Libro de Actas 7ª edición PhDay
Madrid, 6 de octubre de 2023

Programa de Doctorado en Óptica, Optometría y Visión

**FACULTAD DE ÓPTICA
Y OPTOMETRÍA**
UNIVERSIDAD COMPLUTENSE
DE MADRID

Índice

PRÓLOGO

Hemos llegado a la séptima edición de nuestro congreso, el 7° PhDAY-FOO, organizado por y para los doctorandos de la Facultad de Óptica y Optometría de la Universidad Complutense de Madrid. Una iniciativa enriquecedora en la que estos jóvenes científicos podrán presentar sus investigaciones al resto de sus compañeros predoctorales y a toda la comunidad universitaria que desee disfrutar de este evento.

A través de varias sesiones de presentaciones orales y en formato póster, nuestros doctorandos mostrarán la gran diversidad y riqueza de las líneas de investigación incluidas en nuestro programa de doctorado. Se pretende promover el desarrollo de las carreras científicas de los doctorandos, contribuyendo a mejorar sus habilidades de comunicación y facilitando la difusión de su trabajo. Además, el PhDAY constituye un excelente foro para intercambiar nuevas ideas y establecer relaciones y colaboraciones entre grupos de investigación.

Los estudiantes que se han incorporado recientemente al programa no deben faltar a esta jornada al tratarse de una estupenda toma de contacto con la que será su labor académica-investigadora en los próximos años hasta desembocar en la presentación de su tesis doctoral. Igualmente, los doctorandos más veteranos, gracias a su mayor experiencia podrán apreciar el gran trabajo que hay detrás de cada presentación.

Además de los propios estudiantes de doctorado, este evento es especialmente interesante para los Estudiantes de Máster por ser ellos la cantera de futuros doctorandos del multidisciplinar Programa de Doctorado en Óptica, Optometría y Visión. Si eres un estudiante de Máster, en pocos meses te encontrarás con la opción de proseguir tu trayectoria como universitario hasta alcanzar el máximo nivel de estudios y ser Doctor, y esta jornada PhDAY-FOO te puede ayudar a tomar esta decisión.

Profesores, Estudiantes de últimos años de Grado, PAS de la Facultad de Óptica y Optometría son también bienvenidos a este congreso para profundizar en las diversas líneas de investigación vinculadas a nuestro Programa de Doctorado de la mano de sus protagonistas.

Desde el Equipo Decanal de la Facultad de Óptica y Optometría y en particular, como Vicedecana de Posgrado e Investigación y Coordinadora del Programa de Doctorado, quiero agradecer la buena acogida que esta iniciativa ha tenido entre los doctorandos en las diversas ediciones y en especial, en esta 7ª edición (se han inscrito un total de 44 estudiantes, de los cuales 28 serán ponentes). Igualmente, me gustaría agradecer al Comité Organizador (Asmae Igalla El-Youssfi y María Romaguera Planells) toda su dedicación, ilusión y profesionalidad. Sin todos ellos sería imposible el desarrollo de este evento centrado en la difusión científica y el intercambio de experiencias entre los doctorandos.

Ana Isabel Guzmán Aránguez

Coordinadora del programa de doctorado en Óptica, Optometría y Visión
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AGRADECIMIENTOS

El Comité Organizador quisiera agradecer tanto a la Escuela de Doctorado como a la Facultad de Óptica y Optometría de la Universidad Complutense de Madrid, la oportunidad de contribuir a la organización de la 7ª Edición del PhDAY FOO. Ello ha permitido la adquisición de nuevas competencias relacionadas con el desarrollo de eventos de difusión científica.

Queríamos agradecer también a todos los compañeros que han participado, ya sea, como ponentes o como asistentes en esta nueva edición del PhDAY, ya que sin su colaboración y sus aportaciones todo esto no sería posible.

Agradecemos con entusiasmo el apoyo ofrecido por las empresas colaboradoras para llevar a cabo las jornadas PhDAY FOO.

En último lugar, agradecer el esfuerzo de todo el comité científico que ha permitido que todos los trabajos hayan sido valorados de forma objetiva, justa y transparente, dedicando todo su tiempo a evaluar y poder otorgar así los merecidos premios a los participantes.

COLABORADORES

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COMITÉ ORGANIZADOR

Asmae Igalla El-Youssfi

Graduada en Óptica y Optometría y Máster en Tecnologías Ópticas y de la imagen por la Universidad Complutense de Madrid.

María Romaguera Planells

Graduada en Óptica y Optometría por la Universidad de Valencia. Máster en Optometría y Visión por la Universidad Complutense de Madrid.

COMITÉ CIENTÍFICO

Héctor Canabal Boutureira

Licenciado en Física por la Universidad Simón Bolívar (Venezuela) y Doctor en Física por la Universidad Complutense de Madrid con la tesis titulada "Automatización de medidas deflectométricas y su aplicación en la caracterización de lentes oftálmicas". Actualmente es Profesor Ayudante Doctor en la Facultad de Óptica y Optometría de la UCM donde imparte con entusiasmo las asignaturas de Óptica Oftálmica I y II del Grado en Óptica y Optometría y Procesado de Imágenes en el Máster de Tecnologías Ópticas de la Imagen. Forma parte del grupo de investigación Complutense de Óptica Aplicada dedicándose a temas de metrología óptica, procesado de imágenes, visión artificial y *deep learning*.

