Scientific Abstract Highlights

Company Sponsored and Investigator Initiated Trials by Johnson & Johnson Vision to be presented at the American Academy of Optometry

November 6th-9th, 2024

Indianapolis, Indiana

Johnson&Johnson

Introduction

We are excited to showcase some of the scientific abstracts accepted for presentation at the 2024 American Academy of Optometry within this abstract book. This abstract book presents on-label studies conducted by Johnson & Johnson Vision and studies on Johnson & Johnson Vision products independently conducted. In total, there are 23 abstracts, featuring 13 in ‘Contact Lens Research', 3 in 'Ocular Surface Disease’, 4 in ‘IOLs Research and Cataracts', and 3 in 'New Science/Technology'. Therefore, each abstract is a portal into the latest developments and insights that shape our understanding and approach to patient care. Eleven papers have been excluded from this abstract book since the following is promotional material and as such, we can only promote our products for approved/cleared indications for use.

We invite you to explore these abstracts, which offer valuable information on diverse topics. Our goal is to provide you with a comprehensive overview of current research, empowering you with knowledge that can inform and enrich your practice.

In addition to this publication, you are welcome and encouraged to contact our Medical Affairs associates with any further clinical science-related questions. Our goal is to ensure clinicians are well informed of both the science and technology behind our products, and thus, are in the best position to deliver the highest quality care to patients.

Thank you for your dedication to advancing medicine and improving patient outcomes. We hope this collection serves as a valuable resource in your ongoing pursuit of excellence in healthcare.

For Healthcare Professionals Only. Please reference the Instructions for Use for a complete list of Indications and Important Safety Information and contact our specialists in case of any question.

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*Filtering of HEV light by contact lenses has not been demonstrated to confer any health benefit to the user, including but not limited to retinal protection, protection from cataract progression, reduced eye strain, improved contrast, improved acuity, reduced glare, improved low light vision, or improved circadian rhythm/sleep cycle. The Eye Care Professional should be consulted for more information.

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IOLs Research and Cataracts

New Science/Technology

Contact Lens Research

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Appearance and Handling Benefit of ACUVUE® OASYS MAX 1-Day Family of Lenses

M. Bishop, P. Martin, J. Buch, J. Cannon, J. Xu, E. Kelly

Poster Presentation
Friday, November 8, 2024 | 1:00 - 3:00 PM Exhibit Hall H

Purpose:

Contact lens handling, specifically insertion, can be a challenge for wearers of all ages. Wearers can have difficulty locating and removing the lens from the package as well as inserting the lens into the eye. The unique blue-green appearance of ACUVUE® OASYS MAX 1-Day (AOMAX1D) is a result of the combination of a blue-violet light filter and a blue handling tint. The purpose of this work was to determine if the appearance of AOMAX1D had any impact on lens handling.

Methods:

The methods of data collection included a consumer study, a clinical study, and a meta-analysis involving AOMAX1D (Sphere or Multifocal) and Dailies TOTAL1® (DT1, Sphere or Multifocal). The consumer study included 98 habitual contact lens wearers aged 18-60 years. Subjects were asked to view AOMAX1D and DT1 lenses in blister packs and rate which was easier to see. Additionally, subjects were asked if the color difference made it easier to see or not. In the randomized clinical study, 342 habitual contact lens wearers aged 18-39 years were enrolled in a randomized parallel arm dispensing study. After two weeks of wearing AOMAX1D (n=171) or DT1 (n=171), the subjects were asked subjective handling questions. The meta-analysis included 4 dispensing clinical studies involving 366 habitual contact lens wearers aged 40-70 years. Responses to subjective handling questions were collected after one week of wear in all of the included studies.

Results:

For the consumer study, 65% of subjects reported AOMAX1D as easiest to see in the blister compared to only 24% for DT1. Thus, 2.5X more subjects found the AOMAX1D easier to see in the blister than DT1. Over 90% of subjects felt that the unique color of the AOMAX1D had the benefit of making the lens easier to see. In the randomized clinical study, over 95% of subjects wearing AOMAX1D reported it as easy to insert. In the meta-analysis, AOMAX1D Multifocal was found to have easier overall handling versus DT1 Multifocal.

Conclusions:

The results suggest that the unique blue-green appearance of AOMAX1D made the lens easier to see in the blister package and potentially allowed for superior handling when compared to DT1. This information is valuable to Eye Care Professionals as the unique appearance of AOMAX1D may help address the insertion and handling challenges for some wearers. This is particularly meaningful to presbyopia patients, where seeing the lens up close is a challenge.

