjunctival Impression Cytology; Pterygium, Schirmer's Test, Tear Breakup Time, Tear Meniscus Height

GENERAL OPHTHALMOLOGY

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

Evaluation of SARS-COV2 Virus via Tears and Conjunctival Secretions of COVID-19 Patients and its Effectiveness as Diagnostic Tool

*First Author: Ambreen **GUL***
*Co-Author(s): Rafaq **SALEEM**, Fuad **NIAZI***

Objective: The study was conducted to determine the frequency of SARS-COV 2 viruses in ocular secretions of patients with confirmed COVID-19 and its effectiveness as a diagnostic tool. Also, to determine whether all or only conjunctivitis patients of COVID-19 have SARS-COV 2 virus in their ocular secretions.
Methods: Prospective interventional case series of 3 months duration conducted from September 2020 till November 2020. Conjunctival and tear secretion sampling of 60 hospitalized patients of COVID-19 confirmed with nasopharyngeal swabs was performed with disposable conjunctival swab sticks. Sampling was done within 3 days of admission. SARS-COV 2 virus evaluation in tears and conjunctival secretions was done by Qualitative RT-PCR (Reverse transcriptase polymerase chain reaction) analysis. Ocular features were documented. Regarding systemic course of illness, details were noted from their hospital records.
Results: The mean age of patients was 56.63±16.373 years (range 18-89). Out of 60

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patients, there were 42 males (70%) and 18 females (30%). 22 (36.6%) patients had mild disease and moderate and severe disease was present in 19 patients (31.6%) each. 6 (10%) patients had positive conjunctival and tear secretions for SARS-COV 2 viral RNA. All patients with positive ocular secretions for viral RNA were in first week of course of disease and 3 patients had severe COVID 19 disease signifying high viral load. Only one patient had conjunctivitis and ocular symptoms of redness and foreign body sensation.
Conclusions: We speculate that detection of SARS COV 2 viral RNA in ocular secretions of patients with COVID 19 could be spotted whether patients are with or without conjunctivitis. Among COVID 19 patients included in this study, ocular manifestations were not common. Consequently, likelihood of SARS-COV 2 virus transmission via ocular secretions is existing as frequency of patients having SARS-COV 2 viral RNA detected in tears was 10 % in current study. However, SARS-COV 2 virus evaluation in ocular secretions cannot be used as effective diagnostic tool for COVID 19. and therapeutic services.

Keywords: SARS-COV 2 Virus, COVID 19, Ocular Secretions, Conjunctivitis, Qualitative RT-PCR

TELE- OPHTHALMOLOGY

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

Anterior Segment Imaging Using a Simple Universal Smartphone Attachment for Patients

First Author: Vineet ***JOSHI***
Co-Author(s): Pravin K. ***VADAVALLI****, Ashish* ***JAIN****, Rathinam* ***THYAGRAIAN***

Objective: To assess the utility of a universal smart phone attachment to capture images of the anterior segment of the eye.
Methods: A retrospective analysis of 344 images, captured using a smartphone by patients was done to identify factors affecting image quality lack of perspective, resolution, illumination and focus. Based on this analysis, a universal smartphone attachment Grabi™ Lite along with a protocol for anterior segment imaging was designed and validated with eyes imaged on gold standard slit lamp photography. In the prospective arm 9 patients were trained to use Grabi™ Lite with imaging protocol and the images were assessed for suitability in clinical decision making, risk stratification triage and referral to a tertiary eye centre.
Results: The quality of 344 images: good 24(7%), average 209(60.8%) and bad 111 (32.2%). Of these, 55(16%) images were suitable for clinical decision making and 224 (65.6%) images for risk stratification. Lack of focus, illumination, perspective and resolution were seen in 284 (87.1%), 226(69.3%), 167(51.2%) and 126(38.7%) images which improved in the next iteration of 178 images captured by patients using Grabi Lite + imaging protocol to good 103(57%), average 58(32.6%) and bad 17(19.6%) ($p<0.001$ using Chi Square test). Images deemed suitable for clinical decision making and risk stratification for triage also improved to 80 (45%), 158(88.8%) ($p<0.001$ using Chi Square test) respectively.
Conclusions: The Grabi lite + imaging protocol, is an effective tool to improve anterior segment imaging allowing the use of smartphones for teleconsultations. This is a universal solution for all smartphones with the patient as the user.

Keywords: Smartphone Imaging, Anterior Segment, Cornea

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

Assessment of Referable Diabetic Retinopathy by Tele-ophthalmology Versus Fundus Examination by Retina Specialist in Diabetes Care Clinics in India

First Author: Ramachandran ***RAJALAKSHMI***
Co-Author(s): Viswanathan ***MOHAN****,*
Vijayaraghavan ***PRATHIBA***

Objective: To assess the prevalence of sight-threatening diabetic retinopathy (STDR) detected by tele-ophthalmology in diabetes clinics versus fundus examination (FE) by ophthalmologists at diabetes clinics in India.
Methods: People with diabetes (PWD) underwent screening for diabetic retinopathy (DR) by fundus photography with Remidio fundus on phone camera by eye-technicians in 25 diabetes care clinics across India in 2019-2020 and in 5 diabetes care clinics in south India by fundus examination by Retina specialists. Clinical and biochemical assessment was also carried out. DR was graded by the ophthalmologists in both settings using the International Clinical Classification of DR (ICDR) scale. STDR was defined as presence of proliferative DR (PDR) and/ or diabetic macular edema.
Results: The mean age of the PWD screened by tele-ophthalmology (n=25,461) in 25 clinics was 55.3± 11.3 years and mean duration of diabetes 11.3 ± 7.2 years. The mean age and mean duration of diabetes of the PWD

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screened by FE (n=34,239) in 5 clinics was 57.2 ± 11.7 years and 13.7 ± 8.0years respectively. The mean glycated hemoglobin was 8.8 ± 2.1% and 8.4 ± 1.9% in the above two groups respectively. By tele-ophthalmology, any DR was detected in 8194 (32.2%) PWD and STDR requiring referral to ophthalmologist was detected in 2421 (9.5%). By Ophthalmologists' FE, any DR was detected in 14,007 (40.3%) and STDR was detected in 4,463 (12.8%) PWD.
Conclusions: Tele-ophthalmology in diabetes clinics is a good option for timely DR detection as only around 10% of them required referral to ophthalmologist for further management of STDR. Use of tele-ophthalmology and artificial intelligence (AI) are valuable strategies to improve remote DR screening in diabetes clinics especially during these lockdown times.

Keywords: Tele-Retinal Screening, Referable Diabetic Retinopathy; Diabetes Clinics; Asian Indians

Aug 27, 2021 (Saturday), 15:00 – 16:30
Venue: Online via Zoom

COVID-19 Lockdown: Not a Barrier for Retinopathy of Prematurity Screening

First Author: Ashwin ***SEGI***
Co-Author(s): Meenakshi ***RAVINDRAN****, Syed* ***MOHIDEEN****, Fathima* ***ALLAPITCHAI****, Ramakrishnan* ***RENGAPPA***

Objective: To present the outcome of retinopathy of prematurity (ROP) screening through teleophthalmology during the ongoing COVID-19 lockdown.
Methods: This cross-sectional observational hospital-based study included ROP screening of 780 preterm infants between 1st of April to 31st of July 2020. With the help of our RetCam shuttle the mid-level ophthalmic professionals (MLOP) travelled to various hospitals for ROP screening of premature infants. The images obtained were sent to the base hospital and analysed by retina specialist for further management.
Results: Overall, 780 preterm infants were screened of which 466 (59.74%) were new patients and 314 (40.26%) were review patients. Among the preterm infants screened, 128 (16.41%) of them were diagnosed with ROP. Of these 18 of them were advised to undergo laser and 17 were given injection avastin.
Conclusions: RetCam imaging has been a useful screening tool for detecting treatable ROP during these difficult times. With the help of RetCam imaging we were able to accurately detect cases of high-risk ROP (prethreshold and threshold disease) & aggressive posterior retinopathy of prematurity (APROP), and provide appropriate treatment. With the help of teleophthalmology we were able to diagnose and provide timely intervention, which otherwise would have led to complication and blindness due to ROP. In conclusion, teleophthalmology for ROP screening has played a vital role for screening, detecting and managing ROP during the COVID-19 lockdown period and preventing avoidable blindness.

Keywords: Tele-Ophthalmology, Covid-19, Lockdown, Retinopathy of Prematurity, Barrier

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ARTIFICIAL INTELLIGENCE

Comparison of Visual Estimation of Cupping by Human Ophthalmologist to a Machine Learning Algorithm

First Author: John D. ***AKKARA***
Co-Author(s): Anju ***KURIAKOSE***

Objective: To evaluate Glaucomatous cupping from fundus images by using artificial intelligence machine learning algorithm and compare its accuracy to a human ophthalmologist grader.
Methods: Color fundus photographs were taken with a Topcon fundus camera (Topcon TRC; Topcon, Tokyo, Japan) by technicians. 150 fundus photos without artefacts were selected and evaluated using a beta version of a Deep Learning algorithm that analyses single color fundus photographs to detect glaucomatous cupping. Parameters detected include Cup/Disc ratio, Neuro Retinal Rim thickness in 4 quadrants, ISNT rule(Figure 3) and Disc Damage Likelihood Score.
Results: The Deep Learning Algorithm analysed 150 fundus photographs. 15 images(10%) were marked as error by the AI, as it could not detect the disc and cupping from the fundus photo. 135 images were evaluated. Mean difference between human grading & AI grading of CDR was 0.7. NetraAI underestimated cupping in 16.3% of cases. 73.3% of CDR calculated was within 0.1 difference of human grading. 89.6% of CDR calculated was within 0.2 difference of human grading.
Conclusions: A comprehensive AI for glaucoma should evaluate all the parameters including IOP, disc, gonioscopy, fields and OCT together; but such an AI system is not ready yet. Currently, it appears that fully automated disc and cup detection does not always work, and there is still a lot of scope for improvement in accuracy.

Keywords: Artificial Intelligence, Machine Learning, Glaucoma, Cupping, Optic Disc

Detection and Grading Diabetic Retinopathy Using Artificial Intelligence in a Portable Fundus Camera

First Author: John D. ***AKKARA***
Co-Author(s): Anju ***KURIAKOSE***

Objective: To evaluate Diabetic Retinopathy from Fundus photographs from a handheld portable fundus camera using a Deep Learning based Artificial Intelligence Algorithm.
Methods: Fundus photographs taken using a portable handheld fundus camera in camp settings were analysed. 346 such fundus photographs of 173 patients were analysed individually by an ophthalmologist blinded to the diabetic history and other details of the patients. The photographs were graded as no DR, mild NPDR, moderate NPDR, severe NPDR, PDR and ungradable.
Results: The Deep Learning Algorithm analysed 346 fundus photographs which were checked for the image quality as excellent or poor. AI noted only 14(4%) out of the 346 images as having excellent quality, whereas ophthalmologist graded 146(42.2%) images as good quality. Ophthalmologist graded 12(3.46%) images as extremely poor quality. For detection of Diabetic Retinopathy, ophthalmologist noted DR present in 64(18.5%) fundus photographs, whereas AI detected DR in 61(17.6%) of the photographs. Sensitivity was 84.38% and Specificity was 97.52%. The positive likelihood ratio was 33.99 and negative likelihood ratio was 0.16. This gives a positive predictive value of 88.52% and negative predictive value of 96.49%. Accuracy was 95.09%.
Conclusions: Several AI based Diabetic Retinpathy screening systems are now available including IDX-DR, Medios by Remedio, Pegasus by Visulytix and Netra.AI by LebenCare. Low cost mass screening of the diabetic population can be easily undertaken using this technology. AI will help in assist ophthalmologist in diagnosis in screening of diabetic retinopathy.