Pilar Cañadas Suárez

Doctora en Optometría y Visión por la Universidad Complutense de Madrid, Máster en Optometría Clínica por la Universidad Europea, Máster en Investigación y clínica optométrica por Pensilvania College of Optomtery (Philadelphia). Diplomada en Óptica y Optometría por la Universidad de Granada. En la actualidad es profesora contratada doctora e investigadora en la UCM. Su docencia se centra en las asignaturas de Clínica Optométrica, Optometría IV. En la parte investigadora, sus principales líneas de investigación son superficie ocular, microscopía confocal corneal, optometría clínica.

Juan Enrique Cedrún Sánchez

Doctor en Óptica, Optometría y Visión por la Universidad Complutense de Madrid (UCM). Especialista en Baja Visión y Rehabilitación Visual en la Clínica Universitaria de la Facultad de Óptica y Optometría de la UCM. Profesor de Grado e investigador de la UCM. Profesor del Máster Oficial en Optometría y Visión de la UCM. Profesor en Baja Visión del Máster Oficial en Optometría Clínica Hospitalaria de la UCM. Colaborador Honorífico adscrito al IOBA del Máster Oficial en Rehabilitación Visual en Baja Visión de la Universidad de Valladolid. Profesor del curso de Especialización en Capacidades Visuales en Deportistas con Discapacidad y Convencionales (UCM-INEF). Académico Numerario de la Ilustre Academia de Ciencias de la Salud Ramón y Cajal. Miembro de la Sociedad Española de Optometría. Participación en proyectos de investigación financiados, congresos nacionales e internacionales. Numerosas publicaciones científicas y divulgativas en Optometría, Baja Visión y Salud Visual. Director de numerosos trabajos Fin de Grado y Fin de Máster. Actualmente

dirigiendo tres Tesis Doctorales.

Ana Manzanares Ituarte

Doctora en Ciencias Físicas por la Universidad Complutense de Madrid en 2001, donde ejerce como profesora asociada desde 2008, y diseñadora óptica y gerente en Greenlight Solutions desde 2003. Su carrera investigadora se ha centrado en el desarrollo de instrumentación y estudios de plasma-pared, runaways y disrupciones en el contexto de la fusión nuclear por confinamiento magnético, habiendo realizado estancias de investigación y operación del dispositivo JET en Culham Centre for Fusion Energy (Oxfordshire, UK) desde 2009 hasta 2021 y en el experimento ITER en CEA (Cadarache, Francia) desde 2007 hasta 2018.

Francisco Javier Navarro Gil

Doctor en Óptica Optometría y Visión (UCM); Máster en Cirugía Refractiva y Cataratas (UV); Máster en Óptica, Optometría y Visión (UCM); Máster en Optometría Avanzada y Ciencias de la Visión (UV). Con más de 20 años de carrera docente en diferentes Universidades, en la actualidad imparto las asignaturas de Clínica Optométrica I y II y Tratamientos Ópticos en Optometría como profesor asociado del departamento de Optometría y Visión de la UCM y Tecnología Óptica II como profesor colaborador en el Grado de Óptica y Optometría de CUNIMAD. Autor de varias publicaciones científicas indexadas, su carrera investigadora se ha centrado en el área de las alteraciones de la película lagrimal, ojo seco y liberación de sustancias en la superficie ocular mediante lentes de contacto, perteneciendo al grupo de investigación en Bioquímica del Ojo (Ocupharm).

Javier Ruiz Alcocer

Doctor en Optometría y Visión por la Universidad de Valencia desde el año 2012. Como Profesor Contratado Doctor, en la actualidad, imparte su docencia de grado y máster dentro del departamento de Optometría y Visión de la Facultad de Óptica y Optometría de la Universidad Complutense de Madrid. Su actividad investigadora está centrada principalmente en la presbicia.

PONENCIA INVITADA

DESCIFRANDO LA NEUROINFLAMACIÓN Y LA NEURODEGENERACIÓN: MECANISMOS MOLECULARES

En esta charla, la Dra. Laura de Diego García hablará sobre su experiencia como investigadora en la UCM y en el Royal College of Surgeons (Ireland) y comentará aspectos relevantes de su línea de investigación, centrada en el estudio de la neuroinflamación y la neurodegeneración en diferentes enfermedades del sistema nervioso central como el Alzheimer, epilepsia y el glaucoma.
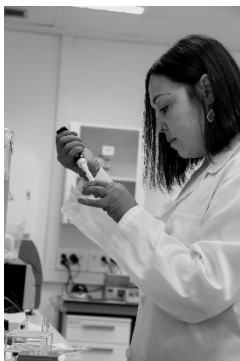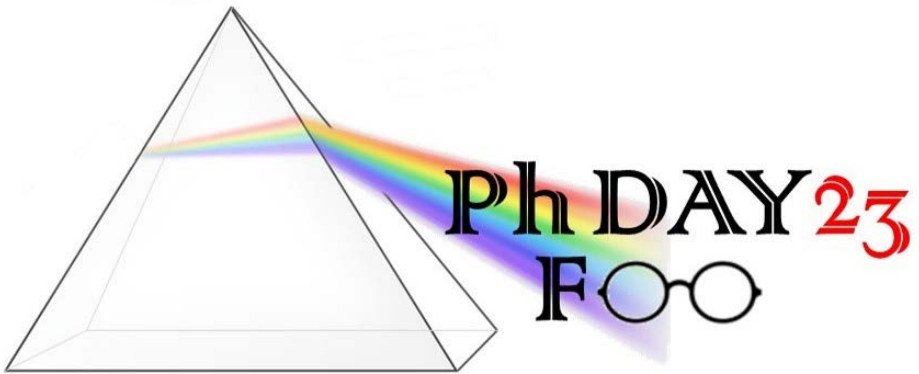