Light Filtering as Depicted by New US Ophthalmic HEV* Band Scheme: Comparison of ACUVUE® OASYS MAX 1-Day Contact Lenses with Other Lenses and Spectacles

K. Arnold, P. Martin, G. Giammanco, T. Sawatzky

Poster Presentation
Friday, November 8, 2024 | 1:00 - 3:00 PM Exhibit Hall H

Purpose:

Despite the volume of work involving high energy visible light (HEV*) and its effect on ocular structures and visual response, there is little agreement on its impact. This inability to reach consensus is fueled by inconsistent characterization of devices filtering light in this region, as well as conflicting use of the term 'blue-blocking' and a lack in standardization of ranges studied. The ANSI Accredited Standards Committee for Ophthalmic Optics, Z80, published a technical report that provides the US ophthalmic definition for HEV* and a band scheme to delineate different regions of HEV* to standardize and provide common language. This work characterizes two ACUVUE® products spanning a range of light management capability. This work also addresses other concepts related to light management, such as luminous transmittance, and utilizes the new band scheme to compare the light filtering of ACUVUE® OASYS MAX 1-Day Contact Lenses with several commercially available 'blue-blocking' spectacle lenses.

Methods:

Transmission spectra from 200 – 800 nm collected on all samples were used to calculate transmission and/or filtering percentages within the different bands of HEV* (380 – 500 nm): HEV3* (380 – 400 nm), HEV2* (400 – 455 nm), and HEV1* (455 – 500 nm). Luminous transmittance calculations were also made using these spectra to address perception of lightness and darkness when wearing these lenses. Calculations were performed according to ISO 8980-3. Transmission spectra for contact lens samples were acquired in packing solution using a Perkin Elmer Lambda 45 UV/VIS scanning spectrophotometer. Transmission spectra for spectacle samples were acquired using a Perkin Elmer Lambda 850 UV/VIS/NIR scanning spectrophotometer outfitted with an integration sphere.

Results:

Using the new US ophthalmic band scheme, ACUVUE® OASYS MAX 1-Day Contact Lenses (-1.00 D) are shown to effectively block 99% HEV3*, filter 41% HEV2* and filter 2% HEV1*. Luminous transmittance, a weighted transmittance value, was calculated in the range of 380 – 780 nm. The luminous transmittance of ACUVUE® OASYS MAX 1-Day Contact Lenses (-12.00 D) was calculated to be 94% with ACUVUE® OASYS 1-Day at 92%. The use of the HEV* band scheme also shows that while ACUVUE® OASYS MAX 1-Day Contact Lenses have a unique filtering spectrum, the filtering percentages in HEV3* and HEV2* are similar to several commercially available 'blue-blocking' spectacle lenses.

Conclusions:

In conclusion, the new US ophthalmic HEV* band scheme is useful to characterize and compare the filtering of ophthalmic devices. It provides common language to enable comparison and a foundation upon which have discussions regarding impact of HEV* on ocular structures and visual response.

*Filtering of HEV light by contact lenses has not been demonstrated to confer any health benefit to the user, including but not limited to retinal protection, protection from cataract progression, reduced eye strain, improved contrast, improved acuity, reduced glare, improved low light vision, or improved circadian rhythm/sleep cycle. The Eye Care Professional should be consulted for more information.

Contact Lens User Experience with lehfilcon A and senofilcon C Monthly Soft Contact Lenses

A. Nixon, P. Martin, J. Xu, C. Leong, J. Buch

Oral Presentation
Friday, November 8, 2024 | 1:00 - 3:00 PM Exhibit Hall H

Purpose:

Reusable soft contact lenses continue to make up a significant segment of the contact lens market, with an estimated 35% of global soft lens fits being monthly replacement modality. The senofilcon C monthly lens launched several years ago in the US market, and at the time was reported to provide superior overall comfort and overall quality of vision among leading monthly lenses. The latest monthly replacement soft lens material in the US market is lehfilcon A. The purpose of this study was to explore the subjective experience for subjects wearing lehfilcon A and senofilcon C reusable lenses over 4 weeks using the Contact Lens User Experience (CLUE) Scale, a rigorously developed patient-reported outcome measure.

Methods:

This was a multi-center, randomized, controlled, double masked, parallel-armed, 4-week dispensing study. Myopic subjects who habitually wore reusable, spherical, silicone hydrogel contact lenses in both eyes and self-reported experiencing glare were randomly assigned to wear senofilcon C or lehfilcon A soft contact lenses for 4 weeks of daily wear. The CLUE scale for this study was customized from a bank of items for each domain and was completed by subjects for their habitually worn lenses and after their assigned study contact lenses were dispensed for daily wear in real world situations for 2 and 4 weeks. The mean overall score was calculated for each group, domain, and timepoint. A score of 60 reflects the average level of the domain in the population of healthy adult, soft, disposable CL wearers, and higher scores indicate more satisfaction with the measured construct. A 5-point shift in the mean CLUE score translates into approximately a 10% shift in population of soft disposable contact lens wearers and has been determined to be clinically relevant.

Results:

There were 83 subjects in the intention-to-treat (ITT) population for each group recruited from 12 US-based sites. The composition of the groups by gender and age were similar. The mean CLUE score by group for their habitual contact lenses were similar for all domains - within about 2 points of one another. The mean CLUE scores and 95% confidence intervals for each group at 2 and 4 weeks are summarized by domain and timepoint in the figure. The mean CLUE scores for the lehfilcon A lens group at 2 and 4 weeks were often less than 60 and were not higher than their mean habitual lens scores for comfort, vision, or handling. The mean CLUE scores for the senofilcon C group at 2 and 4 weeks were greater than 60 for each domain, with each mean score trending higher than their mean habitual lenses and the mean lehfilcon A scores for comfort, vision, and handling.