Keywords: Artificial Intelligence, Machine Learning, Retina, Diabetic Retinopathy, Retinopathy Grading

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Development of Robotic Unmanned Remote Controlled Slit Lamp during COVID Pandemic

First Author: Anuj ***KODNANI***
Co-Author(s): Sulatha ***BHANDARY****, V. S.* ***VENKATESH****, Premjith* ***MENON****, Nayan* ***PRAKASH***

Objective: To develop a robotic remotely operated slit lamp system for ophthalmic examination of patients via local area network and Internet during the COVID era in order to reduce the transmission of virus and to increase the efficacy of examination along with OPD functioning.
Methods: We designed an unmanned remote controlled slit lamp where the risk of COVID

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transmission to the doctor and the patient is exponentially reduced, and at the same time the patient gets the benefit of a complete slit lamp examination from remote access. An existing slit lamp system in the Ophthalmology OPD of Kasturba Medical College and Hospital, Manipal was mounted and calibrated with stepper motors to permit remote control of optical and mechanical components of the device. Slit lamp parts motorized included the slit length controls, slit width controls, magnification change drum, joystick controls (X,Y,Z axis movement), illumination control rheostat, slit lamp angle controls and chinrest height adjuster. The real-time imaging, video and audio were transmitted via local area network and Internet to a computer in the nearby clinician's cabin. The clinician carries out ocular examination using the computer interface to control the motorized slit lamp while interacting with the patient using audio-visual live chat. Post examination counselling or medical advice is provided via the live video chat between the clinician and patient.
Results: The remote slit lamp motor system was tested via the computer interface and patient ocular examination was successfully performed in the Ophthalmology OPD reducing chances of spread of COVID-19 and improving the standard of examination in this pandemic era.
Conclusions: Close contact during ophthalmic procedures has the risk of patient to Ophthalmologist disease transmission which can be prevented by using a remote slit lamp motor system.

Keywords: Unmanned, Remote, Robotic, Slit; Lamp, COVID 19

Improving Screening for Early Glaucoma: Feasibility of Using Style-Transfer to Predict Retinal Nerve Fiber Layer Thickness Distribution in the Ocular Fundus

First Author: Henry ***CHEN***
Co-Author(s): Guan-An ***CHEN****, Jhen-Yang* ***SYU****, Jian-Ren* ***CHEN****, Su-Chen* ***HUANG****. Wei-Wen* ***SU***

Objective: Optical coherence tomography (OCT) is used to measure fundus retinal thickness and can assist clinicians in diagnosing or screening glaucoma. However, accuracy in interpretation of OCT images is limited and time-consuming. We aimed to develop and validate the performance of a deep learning algorithm to detect early glaucomatous optic neuropathy.
Methods: This single-institution study included 1120 color fundus photographs and 1120 OCT images from 560 subjects collected at Taipei Chang Gung Memorial Hospital, with paired data of 189 normal subjects and 371 with glaucoma. The variational autoencoder network training architecture was used for training, and the correlation between the color fundus image and the distribution of retinal nerve fiber layer thickness was estimated through the deep learning network.
Results: The main outcome measures were structural similarity index (SSIM) and peak signal-to-noise ratio (PSNR), which were used for signal strength assessment and image structure similarity assessment of color fundus images converted to a retinal nerve fiber layer thickness distribution model, respectively. The generated images were similar to ground truth, with PSNR: 19.31 dB and SSIM: 0.44.
Conclusions: The prediction model can provide information on the distribution and defects of retinal nerve fiber layer thickness. Furthermore, the proposed technique can aid clinicians in detecting glaucoma at the early stage, especially when only color fundus photographs are available.

Keywords: Image-to-Image Translation, Style-Transfer, Autoencoder, Glaucoma, Optical Coherence Tomography (OCT)

Plateau Iris Prediction Using Loss Value of Neural Style Transfer as Classification Feature

First Author: Natsuda ***KAOTHANTHONG***
Co-Author(s): Boonsong ***WANICHWECHARUNGRUANG****, Warisara* ***PATANAPONGPAIBOON****, Pantid* ***CHANTANGPHOL****, Paisan* ***RUAMVIBOONSUK****, Thanaruk* ***THEERAMUNKONG***

Objective: To evaluate the performance of classification features from anterior segment optical coherence tomography (AS-OCT) as a plateau iris classification model of a limited size of training dataset.
Methods: We conducted a collaboration between an informative technology department and a referral eye center. The study enrolled 179 eyes from 142 patients with primary angle closure disease (PACD). All patients had remaining appositional angle after iridotomy. Each eye was scanned in 4 quadrants for both AS-OCT and ultrasound biomicroscopy (UBM). Process for transferring salience style on UBM to each AS-OCT using neural style transfer was designed for loss values extraction, which are a content loss and a style loss. The loss values of the input AS- OCT image were applied with a neural network as features for classifying plateau iris. The process was validated using a

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separate test set. Sensitivity, specificity, and area under the receiver operating characteristics curve (AUC-ROC) of the process for classifying plateau iris were evaluated, using UBM as a reference standard.
Results: Total paired images of AS-OCT and UBM were from 716 quadrants. Plateau iris was observed with UBM in 276 (38.5%) quadrants. Training dataset were used to develop an algorithm from 556 images, and the test set was validated from 160 images. AUC-ROC was 0.9433 (95%CI: 0.90 to 0.98), sensitivity was 93.10%, specificity was 93.13%, and accuracy was 93.12%.
Conclusions: Classification features obtained from neural style transfer revealed a high performance in predicting plateau iris on the non-contact AS-OCT images with a limitation of the training dataset.

Keywords: Prediction, Neural Style Transfer, Plateau Iris, Artificail Intelligence, Classification

Problems of processing of ophthalmological images for DICOM

First Author: Kazim H. ***OR***

Objective: In DICOM (Digital Imaging and Communications in Medicine) the images in ophthalmological examinations has to be processed, before they can be shared and/or compared, because many instruments with the same tecnique have unique imaging methods. The problems of the different proporties of the images for the same examination are to be solved.
Methods: DICOM is the international standard for medical images and related information. It defines the formats for medical images that can be exchanged with the data and quality necessary for clinical use. Unique imaging in each instruments of different brands using the same technique is a problem, because they may change and/or disturb the image. The need in image processing and its possible negative effects are discussed.
Results: There are very fine mesurements in ophthalmology like in OCT, OCTA, corneal topography, aberometer, fundus fluoressein angiography, B scan ultrasound and other sophisticated instruments. The images made with them are mostly 2D and in pixels, some of them may be 3D and in voxels, which makes the comparison of different devices difficult. To compare the changes in images, they have to have the same background illumination, same size of the image and same size of the background and/or neigbouring sctructures. So changes in contrast, illumination levels and size (pixelisation!) may be necessary, which can change the information in it.
Conclusions: To keep DICOM standarts in ophthalmological images they have to be made similarly in instruments using the same technique. Processing of the images afterwards may result in faults.

Keywords: DICOM, Image Standards, Images, Image Processing

CATARACT

Evaluation of Ocular Biometry by Two Swept Source ASOCT Devices

First Author: Boonsong ***WANICHWECHARUNGRUANG***
Co-Author(s): Anyarak ***AMORNPETCHSATHAPORN****, Wisakorn* ***WONGWIJITSOOK****, Peranut* ***CHOTCOMWONGSE****, Kittipong* ***KONGSOMBOON****, Somporn* ***CHANTRA***

Objective: To investigate agreement among the 3 ocular biometers; IOL Master 700, Galilei 6, and Anterion in measuring various ocular biometry and intraocular lens (IOL) calculation of primary angle-closure disease (PACD).
Methods: This was a prospective study involving measurement of biometry in phakic eyes with diagnosis of PACD and non-PACD eyes as controls with the 3 devices. Intraclass correlation coefficient (ICC) with 95% confidence intervals were used to assess the differences among the devices. Residual target refraction of the IOL calculations under Barrette formula were analyzed.
Results: 161 eyes from 104 patients were enrolled. 71 eyes (44%) were PACD and 90 eyes (56%) were non-PACD patients. In PACD group, agreement for keratometry (K), anterior chamber depth (ACD), axial length (AL), white-to-white corneal diameter (WTW) and were considered strong to excellent (ICC 0.763-0.999, 95%CI 0.635-1), and moderate to excellent agreement for lens thickness (LT) (ICC 0.792, 95%CI 0.484-0.903). In non-PACD group, strong to excellent agreement of K, ACD, AL, WTW (ICC 0.720-0.995, 95%CI 0.615-0.997) and moderate to strong agreement of LT (ICC 0.703, 95%CI 0.588-0.793) were found. With the Barrett formula, Bland-Altman plot showed strong agreement among the final refractions which were calculated from all devices.
Conclusions: Agreements in all biometry, except LT, among the devices in both PACD and non-PACD groups were strong to excellent. All devices could be applied for IOL

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calculation, giving clinically non-different final refraction.

Keywords: Ocular Biometry, IOL Calculation, Agreement, PACD, Cataract

Nd:YAG Capsulotomy - Induced IOL Position Changes

*First Author: Martin **FUS***
*Co-Author(s): Sarka **PITROVA***

Objective: Posterior capsular opacification is one of the most common postoperative complications after cataract surgery. Treatment involves photodisruption of the posterior capsular bag using a Nd:YAG laser. However, change in the structure of the capsular bag may cause a change of the position of the IOL. The aim of this study was to develop a user-friendly software for the evaluation of axial displacement, tilt and decentration of IOL in a capsular bag induced by Nd:YAG laser capsulotomy.
Methods: The study provides IOL position changes in 35 arthephakic eyes, undergoing laser posterior capsulotomy. Before and at least one hour after capsulotomy, all patients underwent the following examinations: optical biometry (Lenstar LS900), OCT (Optovue Avanti), and IOL photography (Verion reference unit). The original software solution was designed for graphical evaluation of the differences between centration, axial displacement and IOL tilt (using MS Visual Studio).
Results: The average of abslute values of differences in IOL position before and after capsulotomy: ACD = 0.11±0.20 mm, IOL decentration in x-axis = 0.065±0.063 mm, IOL decentration in y-axis = 0.048±0.53 mm, tilt in horizontal plane TILT-H = 0.51±0.66° and tilt in vertical plane TILT-V = 0.26±0.44°. All changes were insignificant (P>>0.05). In total, 74.29% of IOLs showed a hypermetropic shift of IOL.
Conclusions: In conclusion, the use of the original software solution showed, that changes in IOL centering, axial displacement and tilt occur after Nd:YAG capsulotomy. However, average abssolute differences were insignificant. In almost 3/4 cases, there was a hypermetropic axial displacement of the IOL.