Laura de Diego García es Doctora en Bioquímica, Biología Molecular y Biomedicina (2017), Máster en Optometría y Visión (2012), y Diplomada en Óptica y Optometría (2007) por la Universidad Complutense de Madrid (UCM); Durante 4 años, realizó una estancia postdoctoral en el Royal College of Surgeons in Ireland (2018-2022). Actualmente, es investigadora postdoctoral del Departamento de Optometría y Visión de la Facultad de Óptica y Optometría de la UCM y del grupo de investigación Ocupharm. Su actividad investigadora se centra principalmente en la identificación de los mecanismos moleculares implicados en la fisiopatología del sistema nervioso central y en la búsqueda de nuevos tratamientos para la epilepsia y el glaucoma.

PROGRAMA CIENTÍFICO

7ª Edición PhDAY- FACULTAD DE ÓPTICA Y OPTOMETRÍA 2023

6 de Octubre de 2023

PROGRAMA CIENTÍFICO 7ª Edición PhDAY- FACULTAD DE ÓPTICA Y OPTOMETRÍA 2023	
9:00-9:15 h. INAGURACIÓN	
Vicedecana de Posgrado e Investigación. Coordinadora de Doctorado en Óptica, Optometría y Visión: Ana Isabel Guzmán Aránguez	Salón de Actos
9:15-11:00 h. COMUNICACIONES ORALES. PRIMERA SESIÓN	
Coordinan: Dra. Ana Manzanares Ituarte Dr. Fco. Javier Navarro Gil Dr. Juan Enrique Cedrún	Salón de Actos
Coordinan: Dr. Héctor Canabal Boutureira Dr. Javier Ruiz Alcocer Dra. Pilar Cañadas Suárez	Hiperaula 137
11:00-11:45 h. PAUSA PARA CAFÉ Y SESIÓN DE POSTERS	
Coordinan: Dra. Ana Manzanares Ituarte Dr. Fco. Javier Navarro Gil Dr. Juan Enrique Cedrún Dr. Héctor Canabal Boutureira Dr. Javier Ruiz Alcocer Dra. Pilar Cañadas Suárez	Hall FOO
11:45-13:15 h. COMUNICACIONES ORALES. SEGUNDA SESIÓN	
Coordinan: Dr. Héctor Canabal Boutureira Dr. Javier Ruiz Alcocer Dra. Pilar Cañadas Suárez	Salón de Actos
Coordinan: Dra. Ana Manzanares Ituarte Dr. Fco. Javier Navarro Gil Dr. Juan Enrique Cedrún	Hiperaula 137
13:15-14:00 h. CONFERENCIA INVITADA	
Dra. Laura de Diego García	Salón de Actos
14:00 h. Entrega de Premios y Clausura	

DESGLOSE DEL PROGRAMA

9:00-9:15 h. Inauguración PhDAY 2023

SALÓN DE ACTOS

Vicedecana de Posgrado e Investigación. Coordinadora de Doctorado en Óptica, Optometría y Visión: Ana Isabel Guzmán Aránguez

9:15-11:00 h. Comunicaciones orales. Primera sesión

SALÓN DE ACTOS

Coordinan: Dra. Ana Manzanares Ituarte, Dr. Fco. Javier Navarro Gil, Dr. Juan Enrique Cedrún.

- Device for recording light exposure in humans. **Iván Kopaitic Otero.**
- Analysis of the effects of different intraocular lenses on visual quality under different illumination conditions. **Inas Baoud Ould Haddi**.
- Color Encription Desktop Servereles Application: Uses Cases. **Sara Ignacio Cerrato**.
- Myopia prevalence in Children in Spain in 2020. **Ana Isabel González Abad.**
- pH measurements with Fiber Optic Gratings for *in-situ* planetary exploration. **Patricia Mesonero Santos.**
- Characterization of the meibomian glands in patients with allergic conjunctivitis and its relationship with histaminase. **Jimmy Fernando Reyes Domínguez** *(online)*.*
- Effect of the elasticity module of soft contact lenses on the morphology and function of the meibomian glands. **Jorge Giovanni Vargas Velasco** *(online)*.*

*Ponencias online Sala de Actos: https://meet.google.com/bcg-smef-soz?authuser=0

HIPERAULA 137

Coordinan: Dr. Héctor Canabal Boutureira, Dr. Javier Ruiz Alcocer, Dra. Pilar Cañadas Suárez

- Therapeutic potential of topical administration of siRNAs against HIF-1α for corneal neovascularization. **Carmen O. Domínguez-Godínez.**
- Design and Characterization of a Diffraction Grating in the Terahertz Frequency Range. **Gonzalo García Lozano.**
- The temporal course of contrast sensitivity recovery following a bleach measured under photopic and mesopic luminance conditions in healthy adults. **Melisa Remis González**.
- Form-deprivation myopia induction to assess purinergic signaling on rabbit posterior pole. **Gonzalo Valdes-Soria.**

- Study of two different devices used to measure the contact lens central thickness. **Alicia López-Raso.**
- Effect of the use of artificial tears on the tear film and the conjunctive for different fixation requirements, in healthy young adults - Results of the investigation. **Jairo Giovanni Rojas Yepes** *(online)*.*
- Rasch Analysis in Patient-reported Outcomes Instruments Construction. **Elsa Albero Ros** *(online)*

*Ponencias online Hiperaula 137: https://meet.google.com/igb-bhyw-bot

11:00-11:45 h. Pausa para café y Sesión de Posters

Hall FOO

Coordinan: Dra. Ana Manzanares Ituarte, Dr. Fco. Javier Navarro Gil, Dr. Juan Enrique Cedrún, Dr. Héctor Canabal Boutureira, Dr. Javier Ruiz Alcocer y Dra. Pilar Cañadas Suárez.