Conclusions:

This study showed a pattern of higher CLUE scores for the senofilcon C lens at 2 and 4 weeks in Comfort, Vision, and Handling versus the lehfilcon A lens. The results of this study suggest that the senofilcon C monthly lens performance remained strong all month long, even against the lehfilcon A material.

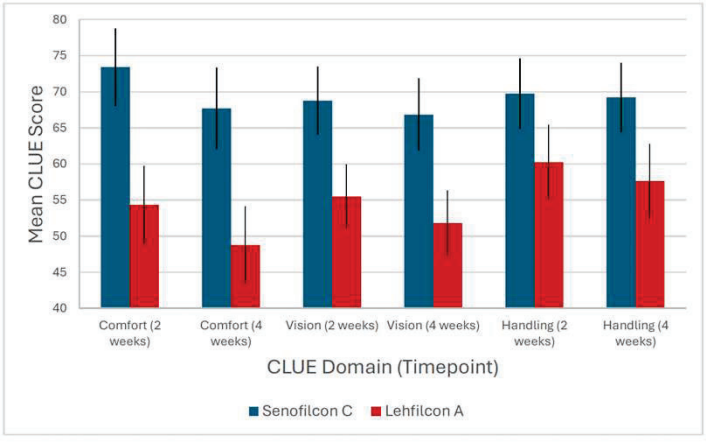

Figure: The mean CLUE score and 95% confidence interval for each lens group by domain and timepoint.

Ocular Surface Disease

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Development and Validation of Image Quality Assessment Algorithms for Infrared Meibography Images Using Deep-Learning

E. Osae, C. Scales, D. Murakami, J. Young, J. Bai, D. Cheng, C. Blackie

Poster Presentation
Thursday, November 7, 2024 | 4:30 - 6:30 PM Exhibit Hall H

Purpose:

Artificial intelligence applications in ophthalmic imaging are becoming widespread for their usefulness in supporting clinical decision making. However, performance of these AI tools rely on high quality images as images of poor quality can undermine their performance. Herein, we developed and validated a set of upstream algorithms to assess the quality of meibography images. Specifically, convolutional neural networks (CNNs) were trained to assess whether infrared meibography (IRM) images are of sufficient quality to perform anatomical assessment of meibomian glands (MG).

Methods:

A deidentified real-world dataset (>143k images) from across North America was assessed by clinicians to establish ground-truth (GT). Two CNNs, trained on annotated images yielded *Image Quality Detection* (IQD) and *Over-Flip Detection* (OFD) algorithms. Performance was evaluated with novel image test-sets.

Results:

Performance metrics include *Sensitivity* (IQD: 0.75, OFD: 0.80), *Specificity* (IQD: 0.85, OFD: 0.88), *Accuracy* (IQD: 0.80, OFD: 0.87), *Cohen's Kappa* (κ, IQD: 0.60, OFD: 0.62), and *Kendall's Tau-*β (τ IQD: 0.61, $p<0.001$, OFD: 0.63, $p<0.001$). AUPRC (IQD: 0.87, OFD: 0.92) and AUROC (IQD: 0.88, OFD: 0.91) with thresholds from 0 to 1.

Conclusions:

Moderate to *substantial agreement* with GT ($\kappa \gtrsim 0.61$) and strong correlation ($\tau > 0.60$) are evidence that these algorithms provide reliable, real-time assessment of quality of IRM images. When employed prior to, or as part of automated structural evaluation or segmentation of meibomian glands, image quality algorithms like these will serve to ensure that high quality images are elected and analyzed, thereby informing the performance of anatomical gland assessment algorithms.

Vector Thermal Pulsation Treatment for Dry Eye in Subjects Previously Using Topical Immunomodulator Therapies

T. Ferguson, S. Ferguson

Poster Presentation
Thursday, November 7, 2024 | 4:30 - 6:30 PM Exhibit Hall H

Purpose:

To evaluate the efficacy of vector thermal pulsation treatment in subjects with a history of dry eye disease currently using a topical immunomodulator medication.

Methods:

Prospective, non-randomized, interventional study. Subjects with bilateral use of a topical immunomodulator drop were recruited to participate. All subjects underwent a vector thermal pulsation treatment (LipiFlow). Patients were seen at baseline in a visit immediately prior to treatment and at months 1 and 3 following treatment. Data collected included tear osmolarity, tear break up time (TBUT), tear meniscus height (TMH), lipid layer thickness (LLT), meibomian gland characteristics and patient-reported symptoms using the ocular surface disease index (OSDI) questionnaire.