Keywords: Posterior Capsulotomy, NdYAG Laser, IOL Position Following Capsulotomy, Posterior Capsule Opacification, IOL Shift

Posteriorly Luxated Cystalline Cataract Imaged Using Inexpensive Portable Smartphone Fundus Camera

*First Author: Anju **KURIAKOSE***
*Co-Author(s): John D. **AKKARA***

Objective: To image a lens and a cataract dislocated into the vitreous cavity using a novel innovative smartphone fundus camera which cannot be imaged by a conventional desktop fundus camera.
Methods: A 55-year-old lady with blunt injury of right eye presented with sudden diminution of vision, redness & pain. On examination, UCVA was 1/60 in right eye & 6/6 in left eye. BCVA was 6/18 in right eye with +10Ds. Anterior chamber was deep with iridodonesis. Jet black pupil suggested aphakia. Posterior segment examination of right eye revealed a posteriorly dislocated clear crystalline lens on the retina which was mobile and shifted with eye movements. Disc and periphery were otherwise normal. Left eye fundus was normal
Results: Using the novel device, photographs were captured of the retina showing the lens resting on the posterior pole. Captured using a smartphone-based fundus camera: HopeScope. The device used was a low-cost smartphone fundus camera named HopeScope. HopeScope was developed by Dr Biju Raju as a second version of his open source DIYretcam published in Indian Journal of Ophthalmology(IJO) in 2016.
Conclusions: The simple smartphone and 20D lens based fundus camera enabled bedside photography. They especially helped to demonstrate mobility of lens on the retina. Low cost and portable. Other options include 3D printed fundus cameras from oDocs and Dr Ahmed Ateya. Smartphone based fundus photography has certain advantages over conventional fundus cameras. Being portable and low-cost, it can be used with patient in supine position. Fundus videos can be taken to show moving objects like dislocated lenses Photos and videos can be immediately labeled, edited, stored and shared.

Keywords: Smartphone Fundus Camera, Dislocated Lens, Cataract, Imaging, Frugal Innovation

CLINICAL & EPIDEMIOLOGICAL

Biological Importance of Sciadopitysin on Different Fungal Strains: Biological Role in the Medicine

*First Author: Dinesh K. **PATEL***

Objective: Plant derived phytochemical and herbal drugs are valuable sources for drug discovery program in the health sectors due to its medicinal potential and some of the best

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examples are curcuminoids, flavonoids and naphthoquinones in the natural products.
Methods: Pharmacological activities of flavonoidal compounds in the medicine were mainly due to their free radical scavenging properties, metal complexion capabilities, and proteins molecule binding capacity. Literature data has been searched in the present investigation to collect the scientific information of sciadopitysin in the medicine. Biological importance of sciadopitysin on different fungal strains has been investigated through literature data analysis of various scientific research works.
Results: Literature data analysis of various scientific research works revealed the health beneficial aspect of sciadopitysin in the medicine. Literature data analysis revealed biological importance of sciadopitysin on different fungal strains in the medicine. Antifungal activity of sciadopitysin has been investigated using Alternaria alternata, Fusarium culmorum, Cladosporium oxysporum in the literature and revealed antifungal activity.
Conclusions: Literature data analysis revealed the biological importance of sciadopitysin on different fungal strains.
Keywords: Biological Importance, Sciadopitysin, Fungal Strains, Biological Role

Data Review and a Pilot Study for Possible Screening in Ethambutol Optic Neuropathy: 7-Year Review in Rajavithi hospital, Bangkok, Thailand

*First Author: Pareena **CHAITANUWONG***
*Co-Author(s): Akechanok **WATCHARAPANJAMART**, Supaporn **SRITHAWATPONG***

Objective: Tuberculosis (TB) is an important major public health in Thailand and also worldwide. Ethambutol is a main treatment of choice. Major side effect of ethambutol to the eye is ethambutol optic neuropathy (EON) which occurs in about 0.5-2%. The purpose of this research was to investigate the characteristic, clinical manifestations, incidence and also investigation which could be a screening test for these patients.
Methods: This study is a retrospective chart review of 4141 patients who received ethambutol as a treatment for TB infection between January 2012 and August 2019 at Rajavithi Hospital, Bangkok, Thailand. Age, gender, underlying disease, clinical manifestation of TB, duration and dose of ethambutol, GFR, BMI was collected. For patients who complaint with visual disturbance both diagnosed as EON and non EON, visual acuity, color vision, ophthalmic examination by slit lamp, fundus photo, visual field, OCT and also OCTA and GCA was included for age and sex match comparison.
Results: 20 patients (0.5%) were diagnosed as EON, 13 men and 7 women. For EON group, the age was range between 28 and 76 years, mean age was 58.58±12.34 years . The average dose of ethambutol was 16.29 mg/kg/day and the duration of therapy was between 1-19 months(mean 235.60 days). The mean BMI of the patients was 13.91±11.54 kg/m2. The most common involved location of tuberculosis was pulmonary infection (58.82%). There are many factors that significantly difference ($P<0.05$) between EON group and non-EON group such as age, BMI, GFR, hypertension and duration of ethambutol therapy. The risk of getting EON was significantly high in older than 60 years-old patients treated with ethambutol more than 90 days. Abnormal ophthalmological findings included impaired visual acuity (94.12%), impaired visual color vision (47.06%), optic disc pallor (64.71%). OCT, OCTA and GCA showed abnormalities in patients with EON but not in non-EON group.
Conclusions: The incidence of EON in Rajavithi hospital, Bangkok, Thailand was 0.5% which is lower when compares to other studies. Age, BMI, GFR, hypertension, and duration of ethambutol therapy could be risk factors for EON. Fundus photo with red-free and HDR, OCT, OCTA, and GCA could help to screen early patients with EON.

Keywords: Ethambutol Optic Neuropathy, Optic Neuropathy, OCT Disc, OCTA

CORNEA

Burden of Ocular Chemical Burn at Tertiary Eye Care Centre of Central India

*First Author: Shweta **WALIA***
*Co-Author(s): Sapna **SABNANI**, Vijay **BHAISARE**, Neetu **KORI***

Objective: To study demographic & clinical characteristics of ocular chemical injury and identify high risk groups.
Methods: Patients presenting with chemical injury were included & Data such as age, gender, occupation, socioeconomic status, education, location of injury, use of protective measures, intoxication status, BCVA Type of chemical severity (Dua's classification), management & complications was recorded.

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Results: Out of 38 cases (42 eyes) 76% were males,most common age group was 20-40 year and almost all had no awareness about PPE,were primary schooled, were Unskilled workers and belonged to Lower middle class. Most common ocular injury setting, severity & chemical were workplace, grade I and alkali respectively. Risk factors for poor final BCVA were identified as poor initial BCVA & higher grade.
Conclusions: Awareness program should be more pictorial as high risk group was illiterate or had primary schooling, should be targeted towards people employed in unskilled work. There should be laws mandating PPE.

Keywords: Ocular Chemical Burn, Awareness, Ocular Surface Disorder

Partial versus Full Thickness Limbal Relaxing Incisions during Phacoemulsification for Treatment of with-the-rule Astigmatism in Senile Cataract Patients

First Author: Nader ***NASSIRI***
Co-Author(s): Kourosh ***SHEIBANI***

Objective: To compare the use of partial thickness and full thickness limbal relaxing incisions (LRI) during phacoemulsification for treatment of with-the-rule astigmatism in senile cataract patients.
Methods: In this prospective randomized controlled trial, 88 older than 65 years patients with by the rule astigmatism cylinder of over 1.25 were randomly divided and either received two partial thickness or one partial thickness and one full thickness corneal incision in limbus area to correct their astigmatism.
Results: One month postoperatively the mean BCVA (P=0.12) and UCVA (P=0.011) correction was higher in the partial thickness group but this difference was not significant at six months. There was no significant difference between the two groups regarding spectacle independence, photophobia, foreign body sensation and patient satisfaction.
Conclusions: Since a full thickness LRI might lead to complications (leakage, endophthalmitis) in rare cases and does not result in better astigmatism correction it is suggested that partial thickness LRI should be considered as the preferred method.

Keywords: Astigmatism, Management; Cataract, Surgery

Screening for MIR184 Mutations in Iranian Patients with Keratoconus

First Author: Kourosh ***SHEIBANI***
Co-Author(s): Nader ***NASSIRI***

Objective: To investigate whether microRNA (MIR)-184 mutations make a substantial contribution to keratoconus (KCN) among affected Iranian patients.
Methods: A total of 47 Iranian KCN patients, diagnosed based on family history, clinical examinations using slit lamp biomicroscopy, refraction and corneal topography were enrolled in this study. The pri-miR-184 encoding gene obtained from the DNAs of all participants was amplified using polymerase chain reaction and subsequently sequenced by the Sanger dideoxynucleotide protocol. The sequences were compared to MIR184 reference sequence in order to identify sequence variations. The potential effects of a single variation observed on RNA structure was predicted.
Results: Only one sequence variation, +39G >T, was observed within the pri-miR-184 encoding sequence in one proband. The patient's KCN-affected sister harbored the same variation. The variation was not novel and was recently shown to be present at similar frequencies among large cohorts of KCN patients and control individuals.
Conclusions: Mutations in MIR-184 are not a major cause of keratoconus among Iranian patients. The pri-miR-184 sequence needs to be screened in larger cohorts in order to establish whether mutations in the gene are present at low frequencies among Iranian patients.

Keywords: MIR-184, Keratoconus, Iran

The Effect of Topical Betamethasone Eye Drops on Postoperative Haze among Patients Undergoing Corneal Collagen Cross-Linking: a Randomized, Double Blind Placebo Controlled Study

First Author: Nader ***NASSIRI***
Co-Author(s): Kourosh ***SHEIBANI***

Objective: To evaluate the effect of betamethasone eye drops on postoperative haze in patients undergoing corneal collagen crosslinking (CXL).
Methods: Patients with mild to moderate keratoconus who were a candidate for CXL treatment entered the study. One eye of each patient randomly received betamethasone and topical antibiotics after CXL and the other eye received topical antibiotics and placebo. The eyes were compared regarding BCVA, UCVA, refraction, keratometric and pachymetric findings, as well as corneal haze by confocal microscopy.
Results: There was no difference in BCVA, UCVA, refraction, keratometric and pachymetric findings between the two groups before and six months after surgery. Based on confocal

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findings, the difference in light reflectance intensity between the case and control groups was statistically significant in anterior (P = 0.001) mid (P = 0.002) and posterior (P = 0.002) stroma six months postoperatively indicating higher haze in the placebo group.
Conclusions: Betamethasone significantly reduced corneal haze but had no effect on visual acuity, refraction, keratometric and pachymetric findings six months post CXL.