- Evaluation of the light-adapted response of the full-field electroretinogram in high myopia. **David Blanco Darriba.**
- Central Nervous System Regeneration: Towards axonal guidance using biofunctionalized silk fibroin fibers as scaffold. **Cristina Castro Domínguez.**
- Effect of violet radiation on the visual system: animal experimentation. **Mª Teresa Domínguez Valdés.**
- Correlation between lens vault and lens rise among myopic andhyperopic population. **Jorge Donís de la Torre.**
- Contrast study of the Meibomian glands. **Elena Fernández Jiménez.**
- Adverse Effects of Tamoxifen on the Anterior Ocular Pole. **Merire Dayan Flores Cervantes.**
- Eye movements in visual search tasks in people with central vision loss. **Leonela González Vides.**
- Characterization of Spectral Response Function Using the Slanted-Edge Method. **Óscar Gutiérrez de la Cámara Ara.**
- Validity of tests used for the diagnosis of Accommodative Excess. **Esther Mármol Errasti.**
- RapiDA V1: Repeatability. **Belén Martínez Álvarez.**
- Framework for evaluation of procedures for hdr luminance imaging measurements. **Ángela María Sáez Gutiérrez.**
- Influence of eye movements on academic performance: A bibliometric and citation network analysis. **Adrián Salgado Fernández.**
- Cone mediated dark adaptation: Developing a new test. **Beatriz Sánchez Gavilán.**
- BTDF measurement of "thick" samples. **Pablo Santafé Gabarda.**
- Involvement of the purinergic system in corneal healing and corneal permeability in a porcine *ex vivo* model. **Laura Ximena Sierra Buitrago.**
- Effect of Age on Ocular Biometry in an African Population. **Mame Diatou Toure Sarr.**

11:45-13:15 h. Comunicaciones orales. Segunda sesión

SALÓN DE ACTOS

Coordinan: Dr. Héctor Canabal Boutureira, Dr. Javier Ruiz Alcocer, Dra. Pilar Cañadas Suárez.

- Impact of several hydrophobic monomers on the properties of hydrogels contact lenses**. Clara Lim**.
- Sports visual analysis in UEFA referees. **Carlos Ramos Athane.**
- The relationship between diameter and vascular tortuosity in healthy retinas, diabetic retinopathy and glaucoma. **Asmae Igalla El Youssfi.**
- Optical and aberrometric evaluation of a new enhanced monofocal intraocular lens with isofocal optic design. **Lidia María Pérez Sanz.**
- Development of e-Health technologies for Big Data Analysis: application to blink dynamics. **Youssef Marrakchi Chikri.**
- Halo quantification in different soft contact lenses for myopia control- **Julia Bodas Romero** *(online).*
- Advances in Blink Dynamics: Age-Related Changes. **Darshan Ramasubramanian** (*online).*

*Ponencias online Salón de Actos: https://meet.google.com/bcg-smef-soz?authuser=0

HIPERAULA 137

Coordinan: Dra. Ana Manzanares Ituarte, Dr. Fco. Javier Navarro Gil, Dr. Juan Enrique Cedrún.

- Light diffusion models in aerosols. **Jaime Quintana Benito.**
- Functional and Structural Retinal Changes in Swiss Mice. **Jose Antonio Matamoros.**
- Evaluation of retinal vasculature by OCT Angiography in type II diabetes. **Nadia Mínguez Caro.**
- Design of Optical Instrumentation for Space Applications. **Carmen Vázquez Pérez.**
- Two-year myopia management efficacy of extended depth of focus soft contact lenses (MYLO) in Caucasian children. **Sergio Díaz Gómez.**
- Molecular and clinical characterization of ocular Surface from patients of glaucoma. **Sandra Carolina Durán Cristiano.**
- Temperature and strain measurement in opto-mechanical structures. **Ana Fernández-Medina Maeso.**

13:15-14:00 h. Conferencia invitada

<u>**SALÓN DE ACTOS**</u>

"Descifrando la neuroinflamación y la neurodegeneración: Mecanismos moleculares".
Dra. Laura de Diego García.