Results:

60 eyes of 30 subjects with a history of dry eye were successfully enrolled and completed the study. Of the 30, 27 were using topical cyclosporine 0.05% and 3 were using lifitegrast 5.0%. At baseline, the mean tear osmolarity was 304.5 ± 12.0 and at month 3, the tear osmolarity was 292.9 ± 9.53 ($P<0.01$). TBUT at baseline was 3.0 ± 1.9 seconds and at month 3 was 5.3 ± 2.2 seconds ($P<0.01$). For TMH, the mean baseline value was 0.2 ± 0.1 mm and at 3 months, the mean TMH was 0.2 ± 0.1 ($P>0.05$). For gland expression quality (3 = clear liquid, 0 = no secretion), the mean total lid expression at baseline was 1.9 ± 0.4 and at 3 months, the total mean expression score was 2.6 ± 0.5 ($P<0.01$). For OSDI, the mean baseline score was 19.6 ± 11.6 and at 3 months, the mean OSDI was 10.7 ± 8.0 ($P<0.01$).

Conclusions:

The results of this study demonstrate that dry eye patients previously managed with a topical immunomodulator can further benefit from vector thermal pulsation treatment for management of their dry eye with an improvement in both objective and subjective dry eye parameters.

Artificial Intelligence Application in the Evaluation of Meibomian Glands

D. Murakami, E. Osae

Oral Presentation
Thursday, November 7, 2024 | 4:30 - 6:30 PM Exhibit Hall H

Purpose:

In recent years, the rapid advancement and widespread adoption of artificial intelligence (AI) technologies have revolutionized various industries, including healthcare. Within eyecare, AI algorithms are increasingly being employed to enhance the clinical assessment and evaluation of Meibomian glands (MGs) as a step to objectively stage Meibomian Gland Dysfunction (MGD) through machine learning analyses of infrared meibography images. Herein, we systematically analyzed and present key findings including the performance metrics of the various algorithms, while highlighting the utility of AI in the management of MGD, and overall understanding of the current landscape of AI-driven meibography technologies.

Methods:

We employed a sensitive search strategy of PubMed, LitSense, Cochran, and Google Scholar databases to collate peer reviewed publications on the topic within the last 20 years. Specifically, we aligned key search terms or string of terms pertaining to this topic such as: 'AI,' 'Meibomian Glands', 'Deep Learning', 'Machine Learning', 'Neural Network', 'Image Analysis', 'AI-assisted' combined with 'MGD', 'Infrared Meibography' and 'Meibomitis' Studies were included if they were written in English, conducted on human subjects, with clearly defined sample demographics, meibography methods and AI algorithms and their associated performance metrics. Relevant articles meeting the inclusion criteria were identified and systematically evaluated for differences/similarities in AI models, meibography image datasets, precision, recall, time-to-segment and overall performance characteristics. Data is represented in forest plots and where appropriate descriptive summaries included.

Results:

We obtained 30 unique studies of which 15 were included in the analysis. The studies differed in terms of image acquisition technologies, size of datasets [112 - 1,600+ meibography images] and AI algorithms. Sample characteristics were also different with minimum age of study subjects ranging from 18-85 years of age. Not all studies presented data on time-to-segment for individual images of meibographs but those that did, showed a range of 480 ms to <1 minute. Overall, the different algorithms showed similarities in terms of substantial performance in their predicative abilities: recall range (54% - 81%), precision range (63% - 83%), F1 range (0.71 – 0.84) and AUC ≤ 0.96.

Conclusions:

The studies identified highlight the utility of AI in the objective evaluation of MGs with a high degree of predictability and speed when compared to manual evaluation methods. This could help standardize real-time inference and clinical assessment of MGs to benefit the clinical staging of MGD. A common limitation of some of the studies is inadequate datasets used in training and validation of the algorithms, suggesting the larger datasets may even enhance the performance metrics of these algorithms.

IOLs Research and Cataracts

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Real World Evidence Visual Outcomes of a New Full-Range Spectacle-Independence Intraocular Lens

D. Cheng, D. Muenz, S. Vilupuru, H. Weeber

Poster Presentation
Thursday, November 7, 2024 | 4:30 - 6:30 PM Exhibit Hall H

Purpose:

To assess real-world outcomes and visual performance of a new full-range spectacle-independence intraocular lens (IOL) which incorporates a softer diffractive profile intended to deliver a continuous range of vision, higher tolerance to refractive error, and reduced dysphotopsias.

Methods:

Clinical records from 19 surgeons at 15 US sites were reviewed retrospectively for patients bilaterally implanted with the new lens over a 5-month period. Preoperative, operative and postoperative 1-month data were evaluated. Key performance outcomes included monocular and binocular distance visual acuity, manifest refraction spherical equivalent (MRSE), near visual acuity, and non-directed visual symptoms. Evaluation of visual acuities was per the investigators' standard of care.

Results:

A total of 96 subjects were bilaterally implanted and met the inclusion/exclusion criteria. Mean ± SD binocular logMAR UCDVA was 0.01 ± 0.07 (20/20 Snellen equivalent), BCDVA was -0.03 ± 0.07 (20/20 Snellen), and UCNVA at 40 cm was 0.10 ± 0.09 (J1 equivalent). 89.6% of subjects did not experience any dysphotopsias in their first eye, or if present, did not rate or only rated them as mild. At the 1-month postoperative visit, 92.7% of subjects had not used spectacles since the surgery and 96.4% did not need a spectacle prescription.