Keywords: Betamethasone, Eye Drops, Haze, Collagen Cross-Linking

GLAUCOMA

Diagnostic Performance of Anterior Segment Optical Coherence Tomography for Detecting Plateau Iris

First Author: Boonsong ***WANICHWECHARUNGRUANG***
Co-Author(s): Warisara ***PATANAPONGPAIBOON****, Nucharee* ***PARIVISUTT****, Kasem* ***SERESIRIKACHORN****, Kornkamol* ***ANNOPAWONG****, Wararee* ***SRIYUTTAGRAI***

Objective: To evaluate diagnostic performance of anterior segment optical coherence tomography (ASOCT) for plateau iris configuration (PIC) based on ultrasound biomicroscopy (UBM) criteria.
Methods: ASOCT and UBM were both performed in primary angle-closure disease (PACD) patients at a tertiary eye care. Paired images of ASOCT and UBM were separately classified by an experienced glaucoma specialist and further analyzed to determine diagnostic power of ASOCT for PIC.
Results: 179 eyes of 142 patients were enrolled in the study. UBM-PIC was observed in 85 eyes (47.49%). Plateau iris was the most common PACD mechanism in both horizontal and vertical axes of ASOCT: 38.55% and 34.08% respectively with high intra-observer (kappa = 0.742). Sensitivity was 56.47% (95% CI; 45.28% to 67.20%), specificity was 48.94% (95% CI; 38.48% to 59.46%) and accuracy was 51.20% (95% CI; 43.63% to 58.72%). Positive predictive value was 32.16% (95% CI; 26.53% to 38.35%) and negative predictive value was 72.40% (95% CI; 65.61% to 78.29%). Agreement of ASOCT with UBM diagnosis was weak (kappa = 0.054).
Conclusions: Diagnostic performance of ASOCT appeared to be limited for PIC detection in clinical practice and should not be substituted the use of UBM.

Keywords: Plateau Iris, UBM, ASOCT, Diagnostic Performance, PACD

Is Post-Trabeculectomy Serous Choroidal Detachment a Risk Factor for Failure in the Long Term?

First Author: Kourosh ***SHEIBANI***
Co-Author(s): Nader ***NASSIRI***

Objective: To investigate the long-term effect of serous choroidal detachment on the success of trabeculectomy in glaucoma patients.
Methods: In this case-control study, 17 patients who underwent trabeculectomy and developed choroidal detachment, and completed at least 3 years of follow-up were included. The controls were matched based on age, sex, preoperative intraocular pressure, and glaucoma type, and lack of choroidal detachment. Surgical success was defined based on two definitions of 5 < IOP < 16 and 20% reduction from the baseline and no need for further glaucoma surgery and all the same but 5 < IOP < 22.
Results: The mean estimated duration of survival ±SD was 2.73 ± 0.35 years (CI 95% 2.1, 3.4), which was significantly shorter than 3.98 ± 0.38 years (CI 95% 3.3, 4.7) in the control group. (LogRank = 5.03 p = 0.02). Cumulative probability of success was 76.5%, 52.9%, 29.4%, 17.6%, and 11.8% in year 1, 2, 3, 4, and 5 in the case group, respectively. Corresponding values were 88.2%, 82.4%, 68.6%, 58.8%, and 47.1%. In the control group, respectively. At baseline, average IOP was 22.3 ± 2.7 and 23.8 ± 8.3 mmHg in the case and control groups, respectively (p = 0.17). Mean IOP was significantly higher in the case group than in the control group in years 2, 3, 4, and 5.
Conclusions: Serous choroidal detachment affects the long-term surgical success of trabeculectomy, especially in patients with advanced glaucoma when lower target pressure is required.

Keywords: Intraocular Pressure, Trabeculectomy, Choroidal Detachment, Surgical Success

Short, Intermediate and Long-Term Results of Ahmed Glaucoma Valve Implantation

First Author: Kourosh ***SHEIBANI***
Co-Author(s): Nader ***NASSIRI***

Objective: To evaluate the efficacy and safety of Ahmed glaucoma valve (AGV) implantation for glaucomatous eyes in short, intermediate, and long term follow up periods.
Methods: In this retrospective study 76 eyes of 76 patients who underwent AGV insertion in

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Imam Hossein Medical Center, Tehran, Iran, between January 2008 and March 2017 with at least three years of follow up were included. At each visit complete ophthalmic examination was performed and the success rate of surgery was assessed. Surgical success was defined as 5 ⩽ IOP ⩽ 21 mmHg and at least 20 % reduction in IOP without any glaucoma medication (complete success), or with the use of anti glaucoma medication (qualified success). The sum of complete and qualified success was reported as cumulative success.
Results: The mean age of patients was 53.18 ± 16.92 years and the mean duration of follow up was 3.27 ± 2.36 years (range: 1-5 years). The complete surgical success rate was 20 % at 1 year, 18 % at 2 years, 16 % at 3 years, 15 % at 4 years, and 8 % at 5 years of
follow up and there was no medication free patient at more than 5 years follow up. The cumulative success rate was 91 %, 88 %, 84 %, 80 %, and 77 % at 1 to 5 years of follow up respectively.
Conclusions: Ahmed glaucoma valve (AGV) implantation for glaucomatous eyes results in acceptable IOP reduction and less medication need in short, intermediate, and long term follow up periods.

Keywords: Glaucoma, Intraocular Pressure, Ahmed Glaucoma Valve, Treatment

GENERAL OPHTHALMOLOGY

Impact of the Lockdown on Ocular Emergency Cases Spectrum and Outcome

*First Author: Shweta **WALIA***
*Co-Author(s): Vijay **BHAISARE**, Sapna **SABNANI**, Neetu **KORI**, Preeti **RAWAT**, Bhupendra **SHARMA***

Objective: Aim of this study was to understand impact of lockdown on spectrum and outcome of emergency cases presenting in Ophthalmology department.
Methods: Data of patients seen during lockdown (March 25, 2020- May 30, 2020) was collected. Descriptive statistics used for analysis.
Results: 192 patients were seen which is 97.5% less cases compared to 2019 (7705 vs 192). 71.4% patients were Male (n=132). Most common age group was 15-30 years. Majority (51.04%)cases were of ocular trauma followed by conjunctivitis and ocular surface disorder (26.04%) , Cataract (9.89%) , glaucoma (6.24%) diabetic retinopathy (4.167%) and ARMD (2.60%) ; Amongst ocular injuries motor vehicle accident (41.8%) were highest followed by domestic activities(17.3%) ; both incidents more common in Males.
Conclusions: Only emergency surgeries were done. Patient volume was low. Consultation was most commonly required for ocular trauma may be because motor vehicle accidents were high despite restrictions on movement.

Keywords: Ocular Emergencies, Lockdown, COVID-19

Ophthalmic Findings in Rhinoorbital Mucormycosis Following SARS-CoV-2 Infection

*First Author: Rajwinder **KAUR***

Objective: To report the cases of rhino-orbital mucor mycosis following SARS-CoV-2 infection who presented or referred from ear-nose-throat department.
Methods: It is an institutional ,retrospective and interventional study of all patients coming to the department of ophthalmology and referred from ENT department .They underwent all the examination which includes visual acuity, color vision, pupillary reaction ,ocular movements, corneal sensation and fundus examination.
Results: Laboratory examination revealed mucor. Ophthalmic findings include total ophthalmoplegia, relative afferent pupillary defect. Central artery occlusion in all cases presented with no perception of light. Optical coherence tompgraphy revealed some rare presentation of CRAO.
Conclusions: Rhino-orbital mucor mycosis has come in this region as severe vision threatening ophthalmic complication in post-COVID patients.

Keywords: Rhino-orbital, Mucor, Mucosis, Ophthalmic Artery Occlusion, COVID-19

LENS

Visual Acuity, Endothelial Cell Density and Polymegathism after Iris-Fixated Lens Implantation

*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

Objective: The purpose of this study was to evaluate the visual acuity as well as endothelial cell density (ECD) and polymegathism after iris-fixated lens (Artiflex® AC 401) implantation for correction of moderate to high myopia.
Methods: In this retrospective cross-sectional study, 55 eyes from 29 patients undergoing iris-fixated lens implantation for correction of

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myopia (−5.00 to −15.00 D) from 2007 to 2014 were evaluated. Uncorrected visual acuity, best spectacle-corrected visual acuity, refraction, ECD and polymegathism (coefficient of variation [CV] in the sizes of endothelial cells) were measured preoperatively and 6 months postoperatively.
Results: In the sixth month of follow-up, the uncorrected vision acuity was 20/25 or better in 81.5% of the eyes. The best-corrected visual acuity was 20/30 or better in 96.3% of the eyes, and more than 92% of the eyes had a refraction score of ±1 D from the target refraction. The mean corneal ECD of patients before surgery was 2,803±339 cells/mm2, which changed to 2,744±369 cells/mm2 six months after surgery (p=0.142). CV in the sizes of endothelial cells before the surgery was 25.7%±7.1% and six months after surgery it was 25.9%±5.4% (p=0.857).
Conclusions: Artiflex iris-fixated lens implantation is a suitable and predictable method for correction of moderate to high myopia. There was no statistically significant change in ECD and polymegathism (CV in the sizes of endothelial cells) after 6 months of follow-up.

Keywords: Cornea, Endothelial Cell, Density, Artiflex, Refractive Surgery

OCULAR IMAGING

A Comparison between Manual Counting and Customized Software Analysis of Lens Epithelial Cell Density

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Objective: To compare the lens epithelial cell density (LECD) in capsulorhexis excised capsules enumerated by manual counting versus customized software analysis and determine factors affecting the LECD.
Methods: Ten to 20 good quality light micrographs of the lens epithelium of a harvested anterior lens capsule underwent manual counting and customized software analysis. Pearson correlation coefficient was performed to explore correlation between the two methods. The effect of age, sex, duration from capsule harvesting to examination, diabetes (DM) and ocular diseases on LECD was evaluated by multiple linear regression analysis. Results: One hundred (80.65%), 9 (7.26%), 8 (6.45%), and 7 (5.65%) excised capsules in eyes with simple cataract, DM, true exfoliation syndrome (TEX), and primary open-angle glaucoma (POAG) were enrolled. The mean LECDs in eyes with simple cataract by manual counting and customized software analysis were 3,939±616 and 2,886±315 cells/mm2, respectively. The LECDs enumerated from both methods had moderate linear correlation in eyes with simple cataract (r=0.589), DM (r=0.439), and TEX (r=0.359) (all p<0.001), but poor linear correlation in those with POAG (r=0.134) (p=0.211). The LECD gradually decreased with age (p 71-year-old was statistically lower than that of eyes ⩽ 60-year-old (mean difference -3.47, 95% CI=-6.21, -0.73).
Conclusions: The LECD enumerated by manual counting and customized software analysis had moderate linear correlation, except in eyes with POAG. There was a gradual decrease in LECD with advancing age in eyes with simple senile cataract.