14:00 h. Entrega de Premios y Clausura

<u>**SALÓN DE ACTOS**</u>

PONENCIAS ORALES

Elsa Albero Ros

Inas Baoud Ould Hadd

Julia Bodas Romero

Sergio Díaz Gómez

Carmen O. Domínguez-Godínez

Sandra Carolina Durán Cristiano

Ana Fernández-Medina Maeso

Gonzalo García Lozano

Ana Isabel González Abad

Asmae Igalla El Youssfi

Sara Ignacio Cerrato

Iván Kopaitic Otero

Clara Lim

Alicia López Raso

Youssef Marrakchi Chikri

José Antonio Matamoros Felipe

Patricia Mesonero Santos

Nadia Mínguez Caro

Lidia María Pérez Sanz

Jaime Quintana Benito

Darshan Ramasubramanian

Carlos Ramos Athane

Melisa Remis González

Jimmy Fernando Reyes Domínguez

Jairo Giovanni Rojas Yepes

Gonzalo Valdés Soria

Jorge Giovanni Vargas Velasco

Carmen Vázquez Pérez

Rasch Analysis in Patient-reported Outcomes Instruments Construction

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Purpose: The psychometric properties of a patient-reported outcomes (PRO) instruments are the key points to investigate their validity and reliability [1]. To assess this, the use of Rasch measurement theory is the gold standard. Being a model of item response theory (IRT), Rasch analysis can determine a subject's probability of choosing a particular response to an item, as a function of its ability and the difficulty of the item [1]. In contrast to classical measurement test theories, where individual's scores are essentially a mathematical sum of the unprocessed rank values associated with a response category across all items. Assuming uniform step sizes along the measurement scale and equivalent item difficulties [1]. Hence, the purpose of this communication is to give an insight into the application of Rasch analysis in the selection of items for PRO instruments construction.

Methods: The process of developing and validating PRO instruments must take into consideration the following components: (1) category threshold order, the degree to which the categories employed for rating items are selected in a coherent sequence and evenly distributed, analyzing the distance between thresholds and categories with the help of item characteristic curves (ICC); (2) Item fit characteristics, the infit and outfit of items is reviewed to assure that the items in the instrument fit with the Rasch model; (3) targeting, difference between item and participant's mean reveals if item difficulty matches with the level of participants' abilities; (4) measurement precision, person separation index highlights if an instrument effectively discerns between different levels of participants' abilities; (5) dimensionality, the extent to which the instrument measures a single underlying construct can be assessed by examining the proportion of raw variance explained by the measure and the eigenvalue of the unexplained variance in the first contrast; and (6) differential item functioning (DIF), the response abilities of distinct subgroups within the same study population exhibit variations in relation to an item. To achieve a Rasch analysis it will be necessary to use a specific software. In this study we will be using WINDSTEPS (Version 5.6.0, 2023), a program that allows to work through the partial credit model, one of the variants of Rasch analysis for polytomous items.

Results: To guarantee that a PRO instrument consists of the fewest items necessary to provide reliable and valid measure the analysis must meet the following quality criteria: (1) response categories must be ordered, average difficulty values   should progress monotonically along the scale and the category steps should be spaced (1.4-5.0 logits); (2) infit   and/or   outfit between 0.7-1.3 logits; (3) difference between item and participant's mean less

than 1 logit; (4) person separation index equal or superior to 2 logits; (5) value of first contrast less than 2 logits; and (6) all items must show a DIF inferior to 0.5 logits.

Conclusion: The application of Rasch analysis helps to ensure that PRO instruments follow a criterion that guaranties validity, reliability, and repeatability.

Keywords: Patient-reported Outcomes instruments, Rasch Analysis, Item response theory, questionnaires.

References

[1] Khadka, J., McAlinden, C., & Pesudovs, K. (). Quality assessment of ophthalmic questionnaires: review and recommendations. *Optometry and Vision Science*. 2013; *90*(8): 720-744.

Analysis of the effects of different intraocular lenses on visual quality under different illumination conditions.

Inas Baoud Ould Haddi[1], Vanesa Blázquez Sánchez[1], Cristina Bonnin Arias[1].
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Purpose: Cataract surgery patients are facing increasingly higher visual demands that necessitate excellent vision at all distances. This is especially critical at intermediate distances due to the growing adoption of new technologies and continuous screen-related tasks.[1,2] The purpose of this study is to compare the effects on visual quality in patients undergoing cataract surgery with different types of extended depth of focus lenses: PhysiOL® IsoPure 123™ (BVI Medical/PhysIOL, Liége, Belgium), Tecnis® Eyhance™ (Johnson & Johnson Surgical Vision, Inc., Santa Ana, CA), and AcrySof® IQ Vivity™ (Alcon Laboratories, Inc., Fort Worth, TX), while subjecting them to different illumination conditions (photopic or mesopic).

Methods: This was an observational, prospective, cross-sectional study conducted in accordance with the principles of the Declaration of Helsinki. All surgeries were performed by the same experienced surgeon (E.D.R) at the Hospital Universitario Sanitas la Moraleja in Madrid. The sample included 23 patients who underwent cataract surgery or lensectomy, with bilateral implantation of one of the three intraocular lenses (IOL) under study: 16 eyes with PhysiOL® IsoPure123™, 14 eyes with Tecnis® Eyhance™ IOL, and 16 eyes with AcrySof® IQ Vivity™. Patients were reviewed 30 days after surgery, and various visual assessments were conducted, including binocular photopic (≥ 85 cd/m^2) and mesopic (≤ 5 cd/m^2) visual acuity (VA) at three distances: far (4 m), intermediate (66 cm), and near (40 cm) using the logMar scale with the ETDRS test. Contrast sensitivity was measured with the CSV-1000 test at 2.5 meters for four spatial frequencies (3, 6, 12, and 18 cycles per degree). Halo perception was assessed with Halo V1.0 software, and quality of life was evaluated using the VFQ-14 questionnaire. Statistical significance was set at a p-value <0.05.