Conclusions:

This real-world evidence study suggests that the new lens demonstrates a full range of distance to near visual performance, with none to minimal visual symptoms typically associated with Full Visual Range IOLs and a high rate of postoperative spectacle independence.

Societal costs of MVAs and falls attributable to the presbyopia corrected pseudophakic population

T. Pastuck, L. Patch, H. Weeber, C. Vidal

Poster Presentation
Friday, November 8, 2024 | 4:30 - 6:30 PM Exhibit Hall H

Purpose:

The objective of this investigation was to quantify the number of injuries and associated healthcare costs of motor vehicle accidents (MVA) and falls for patients that have had presbyopia correcting cataract surgery, identify visual predictor of risks and evaluate potential IOL contributing factors.

Methods:

A compilation of published literature from PubMed, OVID and other sources regarding rate and cost of non-fatal emergency department (ED) treat and release due to MVA and falls for the U.S. population age ≥65 years, as well as visual indices of vulnerability and potential IOL contributing factors were identified and evaluated for quantification rigor.

Results:

In 2021 the cost of nonfatal ED treat and release among the U.S. population age ≥65 years was $643.7M for MVAs and $16.2B for falls. The rate of annual cataract surgery was 8% to 11% per 1,000 of population and 10% were implanted with presbyopia correcting IOLs, resulting in potential costs attributable to pseudophakic patients of $5.2M - $7.1M for MVAs and $130M - $170M for falls. Contrast sensitivity (CS) was identified as a potential strong visual metric for assessing older individuals' fitness for driving and fall risk. Aging can detrimentally affect contrast sensitivity. CS has been reported to be significantly associated with driving performance ($P<0.01$) and poor CS has been identified to increases the risk of falls while walking on uneven surfaces. IOL modulation transfer function (MTF) allows quantification of optical quality and is correlated to clinical CS. MTF 3mm pupil (simulating daylight environment) values for presbyopia correcting IOLs include TECNIS Odyssey® = 0.369, AT Lisa® = 0.306, FineVision® = 0.278, PanOptix® = 0.258 and Vivity® = 0.248. MTF 5mm pupil (simulating dim environment) values were TECNIS Odyssey™ = 0.309, Vivity® = 0.191, AT LISA® = 0.174 and FineVision® = 0.139 and PanOptix® = 0.138.

Conclusions:

The potential economic burden of MVAs and falls attributable to the presbyopia corrected pseudophakic population is considerable. This investigation identified an important metric (MTF) for evaluation of a probable IOL contributing factor, contrast sensitivity and reports on the vastly differing MTF values of existing PC-IOLs. Further investigation is needed to determine if IOLs with higher MTF, when implanted, reduce societal economic burden and patient risk of MVA and falls.

Cataract surgery disparities in the United States: How can optometry reduce the gap?

T. Pastuck, L. Patch

Poster Presentation
Thursday, November 7, 2024 | 4:30 - 6:30 PM Exhibit Hall H

Purpose:

Identify racial, ethnic and/or gender related cataract care disparities and recognize eye care provider and healthcare system modifiable factors that may reduce inequities.

Methods:

A compilation of published literature from PubMed, Cochrane and other sources regarding racial, ethnic and/or gender cataract care disparities along the continuum of care was identified and evaluated for quantification rigor.

Results:

41 articles were identified, of which 20 were included in the analysis due to data robustness. Four patient journey key points were found to impact cataract surgery outcomes: routine eye exam (Black (21%), Hispanic (26%) and Asian (23%) groups less likely to have exams, affecting referrals), surgical evaluation (economic and geographic barriers delay access for non-white and female patients), surgery (Black (OR 1.90), Hispanic (OR 1.42) and Asian (OR 1.57) have increased odds of undergoing complex surgery) and post-op (Black (20.3%), Hispanic (11.3%) and Asian (15.1%) have higher procedure-related complication rates with greater loss to follow-up). The disparities ultimately impact visual and eye health outcomes. Provider and healthcare system modifiable factors reported include practice patterns, process pathways and contextualized care. Applying modifiable factors has been shown to systematically identify the greatest area of disparity in your practice, allow for development of a metric-based priority of focus, aid in recognizing patients at risk and providing needful resources.

Conclusions:

Disparities along the care continuum impact Black, Hispanic, Asian and female patient cataract surgery outcomes in the United States. Providers and healthcare systems have historically underutilized their unique power to expand beyond a strict biomedical role to better serve the community.

New Science/Technology

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Utilizing machine learning models and non-ophthalmic parameters to predict at-risk cataract and glaucoma patients

K. Osei, J. Young, C.W. Chang, C. Scales, S. Menon, C. Holy, C. Blackie

Oral Presentation
Thursday, November 7, 2024 | 9:15 - 9:30 PM Room: 201 - 202

Purpose:

Glaucoma and cataract contribute significantly to visual impairment globally. Early referral and management/treatment of these potentially blinding eye diseases is critical to minimizing the prevalence of visual impairment. Machine learning and artificial intelligence are emerging applications for predicting the progression of eye diseases. This study aimed to evaluate the use of machine learning (ML) models in identifying at-risk glaucoma and cataract patients to aid referral for treatment.