Keywords: Lens Epithelial Cell Density, Cataract, Lens Capsule, Manual Counting, Customized Software Analysis

Anterior Segment Characteristics in Normal and Keratoconus Eyes Evaluated with a Combined Scheimpflug/Placido Corneal Imaging Device

*First Author: Nader **NASSIRI***
*Co-Author(s): Kourosh **SHEIBANI***

Objective: To assess the anterior segment parameters of keratoconus (KC) eyes at different stages of the disease by a new Scheimpflug camera combined with Placido disk corneal topography.
Methods: A total of 225 eyes of 225 individuals comprising 41 suspect KC, 40 mild KC, 71 moderate KC, 48 severe KC and 25 normal eyes were assessed for the following parameters: corneal thickness at the apex (CTA), thinnest corneal thickness (TCT), anterior chamber depth (ACD), corneal volume (CV), corneal keratometry (K), corneal asphericity (Q), and corneal elevation in the anterior and posterior surface. Also, the Zernike coefficients for the corneal aberrations including total root mean square (RMS), RMS Coma, RMS spherical aberration (SA), RMS Astigmatism, Baiocchi Calossi Versaci front index (BCVf), and BCV back index (BCVb) were noted for all eyes.
Results: The TCT, CTA and posterior corneal elevation were significantly different between all comparison groups ($P < 0.05$). ACD values showed inconsistent differences between groups. Mean value of CV in comparing normal eyes vs suspect KC group, normal eyes vs mild KC, and normal eyes vs moderate KC revealed statistically significant change ($P < 0.05$). Also, weak non-significant positive correlation was

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demonstrated between K and CV (r = 0.08). There were statistically significant differences in total RMS, RMS coma, BCVf, and BCVb for most groups (P < 0.05).
Conclusions: Posterior corneal elevation, corneal thickness and high order aberrations are important indices that need to be considered to diagnose different grades of keratoconus.

Keywords: Cornea, Keratoconus, Topography

Central Corneal Thickness in Highly Myopic Eyes: Inter-Device Agreement of Ultrasonic Pachymetry, Pentacam and Orbscan II before and after Photorefractive Keratectomy

*First Author: Kourosh **SHEIBANI***
*Co-Author(s): Nader **NASSIRI***

Objective: To determine inter-device agreement for central corneal thickness (CCT) measurement among ultrasound pachymetry, rotating Scheimpflug imaging (Pentacam, Oculus, Wetzlar, Germany), and scanning slit corneal topography (Orbscan II, Bausch & Lomb, Rochester, NY, USA) in highly myopic eyes before and after photorefractive keratectomy (PRK).
Methods: This prospective comparative study included 61 eyes of 32 patients with high myopia who underwent PRK. Six month postoperative CCT values were compared to preoperative values in 27 patients (51 eyes) who completed the follow up period. To determine the level of agreement, Pentacam and Orbscan II readings were compared to ultrasonic pachymetry measurements as the gold standard method.
Results: Mean CCT measurements with ultrasound, Pentacam, and Orbscan II before PRK were 557µm, 556µm, and 564µm, respectively; and 451µm, 447µm, and 438µm 6 months after surgery in the same order. Preoperatively, the 95% limits of agreement (LoA) with ultrasound measurements were -20µm to 17µm for Pentacam and -21µm to 33µm for Orbscan II. Six months postoperatively, the 95% LoA were -30µm to 23µm for Pentacam and -69µm to 43µm for Orbscan II.
Conclusions: Preoperatively, CCT measurements were higher with Orbscan II as compared to ultrasound. Postoperatively, both Pentacam and Orbscan II measurements were lower than those obtained with ultrasound, but Pentacam had better agreement. The use of ultrasound, as the gold standard method, or Pentacam both appear to be preferable over Orbscan II among patients with high myopia.

Keywords: Myopia, Central Corneal Thickness, Photorefractive Keratectomy, Ultrasound Pachymetry Pentacam, Orbscan II

Comparison of Choroidal Thickness Measure ments between Spectral- Domain Optical Coherence Tomography and Swept-Source Optical Coherence Tomography in Children: Hong Kong Children Eye Study

*First Author: Chun On **LEE***
*Co-Author(s): Xuijuan **ZHANG**, Shumin **TANG**, Lijia **CHEN**, Carol **CHEUNG**, Jason **YAM***

Objective: There is a close association between choroidal thickness and ocular pathologies. Interchangeability among different generations of optical coherence tomography (OCT) remains unclear. We therefore compared choroidal thickness measurements between spectral-domain optical coherence tomography (SD-OCT) and swept-source optical coherence tomography (SS-OCT) in children eyes.
Methods: 114 primary school children from the population-based Hong Kong Children Eye Study were included. Choroidal thickness of the right eye was measured. Intra-class correlation coefficients (ICCs) were analysed for the agreement between the two devices.
Results: The central foveal choroidal thickness (CFCT) obtained by SD-OCT and SS-OCT was 273.24±54.29µm and 251.84±47.12µm respectively. Inter-device agreement was good with an ICC of 0.840 [95% confidence interval (CI): 0.616-0.918 (P<0.001)]. Nonetheless, SD-OCT was significantly thicker than that obtained by SS-OCT [mean difference: 21.40±33.13µm (P<0.001)]. Bland-Altman limit of agreement on the relative difference scale for SD-OCT/SS-OCT was 86.33µm. Conversion equation for CFCT translation was SS-OCT = 35.261 + 0.810 x SD-OCT. Further analysis showed poorer inter-device correlation coefficient in myopic children [ICC: 0.754; 95%CI: 0.454-0.888 (P<0.001)].
Conclusions: In paediatric eyes, ICC shows a satisfactory agreement but statistically significant difference between choroidal thickness obtained by SD-OCT and SS-OCT. The two OCT measurements cannot be interchanged.

Keywords: Spectral-Domain Optical Coherence Tomography, Swept-Source Optical Coherence Tomography, Choroidal thickness, Hong Kong Children Eye Study

Correlation of Ocular Imagings with Visual Prognosis in Hyperbaric Oxygen Treated

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Acute Central Retinal Artery Occlusion Eyes - the HORA Study Report

First Author: Chi Lik ***AU***
Co-Author(s): Callie ***KO***

Objective: Hong Kong first established the hyperbaric oxygen therapy (HBOT) for central retinal artery occlusion (CRAO) treatment under the title of HORA (Hyperbaric Oxygen for central Retinal Artery occlusion) study. This study aims to identify factors associated with good visual outcome.
Methods: Patients diagnosed acute CRAO with symptom onset ⩽ 6hours would be recruited for a course of HBOT situated in a tertiary hospital receiving territory-wide CRAO referrals 24 hours every day, even under the COVID-19 pandemic. Patients' demographics, onset-to-door/HBOT time, diseased eye characteristics and imaging results, medical and drug history were all collected prospectively. Treatment outcomes were reviewed and analysed.
Results: 26 patients aged 67.5±13.3 years old (44–89) were included, with male-to-female ratio of 1.6:1. Mean follow up period was 10.0±5.3 months, and mean visual acuity (VA) improvement was 0.48±0.57 logarithm of minimal angle of resolution (Z=-3.67, p=0.0001). Age, pre-HBOT VA, usage of anti-platelet/anti-coagulant, onset-to-door time and onset-to-HBOT time were not correlated (p=0.49,0.42,0.42,0.36,0.42) with VA outcomes. Concerning OCT parameters, 1mm-zone of central macular thickness (CMT) was not associated with VA changes (p=0.119), but the circular rim of 1-to-3mm-zone of CMT was fairly associated (Spearman's coefficient 0.45, p=0.02). FFA's complete retinal perfusion time was moderately associated with visual outcome (Spearman's coefficient 0.58, p=0.01). One patient got concomitant stroke with CRAO, otherwise no further ischemic cerebro-cardiovascular events, nor contralateral eye CRAO happened during the follow-up period.
Conclusions: HBOT is promising to CRAO patients to regain vision for navigation. Thinner 1-to-3mm-zone CMT, but not the central 1mm zone, was associated with better visual outcome.

Keywords: Central Retainl Artery Occlusion, Hyperbaric Oxygen Therapy, Optical Coherence Tomography, Fundus Fluorescein Angiography, HORA study

Optical Coherence Tomography to Detect Pre-Clinical Retinal Changes in Patients with Mild Cognitive Impairment

First Author: Anju ***KURIAKOSE***
Co-Author(s): John D. ***AKKARA***

Objective: To evaluate the Retinal Nerve Fibre Layer(RNFL) and Ganglion Cell Layer(GCL) changes in patients with Mild Cognitive Impairment(MCI) using Spectral Domain Optical Coherence Tomography(SDOCT)
Methods: A case control study done on 88 eyes of 44 patients, of which 27 belong to Mild Cognitive Impairment (MCI) and 17 were controls. They were assessed using Mini Mental State Examination(MMSE)/ MINICOG/ MOntreal Cognitive Assessment scale(MOCA) tests. Retinal OCT for RNFL around the Optic Disc and Ganglion Cell Layer- Inner Plexiform Layer (GCL+IPL) at the macula was analysed Correlations were made between the Retinal OCT parameters and the Cognitive Impairment of the patients. Statistical Analysis was done using SPSS.
Results: Both groups were of similar age and gender profile. RNFL thickness was significantly reduced in superior and inferior quadrants in patients with Mild Cognitive Impairment (MCI). Generalized RNFL thinning was also noted. GCL+IPL Layer showed significant thinning in superotemporal, inferonasal and inferior quadrants. Generalized thinning was also present in those with MCI compared to controls.
Conclusions: MCI patients were prone to develop neurodegeneration even in the absence of microvascular changes in the retina. A few other studies also found similar changes in patients with Alzheimer's Disease
Hence, it is suggested to carry out routine evaluation of retina with OCT in all patients above the age of 60 to detect early neurodegenerative changes for early management. It is also noted that sensitivity of GC+IPL was higher than that of RNFL to discriminate MCI from controls.

Keywords: Optical Coherence Tomography, Mild Cognitive Impairment, Alzheimer's Disease, Retina, Systemic Illness

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RETINA & VITREOUS

HbA1c as a predictor for response of Bevacizumab in patients with Diabetic Macular Edema

First Author: Sadhana Sri ***SHARMA***
Co-Author(s): Pratap ***KARKI****, Sagun* ***JOSHI****, Sanket* ***PARAJULI***

Objective: To study the influence of glycosylated haemoglobin (HbA1c) on response of bevacizumab in patients with diabetic macular oedema.
Methods: A total of 37 eyes of 37 patients

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presenting to our Retina clinic from July 2017 to July 2018 with vision loss due to Diabetic macular edema were included in this study Participants received monthly intravitreal Bevacizumab 0. 05 ml/ 1 25 mg) for three months and were followed up at 4, 8, 12 weeks In each followup detail examination were done including best corrected visual acuity (BCVA) and central macular thickness (CMT) as measured by SD OCT Main outcome measures were the differences in visual and anatomic outcomes, between subgroups of patients with baseline HbA 1 c< 7 versus HbA 1 c >7 at 3 months.
Results: There were 17 patients with baseline HbA 1 c 7 included in the study. The mean improvement in visual acuity at 3 months was 0. 50 log MAR in HbA 1 c< 7 group and 0. 33 log MAR in HbA 1 c> 7 group (p=0.13, 95 confidence interval). The mean central macular thickness (reduction was 229. 76 µm in patients with baseline HbA 1 c 7 % (p=0. 022, 95 confidence interval).
Conclusions Our study suggests that baseline glycemic control can affect the treatment outcome of intravitreal Bevacizumab in the management of Diabetic Macular edema and the response was found to be better in patients with good glycemic control (low HbA 1 c).