Results: The analysis of VA (LogMar) under photopic conditions showed no significant differences between the Tecnis® Eyhance™, AcrySof® IQ Vivity™, and PhysiOL® IsoPure123™ IOLs for far distance (-0.10±0.08), (-0.14±0.07), (-0.11±0.09) respectively, for intermediate (0.11±0.07), (0.05±0.04), (0.13±0.05) respectively, and for near (0.09±0.05), (0.08±0.06), (0.11±0.07) respectively. Similarly, no statistically significant differences were found in mesopic conditions for far (0.04±0.12), (-0.02±0.11), (0.05±0.09) and near (0.40±0.15) and (0.42±0.12) distances. However, significant differences were observed for binocular VA at intermediate distance without correction (UIVA), with a p-value of 0.017 between Tecnis® Eyhance™ and AcrySof® IQ Vivity™ and a p-value of 0.001 between AcrySof® IQ Vivity™ and

PhysiOL® IsoPure123™. The means were (0.32±0.09), (0.52±0.14), and (0.45±0.12) for AcrySof® IQ Vivity™, PhysiOL® IsoPure123™, and Tecnis® Eyhance™, respectively. Furthermore, there were no significant differences in the subjective perception of patients' quality of life when comparing the responses of wearers of both lenses, nor in terms of contrast sensitivity

Conclusions: The intraocular lenses AcrySof® IQ Vivity™, Tecnis® Eyhance™, and PhysiOL® IsoPure123TM provide similar visual outcomes for near and far vision in binocular vision under different lighting conditions. The extended-range design of AcrySof® IQ Vivity™ lenses enhances intermediate vision without adversely affecting contrast sensitivity.

Keywords: Extended depth of focus, Intraocular lenses, visual quality.

References
[1] Kanclerz P, Toto F, Grzybowski A, Alio JL. Extended Depth-of-Field Intraocular Lenses: An Update. Asia Pac J Ophthalmol (Phila). 2020;9(3):194-202.
[2] Mencucci R, Morelli A, Cennamo M, Roszkowska AM, Favuzza E. Enhanced Monofocal Intraocular Lenses: A Retrospective, Comparative Study between Three Different Models. J Clin Med. 2023;12(10):3588. Published 2023 May 21.

Halo quantification in different soft contact lenses for myopia control

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Purpose: There are currently different studies that discuss the efficacy of soft contact lenses for myopia control, but there are no studies that compare the visual quality provided by soft contact lenses.(1, 2) The purpose of this study is to compare the halo size and position with different soft contact lenses for myopia control.

Methods: A study was conducted with 18 participants (15 females and 3 males) with a mean age of 23.72 ± 2.14 years. Participants had myopia between -0.50D and -6.00D with astigmatism no more than -0.75D. The tests were performed at the Optometry Clinic of the Faculty of Optics and Optometry.

A total of 8 soft contact lenses for myopia control were evaluated, which were classified into 3 different designs: dual focus, extended depth of focus (EDOF) and multifocal design.

Under scotopic conditions, the participant was placed 2 metres away from the instrument (Light Disturbance Analyzer, Binarytarget Lda. Braga, Portugal), in a monocular way. The instrument displays a central 5 mm LED light, and 240 1 mm LED lights peripherally, distributed in 24 meridians. In this study, only 12 meridians were evaluated.During the test, the central light is always turned on. The test consisted of to identify a peripheral stimulus around a central LED stimulus.

Results: Two main halo parameters were analysed, the size and direction of the halo. For this study, both eyes were analysed, but no statistically significant differences were found between the two eyes, so only the right eyes have been chosen for this communication.

The lens design with the largest halo size was a high addition multifocal design with 16.04 ± 8.52 mm radius. However, the lens with the smallest halo size was also a low addition multifocal design, with a halo size of 3.42 ± 1.41 mm.

In relation to the results of the position of the halos, the lens that showed the greatest deviation was a high addition multifocal design lens, with a horizontal offset of 2.80 ± 1.75 mm, while the lens that showed the greatest centering was an EDOF design lens, with an offset of 0.02 ± 0.32 mm.

Conclusions: All of the myopia control designs evaluated in this study created a halo size larger than the participants habitual correction. The size of the halo is related to the addition of the lens, not just the design. Further studies are needed to analyse the relationship between these parameters.

Keywords: Myopia control, contact lenses, halo

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Two-year myopia management efficacy of extended depth of focus soft contact lenses (MYLO) in Caucasian children

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Purpose: To assess the efficacy in managing the growth of myopia in children of the new Mylo® contact lens design (Mark´Ennovy, Spain) based on the extended depth of focus (EDOF) at two years of follow-up.

Methods: Longitudinal prospective study conducted at the Integral Ophthalmology Clinic in Bilbao, Spain. 90 children between 6-13 years old with myopia between -0.75 and -10.00D sphere and cylinder <0.75D cylinder took part. Forty-five children were assigned to the experimental group fitted with EDOF contact lenses and 45 to the control group who wore spectacles. Measurements of VA, subjective refraction, axial length (IOL Master 700 Biometer, Zeiss, Germany) and cycloplegic Auto-Refraction (OPD Scan III, Nidek, Japan) were taken at pre,6,12,18 and 24 months.
The SPSS 28 software (SPSS Inc, USA) was used to analyze the data. The normality of the variables was verified with the Kolmogorov-Smirnov test. Measured repeated ANOVA was performed to compare the obtained results at different times. Student's t test was used for normal samples or the Wilcoxon test otherwise. The significance level was set at 0.05.