Methods:

From a large de-identified electronic health record system, patients with cataract (n = 197,570) and glaucoma (n = 192,727) were age- and gender-matched to patients without any eye conditions (n = 197,570 for cataract, n = 192,727 for glaucoma). Five different ML algorithms, namely, Generalized Linear Model (GLM), L1-Regularized Logistic Regression (L1-LR), Random Forest (RF), Extreme Gradient Boosting (XGBoost), and J48 Decision Tree (J48 DT) were deployed and assessed for their performances on the predictability of at-risk glaucoma and cataract patients based on 142 – 182 non-ophthalmic factors. 80% of the data were used for training while 20% were used for testing the models. Performance metrics, including prediction accuracy, area under the curve (AUC), sensitivity, and specificity were measured for each algorithm.

Results:

All 5 machine learning models demonstrated the ability to identify cataract and glaucoma cases that required treatment. Overall, XGBoost algorithm ranked highest for performance for both cataract [prediction accuracy: 78.6% (95% CI 78.3% - 78.9%), AUC: 0.878 (0.780-0.824), sensitivity: 0.796, specificity: 0.776)] and glaucoma [prediction accuracy: 70.8% (70.5%-71.1%), AUC: 0.785 (0.782-0.788), sensitivity: 0.689, specificity: 0.728]. J48 DT had the lowest performance rank for cataract (prediction accuracy: 66.5%, AUC: 0.710, sensitivity: 0.702, specificity: 0.628) and glaucoma (prediction accuracy: 62.0%, AUC: 0.647, sensitivity: 0.647, specificity: 0.593).

Conclusions:

All 5 machine learning algorithms were able to predict at-risk cataract and glaucoma patients, based on electronic health records. This suggests that utilizing ML tools like these can be beneficial in triaging cataract and glaucoma cases for early referral and management, consequently eliminating worsening of the diseases, and reducing visual impairment.

Deployment of Machine Learning Methods Utilizing Artificial Intelligence to Identify At Risk Patients with Age-Related Macular Degeneration and Diabetic Retinopathy from a Large Patient Health Record Database

E. Wygonik, J. Young, C. Chang, C. Scales, S. Menon, C. Holy, C. Blackie

Poster Presentation
Friday, November 8, 2024 | 1:00 - 3:00 PM Exhibit Hall H

Purpose:

Approximately 1.9 million Americans suffer from vision loss because of undiagnosed or untreated ophthalmic conditions. The identification and referral of at-risk patients from primary care practitioners (PCPs) to eye care professionals (ECPs) remains a challenge. Only 56.9% of US adults at high risk for vision loss in 2017 visited an ECP annually. Artificial Intelligence (AI) has the potential to triage the patients of PCPs for referral to ECPs without additional ophthalmic diagnostic equipment or testing. This study was designed to build and compare 5 machine learning (ML) methods applicable to PCP electronic health records (EHR) for capability of triaging patients at risk for Age Related Macular Degeneration (AMD) or Diabetic Retinopathy (DR) for referral to ECPs.

Methods:

Accessing the Optum deidentified EHR data set, 348,989 patients with AMD or DR were exact matched on age and gender with 348,989 controls without eye conditions. Between 142 and 182 non-ophthalmic parameters per patient were input into five Machine Learning (ML) methods: generalized linear model, L1-regularized logistic regression, random forest, Extreme Gradient Boosting (XGBoost), and J48 decision tree. Model performance was compared for each pathology to select the most predictive algorithm. The area under the curve (AUC) was assessed for all algorithms for each outcome.

Results:

XGBoost demonstrate the best performance, showing a prediction accuracy and an AUC of 77.4% (95% CI 76.7-78.1%) and 0.858 for exudative AMD; 79.2% (95% CI 78.8-79.6%) and 0.879 for nonexudative AMD; 85.0% (95% CI 84.2%-85.8%) and 0.924 for type 1 nonproliferative diabetic retinopathy (NPDR), 82.2% (95% CI 80.4%-84.0%) and 0.911 for type 1 proliferative diabetic retinopathy (PDR), 81.3% (95% CI 81.0%-81.6%) and 0.891 for type 2 NPDR, and 82.1% (95% CI 81.3%-82.9%) and 0.900 for type 2 PDR.

Conclusions:

The 5 ML methods deployed successfully demonstrated the ability to identify patients with elevated odds ratios for ocular pathology related to AMD and DR and thus are capable of triage for these conditions based on PCPs EHR alone, without additional ophthalmic diagnostics. Application of such ML could lead to earlier treatment, reducing disease and associated economic burdens and potentially improving patient lives.