Keywords HbA1c, OCT, Macular Edema, Bevacizumab, Diabetes

OCT Patterns of Diabetic Macular Edema and Treatment Response to Bevacizumab

*First Author: Sadhana **SHARMA***
*Co-Author(s): Pratap **KARKI**, Sagun **JOSHI**, Sanket **PARAJULI***

Objective: To study different morphological patterns of diabetic macular edema (DME) based on Optical Coherence Tomography (OCT) and compare their treatment response to Bevacizumab.
Methods: 112 eyes of 112 patients with diabetic macular edema were included and treated with intravitreal Bevacizumab (1.25mg/0.05ml monthly for 3 months). The morphological patterns of DME were classified on the basis of OCT into 3 groups-Diffuse retinal thickening (DRT), Cystoid macular edema (CME) and Serous retinal detachment (SRD) and changes in central macular thickness (CMT), best corrected visual acuity (BCVA) after treatment were compared.
Results: A total of 112 eyes with DME were included and consisted of 40 DRT, 37 CME, and 35 SRD. Treatment with Anti-VEGF resulted in decrease in central macular thickness and improvement in best-corrected visual acuity in all three groups. The baseline visual acuity and CMT of DRT group was better than that of the other two groups. The treatment outcome was measured in terms of CMT and BCVA. Change in CMT was statistically significant among three groups and was found to be better in DRT group (p<0.05, 95% confidence interval). However, there was statistically no significant variation between the three groups regarding the change in BCVA (p=0.169, 95% confidence interval).
Conclusions: Anatomic and visual improvement can be achieved by Anti-VEGF agents in all patterns of DME. However, individual pattern may respond differently. DRT, which appears to be the earliest form of DME, responds better than other types. Thus, the pattern of macular edema shown by OCT may provide an objective guideline in predicting the response of Anti-VEGF injection in DME.

Keywords: OCT, Macular Edema, Diabetes, Bevacizumab, DME

Outcomes of Vitreoretinal Complications Requiring Surgery after Abusive Head Trauma

*First Author: Yasmin **ISLAM***
*Co-Author(s): Syed K. **GIBRAN***

Objective: Abusive head trauma (AHT) can result in non-clearing vitreous hemorrhages (VHs), retinal detachments (RDs), and retinal tears that require vitreoretinal surgery. There is ample guidance from professional societies emphasizing the importance of urgent ophthalmologic evaluation, but there is no available literature evaluating the outcomes of vitreoretinal surgery in aggregate and providing guidance on the timing of vitreoretinal intervention. This review and case series aims to fill this knowledge gap.
Methods: A literature search for studies reporting outcomes of vitreoretinal surgery in children with AHT from 2011-2021; nine articles were included. These were combined with a case series of three patients at our academic institution. The visual acuity (VA) and anatomical outcomes were compared between patients who received surgery within four weeks of diagnosis and those who had delayed surgery.
Results: A total of 78 eyes from 57 patients received intervention ranging from panretinal photocoagulation to pars plana vitrectomy (PPV) and scleral buckling. Most required a PPV (74 eyes/95%). 72 eyes (92%) had a non-clearing VH, while 7 eyes (9%) had an RD. 75 eyes (96%) had anatomical success, defined as an attached retina without vitreous hemorrhage. Surgery performed within four weeks of injury showed a trend towards improved anatomical and VA outcomes as compared to delayed surgery.
Conclusions: Vitreoretinal surgery after AHT

has good anatomical success rates, but there is a trend towards improved VA outcomes when surgery is performed within four weeks of diagnosis. This highlights the importance of urgent ophthalmologic evaluation and referral to a pediatric retina specialist for non-clearing VH, RDs, and retinal tears after AHT.

Keywords: Abusive Head Trauma, Non-Accidental Trauma, Pediatric Retina, Vitreous Hemorrhage, Retinal Detachment

TELE-OPHTHALMOLOGY

Anaglyph Glasses and Virtual Reality Headsets for Watching 3D Ophthalmic Content

First Author: John D. ***AKKARA***
Co-Author(s): Anju ***KURIAKOSE***

Objective: To evaluate the various methods of watching 3D ophthalmology content and their affordability, quality, usability and effectiveness.
Methods: The authors tested various methods of 3D viewing including 3DTV, red-blue anaglyph, stereo viewer, cross & parallel eye viewing, mirror viewing and Virtual Reality Headsets including Google Cardboard. Some ophthalmic 3D content was made by the authors using special 3D cameras, some using special smartphone apps and some using specialized computer software. The advantages and disadvantages, affordability, quality, usability was evaluated and described.
Results: We made 3D photos and videos using smartphones and 3D cameras. We tested expensive 3DTV, medium cost red-blue anaglyph method and inexpensive virtual reality headsets and several other methods to watch 3D surgical videos and 3D ophthalmic photos. The best 3D effect was seen in 3D TV followed by Google Cardboard followed by Anaglyph glasses. The cost of 3DTV was the highest followed by Google CardBoard followed by Analygh Red-Blue glasses ebing the cheapest. Ease of use was best for Anaglyph gasses followed by 3DTV followed by Google Cardboard. For those wearing spectacles, all three methods proved to be cumbersome, but some modified version of Anaglyph glasses supported prescription glasses and a modified Google Cardboard supported smaller prescription glasses a well as certain types of 3DTV glasses.
Conclusions: The advantages of 3D videos and photos in ophthalmology and the ease of viewing such 3D content is apparent. We hope to add value to ophthalmology teaching programme with use of this innovative teaching method which has become easily available due to recent advances in low cost technologies.

Keywords: Virtual Reality, Teaching, Headset, Simulation, Surgical Videos

Comparison of Two 3D Printed Smartphone Fundus Cameras

First Author: Anju ***KURIAKOSE***
Co-Author(s): John D. ***AKKARA***

Objective: To 3D print and compare two different models of 3D printed fundus cameras.
Methods: 3D STL files for oDocs Fundus Smartphone Ophthalmoscope were downloaded from ThingiVerse.com and 3Dprinted on Ultimaker 3. The parts were fixed together using screws and a 20D lens was added. Fundus photos in dilated eyes were obtained after some practice. Specialized camera Apps such as HopeScope, MIIretcam and Ullmann Indirect for fundus photography were useful. Similarly, 3D STL files for smart.ophth.tips Smartphone Ophthalmoscope were obtained from the creator, downloaded and 3Dprinted. It was assembled with one additional part We also used another Smartphone Ophthalmoscope called HopeScope to take fundus photos to compare.
Results: The 3D printed oDocs Fundus and also the Smart OphthTips fundus camera were assembled and used. Once the 20D lens was placed in the appropriate position on the adapter, we were able to take fundus photographs in dilated eyes. There was a learning curve, but it was much easier than direct handheld method. The 3D printed devices were more portable but also less durable than the HopeScope.
Conclusions: Several models of 3D printed smartphone fundus camera adapters are available which we can download, 3dprint and use. It makes smartphone fundus photography much easier and stable. The 3D printed adapters make it accessible to more people and it lends way to better modifications of the existing designs. For a bedridden patient, especially in an ICU, a handheld fundus camera is the only option.

Keywords: 3D Printing, Fundus Camera, Smartphone, Retina Imaging, Smartphone Fundus

Feasibility Study of Home Vision Testing by the Caregivers for Tele-Ophthalmology

First Author: Navya D. ***DAVARA***

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*Co-Author(s): Padmaja K. **RANI**, Pravin K. **VADAVALLI**, Raghava C. **CHINTOJU**, Neelima **MANCHIKANTI**, Chodup **THINLEY***

Objective: To assess the feasibility of home-vision testing using a smartphone app (Peek Acuity) by the caregivers.
Methods: Patients attending departments of refractive surgery, comprehensive, glaucoma, retina at a tertiary eye Institute were prospectively enrolled. All underwent standard COMPlog visual acuity (VA) testing. Patients and caregivers were shown VA evaluation videos using the Peek acuity app. The app was installed on the caregiver's or patient's smartphone and patient's VA was measured by the caregiver in the clinic under the supervision of an optometrist. In one week, data of peek acuity by the caregivers at home was collected by telephone survey. VA measurements of COMPlog and Peek acuity at baseline and one week were done. A questionnaire was administered to assess the ease of use and challenges of using the app by the caregivers.
Results: A total of 100 patients age group from 13 to 76 years (Mean age: 40 ±18 SD) and 100 caregivers (Mean age: 37 ±12SD) participated. VA measurements by peek acuity at the baseline were comparable with COMPlog (p=0.763) showed less than one letter difference (Std ME=0.009). At one week, peek acuity measurements were comparable with COMPlog (p=0.347) less than letter difference (Std ME=0.032). Most caregivers (90%) felt the ease of using an app 97% have recommended peek acuity for checking vision.
Conclusions: Peek acuity can be used effectively by the caregivers as a home–vision assessment tool in teleophthalmology. The app was found to be easy to use by the caregivers.

Keywords Home-Vision Testing, Caregivers, Tele-Ophthalmology

Identifying Undetected Prevalent Disease: The First Pass Effect in Diabetic Retinopathy Screening Programs

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*Co-Author(s): Lizzie A. **AQUINO**, Claude M. **SALVA**, Lloyd P. **AIELLO**, Tunde **PETO**, Paolo **SILVA***

Objective: To compare referable diabetic retinopathy (refDR) rates identified on rapid assessment of avoidable blindness and DR (RAAB+DR) with community-based DR screening program (DRSP) in the same population.
Methods: RAAB+DR was performed following standard methodology using random compact segment sampling with ultrawide field imaging (UWFI) to assess DR and diabetic macular edema (DME). DRSP was performed using validated methodology of 5-field-50-degree mydriatic imaging that has substantial agreement for DR/DME (Kw=0.79/0.81) compared to Early Treatment Diabetic Retinopathy Study (ETDRS) photography. RAAB+DR was performed in preparation for implementation of DRSP. DRSP is ongoing and data represents 10.6% of screening target. RefDR was defined as moderate non-proliferative DR (NPDR) or worse, DME or ungradable.
Results: Evaluating the same target population, 1,609 individuals were evaluated in RAAB+DR, with 341(21.2%) people with diabetes (PwDM). DR severity was 239(70.1%) no DR, 38(11.1%) mild NPDR, 35(10.3%) moderate, 10(2.9%) severe, 19(5.6%) proliferative DR (PDR), 34(7.4%) DME and 9(2.4%) ungradable. DRSP evaluated 562 PwDM, distribution of DR severity was 335(59.6%) no DR, 92(16.4%) mild NPDR, 51(9.1%) moderate, 39(6.9%) severe, 33(5.87%) PDR, 30(5.4%) DME and 31(5.5%) ungradable. RefDR was identified in 86(18.7%) of the RAAB+DR cohort and 169(30.1%) in DRSP.
Conclusions: In the initial stage of screening there will be a significant first-pass effect, detecting higher levels of previously undetected prevalent disease. Hence, planning for DRSP needs to account for this initially large demand for eyecare services. In this cohort, there was a 61% increase in refDR rate that needs to be accommodated in the existing healthcare system.