Results: All participants completed the study at 2 years. In the experimental group (20 males, 25 females) the age of onset was 10.9 ± 1.6 years and the equivalent spherical was -2.80 ± 1.81D. In the control group (19 males, 26 females) the age was 11.2 ± 1.1 years and the spherical equivalent -2.69 ± 0.99D. After 2 years of follow-up, there was a statistically significant difference in the evolution of myopia between the experimental and control groups (0.62 vs. 1.13D respectively, $p < 0.001$). In addition, there was less axial elongation in the contact lens group compared to the control (0.37mm vs. 0.66mm respectively, $p < 0.001$). Comparing both groups, the efficiency in the refractive change was 45%, while in the axial length change it was 44%.

Conclusions: The use of the EDOF contact lens in myopic children reduced the progression of refractive value and axial elongation compared to the group wearing spectacles.

Keywords: soft contact lenses; extended depth of focus; Myopia management.

Therapeutic potential of topical administration of siRNAs against HIF-1α for corneal neovascularization

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Purpose: Given the implications of the problem of neovascularization on ocular health, as well as the growth in the number of cases, the purpose of the present study has been testing the efficacy of siRNAs (small interfering RNA) designed to silence Hypoxia Inducible Factor -1α (HIF-1α) and to demonstrate that their use stops neovascularization in a model of corneal burn.

Methods: Corneal wounds in the limbic zone were made in the eyes of New Zealand white rabbits. Topical applications of siRNAs were done the next day to the wound for four consecutive days and eyes were examined with a slit lamp. Evaluation of neovascularization progress was done by analyzing images by ImageJTM and to determine the neovascular area in Matlab ® was used. At the same time, a rabbit corneal cell line was used for in vitro study of hypoxia exposure and Western blot analysis of the cell's extracts were done.

Results: Under normal cell culture oxygenation, the expression of HIF-1α was lower than that observed under hypoxic conditions. After 2 h of hypoxia, there was a significant increase in the HIF-1α expression, effect that was maintained up to 6 h. The increased in HIF-1α was mimicked by a cell permeable prolyl4-hydroxylase inhibitor. Cobalt chloride showed no capacity to increase HIF-1α in vitro. The effect of three different siRNA on HIF-1α was tested after 4 h of hypoxia. siRNA#1 was able to silence 80% of HIF-1α expression, siRNA#2 and siRNA#3 reduce the expression in 45% and 40% respectively.

Conclusion: In addition, the three siRNA were tested in a corneal model of neovascularization. scrambledsiRNA#2 was the most effective inhibitor of blood vessel production, followed by siRNA#3 and siRNA#1. Compared to the scrambled siRNA (100% of blood vessel generation), siRNA#2 blocked the presence of blood vessels by 83 ± 2%, siRNA#3 inhibited 45 ± 7% and siRNA#1 only inhibited 18 ± 5%.

In conclusion, the topical application of siRNA towards HIF-1α seems to be an effective and reliable method to stop neovascularization.

Keywords: SIRNA; Neovascularization;cornea

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Molecular and clinical characterization of ocular Surface from patients of glaucoma

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Introduction: Glaucoma is a neurodegenerative disease, of great clinical interest, being the second cause of blindness worldwide [1]. The pharmacotherapeutic intervention for treatment is antiglaucoma drugs, which aim to reduce intraocular pressure [2]. However, some excipients of these medications induce alterations in the ocular surface, inducing dry eye disease [3].

Purpose: The present study aims to characterize at a clinical and molecular level the state of the ocular surface in patients with primary open-angle glaucoma.

Methods: A prospective observational cross-sectional study will be carried out with a descriptive and correlational scope. 50 individuals with a diagnosis of primary open-angle glaucoma and 50 controls will be included, who will undergo ocular surface tests such as ocular redness, NIKBUT, meniscometry, meibomian gland evaluation, and fluorescein staining using the Keratograph. Finally, a conjunctival tissue sample will be taken from impression cytology, a part of the sample will be used to evaluate the degree of squamous cell metaplasia and the other for transcriptomic analysis and its subsequent analysis in gene ontology. Descriptive statistics will be performed and percentages, mean and standard deviation of the data will be presented. In addition, analytical statistics are applied to establish the evaluation between the different tests. Regarding the RNAseq analysis, some R packages will be used to define the differentially expressed genes.

Expected results: The state of the ocular surface will be defined and from this, it will be established which structures of the ocular surface are affected after the use of antiglaucoma drugs. In addition, it will be established if there is a relationship between the duration of the treatment and the modifications found on the surface.

Keywords: glaucoma, ocular surface, conjunctiva, antiglaucoma drugs, transcriptomic.

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Temperature and strain measurement in opto-mechanical structures

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Purpose: The current work is an application tailored to space optical instrumentation consisting of measuring temperature and strain using embedded Fiber Bragg Gratings (FBGs) in a Carbon Fiber Reinforced Polymer (CFRP) optical bench. Temperature and strain sensors based on FBGs have been embedded in the top skin of an optical bench to carry out a proof of concept.

Methods: The optical bench has been verified in a thermal-vacuum test, consisting of three thermal cycles with stabilization steps at 100 ˚C, 60 ˚C, 20 ˚C and -20 ˚C. Six FBG have been embedded in the upper skin of the optical bench. Two sets of six thermocouples, main and redundant, have been located close to each temperature sensor for calibration purposes. The embedded strain FBG sensors consist of an array of seven FBGs with wavelength between 1520 nm and 1550 nm, spaced at 5 nm. For redundancy and intercomparison, a surface-mounted sensor array has been glued to the top skin of the optical bench. The FBG sensors were read by a Si255 LUNA Hyperion optical interrogator. Peak wavelength detection has been performed in two different and complementary ways: the peak wavelength of each FBG was monitored by the LUNA Peak Detection application and the spectral response of the FBGs of each channel was recorded every thirty minutes with the peak wavelength obtained using a tailored MATLAB algorithm.