Use of machine learning and electronic health record to identify at risk ocular surface disease patients for management

E. Osae, J. Young, C. Chang, C. Scales, S. Menon, C. Holy, C. Blackie

Poster Presentation
Thursday, November 7, 2024 | 4:30 - 6:30 PM Exhibit Hall H

Purpose:

The identification and referral of at-risk ocular surface disease patients from primary care practitioners (PCPs) to eye care professionals (ECPs) remains a challenge. Since artificial intelligence (AI) has been successfully used to predict and/or stage other treatable ophthalmic conditions including glaucoma, diabetic retinopathy, and ocular tumors, we sought to use AI to triage primary care patients at risk for ocular surface disease (OSD), as a step to refer them to their ECPs for management.

Methods:

Specifically, using a large deidentified retrospective electronic health record dataset from 2015 onwards, and applying the codes of international classification of diseases, 3720 patients with OSD requiring treatment (dry eye and /or MGD) were exact-matched on age and gender to 3720 controls without the conditions. Five distinct machine learning algorithms including generalized linear model (GLM) , L1-reugularized logistic regression (L1-LR), random forest (RF), Extreme Gradient Boosting (XGBoost), and J48 decision tree (DT) were deployed and assessed for their respective performances on the predictability of OSD among the cohort. Prediction accuracy, area under the curves (AUC),among other performance metrics were recorded for each algorithm.

Results:

The *XGBoost* algorithm demonstrated the best performance, showing a prediction accuracy of 72.2% (95% CI 69.9% - 74.5%) and an AUC of 0.803 (0.780-0.824) for OSD requiring treatment. This was followed in decreasing order by *RF*: accuracy = 70.9% (95% CI 68.6 % - 73.2%), AUC = 0.771 (0.747-0.795), *L1-LR*: accuracy = 69.0% (66.7%-71.3%) AUC = 0.757 (0.732-0.782), with *J48* being the least in terms of predictive performance, demonstrating 65.1% accuracy and an AUC of 0.702.

Conclusions:

Overall, the machine learning algorithms successfully demonstrated the ability to identify patients with high odds of OSD requiring treatment, based solely on their electronic health records. This suggests application of artificial intelligence tools like these could benefit the triaging of patients as a step to early treatment of OSD, consequently preventing the worsening of OSD and enhancing patient quality of life.

Important Safety Information: ACUVUE® Contact Lenses are indicated for vision correction. As with any contact lens, eye problems, including corneal ulcers, can develop. Some wearers may experience mild irritation, itching or discomfort. Lenses should not be prescribed if patients have any eye infection, or experience eye discomfort, excessive tearing, vision changes, redness or other eye problems. Consult the package insert for complete information. Complete information is also available from Johnson & Johnson Vision Care, Inc. by calling 1-800-843-2020, or by visiting www.jnjvisionpro.com.

INDICATIONS AND IMPORTANT SAFETY INFORMATION FOR TECNIS ODYSSEY™ IOL WITH TECNIS SIMPLICITY™ DELIVERY SYSTEM, MODEL DRN00V AND TECNIS ODYSSEY™ TORIC II IOL WITH TECNIS SIMPLICITY™ DELIVERY SYSTEM, MODELS DRT150, DRT225, DRT300, DRT375

Rx Only

INDICATIONS:
The TECNIS SIMPLICITY™ Delivery System is used to fold and assist in inserting the TECNIS Odyssey™ IOL, which is indicated for primary implantation for the visual correction of aphakia in adult patients, with less than 1 diopter of pre-existing corneal astigmatism, in whom a cataractous lens has been removed. The
TECNIS SIMPLICITY™ Delivery System is used to fold and assist in inserting the TECNIS Odyssey™ Toric II IOLs that are indicated for primary implantation for the visual correction of aphakia and for reduction of refractive astigmatism in adult patients with greater than or equal to 1 diopter of preoperative corneal astigmatism, in whom a cataractous lens has been removed. Compared to an aspheric monofocal lens, the TECNIS Odyssey™ IOLs mitigate the effects of presbyopia by providing improved visual acuity at intermediate and near distances to reduce eyeglass wear, while maintaining comparable distance visual acuity. The lens is intended for capsular bag placement only.

WARNINGS:
Intraocular lenses may exacerbate an existing condition, may interfere with diagnosis or treatment of a condition or may pose an unreasonable risk to the eyesight of patients. Patients should have well-defined visual needs and be informed of possible visual effects (such as a perception of halo, starburst or glare around lights), which may be expected in nighttime or poor visibility conditions. Patients may perceive these visual effects as bothersome, which, on rare occasions, may be significant enough for the patient to request removal of the IOL. The physician should carefully weigh the potential risks and benefits for each patient. Patients with a predicted postoperative residual astigmatism greater than 1.0 diopter, with or without a toric lens, may not fully benefit in terms of reducing spectacle wear. Rotation of the TECNIS Odyssey™ Toric II IOL from its intended axis can reduce its astigmatic correction. Misalignment greater than 30° may increase postoperative refractive cylinder. If necessary, lens repositioning should occur as early as possible, prior to lens encapsulation. The lens and delivery system should be discarded if the lens has been folded within the cartridge for more than 10 minutes. Not doing so may result in the lens being stuck in the cartridge. Do not attempt to disassemble, modify, or alter the delivery system or any of its components, as this can significantly affect the function and/or structural integrity of the design.