Keywords: Diabetic Retinopathy, Ddiabetic Eye Disease, Screening, First Pass Effect

Impact of Implementing Tele-Ophthalmology Referral Guidelines Using the eyeSmart EMR App in Rural India

*First Author: Padmaja K. **RANI***
*Co-Author(s): Anthony V. **DAS**, Niranjan **KUMAR**, Rohit **KHANNA***

Objective: To describe the clinical indications and the impact of implementation of specific teleophthalmology referral guidelines in a large rural village vision center network in India.
Methods: This cross-sectional vision center-based study included 1,016,284 patients presenting between January 2017 and March 2020. Patients who were referred for a teleophthalmology opinion were included as cases. The data were collected using the eyeSmart EMR App on a smart tablet. A training intervention was done to reinforce the implementation of targeted teleophthalmology referral guidelines.

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Results: Overall, 63,703 (6.3%) patients were referred for a teleophthalmology opinion and were included for analysis. The median age was 41 (IQR: 26-59) years and adults (88.4%) were commonly referred for a consult. The two most common age groups were between 31-40 years (17.4%) and 21-30 years (16.3%) and the majority of patients were male (59.1%). The most common clinical indication was cornea and anterior segment disorders (71.05%). The most common queries for teleophthalmology referral before versus after the reinforcement of implementation of guidelines were red eye (33.4% vs 45.6%) followed by cataract (21.2% vs 8.1%). There was an increase in the red eye (< 0.001) and a decrease in cataract (< 0.001) which was statistically significant. The proportion of patients for whom a tele-ophthalmology consult could have been requested but not sent was minimal (2.3%).
Conclusions: Implementation of targeted teleophthalmology referral guidelines enable an effective triage to seek opinion for more pertinent ocular diseases that require care. Adult male patients with cornea and anterior segment disorders are most commonly referred for a teleophthalmology opinion.

Keywords: Tele-Ophthalmology, Referral Guidelines, Big Data, Electronic Medical Records

Impact of Teleophthalmology during COVID-19 Lockdown in a Tertiary Care Centre in South India

*First Author: Ashwin **SEGI***
*Co-Author(s): Meenakshi **RRAVINDRAN**, Fathima **ALLAPITCHAI**, Syed **MOHIDEEN**, Ramakrishnan **RENGAPPA***

Objective: To describe the experience of tele-consultations addressed at our hospital in India during the ongoing coronavirus (COVID-19) lockdown.
Methods: This cross-sectional hospital-based study included 977 tele-consultations presenting between April 1st and May 31st 2020. A two-level protocol was implemented to triage the calls.
Results: Overall, 977 tele-consultation were addressed. Of the 621 teleconsultation addressed the most common queries were related to redness/ pain/ watering/ blurred vision/ itching/ irritation (52.49%), followed by queries related to medications (28.01%), appointments (18.84%) & 0.64% cited an emergency need to visit the hospital due to sudden loss of vision. The majority of the queries were directed to the department of cornea (58.93%) followed by retina (16.26%), cataract (13.04%), glaucoma (10.14%) & paediatric ophthalmology (1.61%). The most common advice given to the patient was related to medications (47.66%) followed by appointment related queries (31.72%) & fixing of surgical appointment (20.61%). Among the 356 preterm babies that were screened, 57 (16.01%) were diagnosed with retinopathy of prematurity (ROP). Of them 3 required laser and 3 were given injection.
Conclusions: Teleconsultation is here to stay beyond the pandemic. Whatsapp was the preferred modality of communication for us. Teleophthalmology has given us insights to use this evolving technology to reach out to the population at large to provide eye care services. We believe that this mode of teleophthalmology has helped us in providing feasible eye care to the patients.

Keywords: Tele-Ophthalmology, Covid-19, Lockdown, Impact, South India

Improvising Tele-Ophthalmology – Novel Use of Google Hangouts for Vision Center Tele-consultation in India

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Objective: To describe the novel use of Google Hangouts for Ophthalmological teleconsultation through vision centers (VCs) in remote parts of South India.
Methods: The prime requirements are dual monitor desktop setup for base hospital doctor and trained mid-level Ophthalmic personnel (MLOP) at vision center, good internet connectivity, and a dedicated Email-ID for login at both the user interface. Initially, an event is created for consultation, a guest user is added and the invitation is sent to respective VCs. Next, from the base hospital user interface the event is selected through Google meet app, and teleconsultation is provided for patients examined at the vision center.
Results: The trained MLOP at the VC performs the ophthalmic examination of the patients and the findings including images are uploaded in the electronic medical recording (EMR) database software. The base hospital doctor in turn cross cross-checks the findings of the patient and provides Ophthalmic teleconsultation. The patients are either provided with medications, glasses or are advised surgery at the base hospital. Further, those needing specialty referral for cataract, glaucoma, retina, uvea, or pediatric are referred to the base hospital for detailed evaluation. These patients are provided treatment at the base hospital itself.
Conclusions: This is the first time novel use of Google Hangouts for Ophthalmological teleconsultation across the globe. As compared

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to other apps like Marratech and Skype., it provides better quality images along with better audio and video quality. This is low cost better alternative for hassle-free didactic telecommunication and may be a boon for teleconsultation in remote parts of the world.

Keywords: Novel, Google Hangouts, Vision Centre, Tele-Consultation, Tele-Ophthalmology

Innovative Solutions for Effective Tele-Ophthalmology in Primary Eye Care

*First Author: Padmaja K. **RANI***
*Co-Author(s): Ranganath **VADAPALLI**, Anthony V. **DAS**, Rohit **KHANNA**, Anand K. **PANAGANTI**, Pravin K. **VADAVALLI***

Objective: To describe the innovations aimed at improving the image quality and tracking referrals in a primary eye care teleophthalmology system.
Methods: The study is carried out in a rural primary eye care network from India. Picture of the day is an innovation introduced to enhance the quality of images captured by Vision technicians (VT) sent for teleconsultation at primary level. Selected images are shared with the WhatsApp group of VTs, inspiring them to capture high-quality photos independently. Introduction of color coding for referral tracking is an innovative solution built into the electronic medical record system of a primary eye care teleophthalmology. Red indicates urgent referral, yellow indicates semi-urgent referral, and green indicates eye problems that can be treated by primary teleconsultation.
Results: A total of 365 picture of the day images was selected from 46,532 patients who received teleconsultations from June 2020 – May 2021. Of 46,532 patients who were referred for teleconsultation at primary level, 39079 (84%) could be managed using Teleconsultation at VC alone (Green color), saving time, money and reducing unnecessary travel thus reducing carbon footprints. A total of 3729 (8%) required semi urgent referral (Yellow color) and 3724 (8%) required urgent referral (Red color) for medical / surgical management to a higher level of care.
Conclusions: The integration of the picture of the day and the monitoring of referral by color codes are innovative solutions to improve the effectiveness of teleophthalmology in primary eye care..

Keywords: Tele-Ophthalmology, Picture of the Day, Color Coding, Referral Tracking

Is Tele-Ophthalmology Different in Urban and in Rural Areas?

*First Author: Ankita **SANGLE***
*Co-Author(s): Sulatha **BHANDAR**, Priyanka **RAMESH***

Objective: To learn how telemedicine was used by ophthalmologists during the COVID-19 lockdown, to learn about rural and urban practitioners' experiences and to comprehend issues with Teleophthalmology implementation.
Methods: Ophthalmologists were sent a questionnaire-based e-survey, and the responses were analyzed.
Results: 407 ophthalmologists responded, with 283 from cities and 124 from rural areas. Teleconsultation was conducted via regular and video calls, texts, and emails. Technical issues, payment modes, and the inability to perform tests were some of the issues in rural areas. The urban setting presented challenges in terms of medicolegal aspects or prescription misuse. High levels of satisfaction and acceptance were reported in urban areas as a result of increased accessibility, reduced time and travel costs. Teleconsultation was less effective in rural areas due to a lack of internet access or consistent connections.
Conclusions: During the COVID19 pandemic, teleophthalmology is evolving. Better teleophthalmological tools could improve consultation quality and patient care and satisfaction. Teleconsultation in ophthalmology is difficult because it necessitates close contact and the administration of various subjective and objective tests. Teleconsultations are popular among patients due to their increased accessibility, lower travel costs, and shorter wait times.

Keywords: COVID-19, Rural, Urban, Tele-Consultation, Tele-Assistants

Role of Vision Centers in Eliminating Avoidable Blindness Caused Due to Uncorrected Refractive Error in Rural South India

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Objective: To study the role of Vision centers in eliminating preventable blindness through refractive error correction in Rural South India.
Methods: A retrospective analysis of patients attending 15 Vision centers in Rural South India from a period of January 2019 to December 2019 was done. Medical records of 79,562

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newly registered patients and 29,019 review patient's from 15 Vision centers were included for data analysis.
Results: A total of 1,08,581 patients were included in the study. Of the total 1,08,581 patients 79,562 were newly registered patients and 29,019 were review patients. Males were 52,201(48.1%) and Females were 56,308(51.9). The mean age of all examined patients were 41.03 ± 20.9 years (Standard deviation) and ranged from 01 – 113 years. Presenting mean visual acuity was 0.31 ± 0.5 in right eye and 0.31 ± 0.4 in left eye. Of the 1,08,581 patients 22,770 patients had refractive error in right eye and 22,721 patients had uncorrected refractive error in left eye. Glass prescription was given to 17,178 (15.8%) patients. 8,109 (7.5%) patients were referred to base hospital for specialty clinic expert opinion or for cataract surgery.
Conclusions: Vision center utilizing tele-consultation for comprehensive eye screening unit is a very useful tool in eliminating avoidable blindness caused due to uncorrected refractive error. Vision Centre model is believed to be efficient as it facilitates early detection and management of uncorrected refractive errors.

Keywords: Refractive Error, Uncorrected Refractive Error, Vision Center, Vision Technician, Tele-Consultation

Setting up Asynchronous Virtual Glaucoma Clinics in Orkney

*First Author: Elewys **HEARNE***
*Co-Author(s): Susan **LIGHTMAN***

Objective: To identify the value of asynchronous virtual glaucoma clinics in the detection of ocular morbidity from glaucoma in a remote and rural population in the UK.
Methods: On Orkney clinics were set up using the Royal College of Ophthalmologists guidelines for virtual glaucoma clinics. The Ophthalmologist went through the virtual clinical data comparing where possible with previous data and decided on management options 1) stable – see 1 year, 2) some changes but eye pressure stable - see in 6 months, 3) high IOPs - booked into the next available clinic. Patients were written to with the outcome of their clinic and a copy sent to their GP and optometrist.
Results: Over 1 year 109 glaucoma patients were seen in the asynchronous virtual clinics. The vast majority had chronic open angle glaucoma, with 10 narrow angle/closed angle, 8 ocular hypertensives and 2 uveitic glaucoma. 35 patients were stable and reviewed in a year. 35 patients were seen again in 6 months. 39 patients were asked to come into the next clinic to be seen by the Ophthalmologist as their IOP was too high or there were concerns about increasing visual field loss. When the management was changed the patient was booked into the eye clinic in approximately 2 months for an IOP check.
Conclusions: The asynchronous virtual clinic is a way of maintaining regular review for significant numbers of patients that can be seen and managed and has the safety net that patients can be reviewed urgently if necessary.

Keywords: Orkney, Glaucoma, Virtual

Synchronous Tele-Ophthalmology – A Hidden Boon for Rural Population in Pre-Corona Era

*First Author: Sanjay **THAKUR***
*Co-Author(s): Sagar **KARMAKAR**, Biswarup **RAY**, Soumen **CHAKRABORTY***

Objective: 70% of India's population resides in rural areas. But 70% of ophthalmologists practice in urban areas. Teleophthalmology plays an important role in bridging this divide. The aim of this study was to provide Synchronous Teleophthalmology services to 20 villages spread over two districts of West Bengal.
Methods: 20 Vision Centers were provided with necessary equipment and software. Two medical colleges in the above two districts were selected for tele consultation. The optometrists were trained at Regional Institute of Ophthalmology, Kolkata, and Vivekananda Mission Asram, Chaitanyapur. These trained optometrists undertook the history taking and ocular examination. After refraction, patients had tele consultation with an ophthalmologist in medical college and were given prescription online. Some patients were referred to medical college, whenever necessary.
Results: These 20 centres served a population of about 25.86 lakhs. 2,32,651 patients were examined in these vision centres over a five-year period. About 40 % of the patients (93,584 patients) were diagnosed with refractive error. Only 6.2% (14,579) patients required referral to medical colleges. Of these, 7518 patients had cataract and 1121 patients needed posterior segment evaluation.
Conclusions: More than 93% patients can be treated on site only resulting in saving of time, money, and effort of the patient. It is a cost-effective method of providing eye care to people living in remote, rural areas where access to eye care is limited.

Keywords: Synchronous, Teleophthalmology, Vision Centres

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Tele-Rehabilitation for Persons with Vision Impairment during COVID 19: Experiences and Lessons Learned

*First Author: Beula **CHRISTY***
*Co-Author(s): Padmaja K. **RANI**, Anthony V. **DAS***

Objective: The current COVID-19 pandemic is causing challenges to access rehabilitation intervention by people with visual impairment, thereby risking increasing their disability effects. Tele-rehabilitation is the best viable option to maintain the continuum of care in a situation like the current pandemic when social distancing measures are inevitable.
Methods: The Institute for Vision Rehabilitation, in South India initiated telerehabilitation for persons with visual impairment. The International Classification of Functioning, Disability and Health framework was followed to provide services such as counseling for mental well-being, information and resources, educational interventions, Assistive Technology programs, therapeutic interventions for children with multiple disabilities, access to digital libraries, and rehabilitation helpline. A team of professionals involved in the service care. Phone and what's app calls were used to facilitate the training. The duration and the number of training sessions were individual need-based with an average of 45 minutes per session and 175 training sessions.
Results: Three hundred and fifty individuals and their families benefited. The service include early intervention (n= 129), and low vision care (n= 176) inclusive of computer training (n=53), soft skills (n=53), digital books (n= 55). Nearly two-thirds of the participants were male (n=205).
Conclusions: A well-planned telerehabilitation approach can expand the scope of reaching the visually impaired from geographically isolated areas where scarcity of service providers and service centers. National policy on telerehabilitation can reduce disability burden for individuals and their families.

Keywords: Tele-Rehabilitation, Visual Impairment, Intervention

Tele-Screening of Vision Threatening Conditions by Non-Ophthalmologists during COVID-19 Lockdown – a Pilot Study

*First Author: Abhishek **ONKAR***
*Co-Author(s): Rashmi **KUMARI**, Manish **KUMAR**, Nishit **RANJAN**, **SUMMET***

Objective: To evaluate the efficacy of tele-screening by non-ophthalmologists for ophthalmic vision threatening conditions.
Methods: 48 consenting patients availing telemedicine services during COVID-19 lockdown complained of ocular symptoms. They were attended to by non-ophthalmologists (NO) who had been given a list of ocular symptoms to ask for from patients. They were also asked to video-record and assess direct pupillary reaction, swinging flash-light test, ocular movements, red-desaturation and Amsler grid testing where possible. Photographs focused on pupil with and without red-eye filter were procured. The attending personnel was asked to mention Vision Threatening (VT), Probably Vision Threatening (PVT) and Non-Vision Threatening (NVT) against each caller. The records were reviewed by two ophthalmologists (O1, O2) who also labelled them as VT, PVT or NVT and patients reverted back with their treatment plan. Comparative analysis as to the degree of agreement between non-ophthalmologists and ophthalmologists was done.
Results: Out of the 48 patients examined, 7 patients were labelled as VT by NO while 2 of these were labelled as VT by both O1 and O2. The remaining 5 were labelled as NVT by O1 and O2. Additionally, one patient labelled as VT by O1 and O2 was initially labelled as PVT by NO.
Conclusions: Though there can be an over-estimation on the part of NO, screening for vision threatening conditions by non-ophthalmologists is an effective strategy which can help redirect specialist ophthalmic services to more focused care during pandemics.

Keywords: Tele-Screening, Vision-Threatening, Non-Ophthalmologists

User Acceptability of Home Monitoring of Macular Disease – Do our patients approve?

*First Author: Meriam **ISLAM***
*Co-Author(s): Stafford **SAMSONE**, Lucas **BACHMANN**, Dawn **SIM***

Objective: To understand the patient acceptability of the use of the smartphone-based application "Alleye" in monitoring metamorphopsia for patients with macular disease through the Covid-19 pandemic and beyond.
Methods: During the first Covid-19 national lockdown in the United Kingdom in March 2020 245 patients were trained in the use of the smartphone based application Alleye(Oculocare Ltd) at Moorfields Eye Hospital in London. We assessed the user acceptability and patient satisfaction of the use of the "Alleye" app consequently via a patient survey with assessment of patient acceptability via the use of a Likert scale.
Results: Thus far over 100 responses have been received. Preliminary data from a random sample of 50 patients demonstrates 96% of

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patients either agreed or strongly agreed with feeling confident with smartphone usage. 90% agreed or strongly agreed with the statement “I think it is important that my vision helps doctors decide when my next appointment is.” . There is a high level of understanding that testing vision remotely allows the medical team to understand their eye condition better at 86%, and 78% of patients felt that they could include this testing into their daily routine. Most importantly, an encouraging 80% agreed or strongly agreed that using Alleye to test their vision reassured them, with 30% feeling Alleye testing worried them. Proposed improvements and next steps from our patients included how to embed patient education into the home test, and how to improve communication regarding next steps regarding the next appointment to ease anxiety and enhance compliance.
Conclusions: Patient engagement and satisfaction with remote monitoring of macular disease via the Alleye application is encouraging. Further study of all patients in an ongoing manner is key as restrictions continue to relax is necessary to understand how Alleye can integrate with our "new normal" to enhance patient experience in the new post-pandemic digital environment.

Keywords: Remote Monitoring, Smartphone, Metamorphopsia, Digital Health

ABSTRACTS- VIDEOS

VIDEOS

ARTIFICIAL INTELLIGENCE

Automated Screening Algorithm for Detection of Retinal Conditions referable to Ophthalmologists

*First Author: Mansi **GUPTA***
*Co-Author(s): Ganesh **BABU**, Krunal **PATEL***

Objective: The major obstacle in managing retinal diseases which are treatable to prevent vision loss is early detection, because of lack of awareness and lack of fundus examination on routine basis. To address this urgent need, Carl Zeiss Meditec developed VISUHEALTH – AI RETINA, an automated screening web tool in a connected environment to support/screen/detect an abnormal condition in retina by categorizing non-mydriatic fundus images as non – referable (Normal) or referable (Abnormal) to ophthalmologist. Referable is defined as presence of clinical finding(s) leading to a retinal condition(s) including, but not limited to, diabetic retinopathy, hypertensive retinopathy, macular edema, age related macular degeneration and suspicious ONH. Non - referable is defined as absence of clinical findings in the fundus photograph. VISUHEALTH – AI RETINA is CE certified and registered in the European market.
Methods: VISUHEALTH – AI RETINA is an optimization algorithm based on machine learning technique of deep neural networks. To validate its performance, a total of 5500 anonymized fundus images were analyzed and graded by 3 independent ophthalmologists and the same set of images were processed by algorithm. The gradings by the ophthalmologists were used to establish the reference standard against which the algorithm's output was compared at 10 operating points.
Results: The accuracy of the algorithm ranged from 85.6% - 89.3% while the sensitivity and specificity ranged from 85.01% - 89.16% and 84.85% - 90.23% respectively.
Conclusions: In this abstract, we demonstrated the performance of VISUHEALTH – AI RETINA, which can reduce the workload of manual grading in a routine screening service.

Keywords: Automated Algorithm, Diagnosis, Screening, Classification, Retina Image

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RETINA & VITREOUS

Intra-Operative Overlooked Mistakes not Always a One-Way Ticket

*First Author: Sriharanathan **POOPALARATNAM***

Objective: To demonstrate intra-operative mistake made, can be rectified smoothly by early detection on table.
Methods: Real-time video of macular hole surgery with planned inverted ILM flap. When vitreous stained with triamcinolone some segregated into Macular hole which was overlooked and ILM peeling was started. Soft tip backflush was exploited with active proportional reflux mode to flush out triamcinolone particles from macular hole without uprooting partially peeled ILM.
Results: ILM flap was intact and Triamcinolone molecules flushed out, leaving Sri.
Conclusions: Early on table detection faulty surgical steps can be rectified, prevent revisional surgeries and bad surgical outcome. In addition alertness during surgery and knowing all the functions of your available surgery toolbox are qualities of successful surgeon.

Keywords: Macular Hole, Proportional Reflux Mode, Active Back-Flush

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TELE-OPHTHALMOLOGY

Creating the Eye Grader App for Clinical Grading in Ophthalmology

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Objective: Grading scales help to objectively document clinical findings. There are several good clinical grading scales - not feasible to memorize all. It would be convenient to have at your fingertips. Noting the absence of any existing app, the authors programmed a smartphone app with all necessary grading systems. But it is difficult to memorize and recall these grading systems during clinical examination.
Methods: The authors made an app for these grading systems in ophthalmology where one can search for each grading system and can grade clinical findings accordingly.
Results: With help of ophthalmology postgraduate residents preparing for exams, the authors collected clinical grading scales & formatted data for uniformity & accuracy. Using App building Software Development Kit (PhoneGap), authors compiled collected information into Android based smartphone App “Eye Grader” and uploaded on the Google

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Play store. The iPhone version was delayed due to higher cost involved
As of June 2021, Android App had around 4000 downloads from around 80 countries, with the maximum users being from India, USA, Mexico, Egypt and Jordan.
Conclusions: This app was distributed among postgraduate residents learning ophthalmology. Suggestions for corrections, re-organizing and adding more data were obtained. To conclude, this compact app for clinical grading in ophthalmology was found to be useful for ophthalmologists.

Keywords: Smartphone, App, Grading, Pedagogy, Clinical Stages

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