PRECAUTIONS:
Interpret results with caution when using autorefractors or wavefront aberrometers that utilize infrared light, or when performing a duochrome test. Confirmation of refraction with maximum plus manifest refraction technique is strongly recommended. The ability to perform some eye treatments (e.g., retinal photocoagulation) may be affected by the IOL optical design. The surgeon should target emmetropia, as this lens is designed for optimum visual performance when emmetropia is achieved. The TECNIS Odyssey™ IOLs should not be placed in the ciliary sulcus. Carefully remove all viscoelastic and do not over-inflate the capsular bag at the end of the case. Residual viscoelastic and/or over-inflation of the capsular bag may allow the lens to rotate, causing misalignment of the TECNIS Odyssey™ Toric II IOL. All preoperative surgical parameters are important when choosing a TECNIS Odyssey™ Toric II IOL for implantation, including preoperative keratometric cylinder (magnitude and axis), incision location, the surgeon's estimated surgically induced astigmatism (SIA) and biometry. Variability in any of the preoperative measurements can influence patient outcomes and the effectiveness of treating eyes with lower amounts of preoperative corneal astigmatism. The effectiveness of TECNIS Odyssey™ Toric II IOLs in reducing postoperative residual astigmatism in patients with preoperative corneal astigmatism < 1.0 diopter has not been demonstrated. Patients with a predicted postoperative astigmatism greater than 1.0 D may not be suitable candidates for implantation with the
TECNIS Odyssey™ IOLs, as they may not obtain the benefits of reduced spectacle wear or improved intermediate and near vision seen in patients with lower predicted postoperative astigmatism.

ATTENTION:
Reference the Directions for Use for a complete listing of Indications and Important Safety Information.

INDICATIONS AND IMPORTANT SAFETY INFORMATION for LIPIFLOW® Thermal Pulsation System

Rx Only

INDICATIONS

The LipiFlow® Thermal Pulsation System is intended for the application of localized heat and pressure therapy in adult patients with chronic cystic conditions of the eyelids, including meibomian gland dysfunction (MGD), also known as evaporative dry eye or lipid deficiency dry eye.

CONTRAINDICATIONS

Do **not** use the LipiFlow® System in patients with the following conditions. Use of the device in patients with these conditions may cause injury. Safety and effectiveness of the device have not been studied in patients with these conditions.

· **Ocular surgery within prior 3 months**, including intraocular, oculo-plastic, corneal or refractive surgery procedure
· **Ocular injury within prior 3 months**
· **Ocular herpes of eye or eyelid within prior 3 months**
· **Active ocular infection** (e.g., viral, bacterial, mycobacterial, protozoan, or fungal infection of the cornea, conjunctiva, lacrimal gland, lacrimal sac, or eyelids including a hordeolum or stye)

· **Active ocular inflammation** or **history of chronic, recurrent ocular inflammation within prior 3 months** (e.g., retinitis, macular inflammation, choroiditis, uveitis, iritis, scleritis, episcleritis, keratitis)
· **Eyelid abnormalities that affect lid function** (e.g., entropion, ectropion, tumor, edema, blepharospasm, lagophthalmos, severe trichiasis, severe ptosis)
· **Ocular surface abnormality that may compromise corneal integrity** (e.g., prior chemical burn, recurrent corneal erosion, corneal epithelial defect, Grade 3 corneal fluorescein staining, or map dot fingerprint dystrophy)

PRECAUTIONS

Use of the LipiFlow® System in patients with the conditions described in the LipiFlow® instructions for use may result in reduced treatment effectiveness because these conditions may cause ocular symptoms unrelated to cystic meibomian glands and require other medical management. Safety and effectiveness of the device have not been studied in patients with these conditions.

WARNINGS

Caution: Use carefully. May cause serious burns. Do not use over sensitive skin areas or in the presence of poor circulation. The unattended use of the device by children or incapacitated persons may be dangerous.

ADVERSE EFFECTS

Potential adverse effects that may occur as a result of the procedure include, but are not limited to, the onset or increase in:

· Eyelid/eye pain requiring discontinuation of the treatment procedure;
· Eyelid irritation or inflammation;
· Ocular surface irritation or inflammation; and
· Ocular symptoms (e.g., burning, stinging, tearing, itching, discharge, redness, foreign body sensation, visual disturbance, sensitivity to light).
· Physical pressure-induced injury to the eyelid; and
· Ocular surface (corneal) infection.

ATTENTION Reference the LipiFlow Thermal Pulsation System Instructions for Use for a complete listing of indications, warnings, and precautions.

*Filtering of HEV light by contact lenses has not been demonstrated to confer any health benefit to the user, including but not limited to retinal protection, protection from cataract progression, reduced eye strain, improved contrast, improved acuity, reduced glare, improved low light vision, or improved circadian rhythm/sleep cycle. The Eye Care Professional should be consulted for more information.