Results: Figure 1 and Table 1 summarize the main results obtained. The figure is an intercomparison of the measurements of the FBG temperature sensors and the thermocouples while the table is a comparison between the strain measured by the embedded and surface-mounted FBG strain sensors.
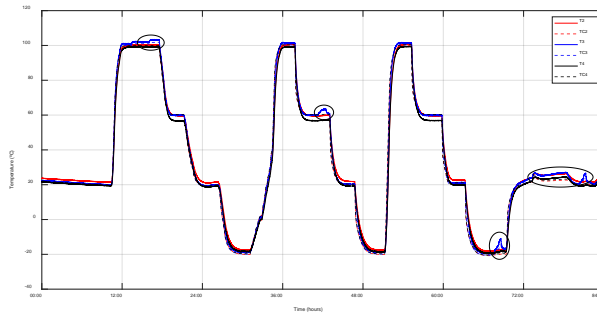
Figure 1. Temperature evolution from 100 ˚C to -20 ˚C; T2, T3 and T4 are FBG temperature sensors and TC2, TC3 and TC4 are the thermocouples. (1)

Sensor	Temperature (˚C)	Surface (µε)	Embedded (µε)	Difference (µε)
S1	100	0±8	0±6	0±10
	60	-7±3	-48±12	-41±15
	20	-25±10	-30±34	-5±44
S2	100	0±9	0±8	0±17
	60	-44±10	-6±45	38±55
S3	100	0±6	0±9	0±15
	60	4±20	-13±17	-17±37
S4	100	0±5	0±9	0±10
	60	0±13	-20±23	-20±36

Table 1. Comparison between the results of embedded and surface mounted strain sensors S1. S2, S3 and S4. (1)

Conclusions: The temperature measurements using FBG sensors and thermocouples have been correlated with good agreement. The optical bench strain has been measured, indicating that embedded strain sensors offer better solutions for monitoring optical bench strain for optical instruments than surface-mounted ones.

Keywords: Carbon Fiber Reinforce Polymer, Embedded Fiber Bragg Gratings, temperature measurement, strain measurement.

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Design and Characterization of a Diffraction Grating in the Terahertz Frequency Range

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Purpose: The development of new far-infrared spectrometers will play a significant role in future space missions, providing enhanced insights into the universe [1].

An optimized reflection diffraction grating with a saw-tooth profile has been designed and manufactured to achieve maximum efficiency within the 70 to 114-micron range.

The challenge lies in the difficulty of producing profiles at these dimensions and the scarcity of efficient instrumentation within this range, representing a technological challenge in the manufacturing and characterization of this grating.

Methods: Two commercial software packages were employed for the design and optimization of the grating profile, one based on the rigorous solution of Maxwell's equations (Rigorous Coupled-Wave Analysis, RCWA) [2] and another based on the Finite Element Method (FEM).

Two diffraction gratings were manufactured to evaluate the manufacturing capacity for this type of profile: micro-structuring with a 5-axis femtosecond laser and traditional micromachining technique using milling tools. Each fabrication method introduces defects, which could impact on the grating diffraction efficiency.

Characterization of the grating's geometry was conducted by measuring nine distinct areas of the diffraction grating using a confocal microscope. Relative grating efficiency measurements [3] were performed using a setup where the emission from a quantum cascade laser was diffracted by the grating, and this energy was subsequently collected by a pyroelectric detector.

Results: An optimized diffraction grating in the Terahertz range has been designed, achieving an efficiency exceeding 70% across the entire spectral range, as validated through two distinct simulation methods. The FEM method predicts efficiencies higher than those of the RCWA.

The gratings have been fabricated using two different methods. Data obtained through confocal microscopy demonstrates that, despite defects introduced during the manufacturing of the gratings, both manufacturing processes able to reproduce the grating profile within specifications, with the laser fabrication method being the most accurate.

Experimental measurements of both gratings show efficiencies close to those predicted by commercial software, satisfying the design requirements.

Conclusion: A diffraction grating in the terahertz range has been designed and optimized, manufactured using two different methods, and the diffraction efficiency of both gratings has been measured. Experimental results demonstrate that both gratings meet the specifications outlined in the design.

Keywords: Diffraction Grating, Terahertz, Far-Infrared Spectrometers.

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Myopia prevalence in Children in Spain in 2020

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Purpose: This study aims to update the prevalence rates of myopia in Spain in 2020 in children between 5 and 7 years old and analyze the risk and prevention factors of myopia.

Methods: Epidemiological and cross-sectional study in a population of children between 5 and 7 years old. All the children participated in the "School campaign in favour of children´s visual health" carried out by the Alain Afflelou Foundation. The data was collected through the Alain Afflelou opticians in different autonomous communities of Spain. Children's parents read the information sheet and signed the informed consent form before the data collection had begun. The children underwent an optometric examination and the parents filled out a questionnaire about the children´s lifestyle and family ocular health history. To determine the refractive error in children, the criterion of the spherical equivalent (SE) was used. Within myopia, a subdivision of the degree of myopia was made, according to the classification of the American Academy of Optometry [1]. The number of hours per day exposed to sunlight was collected and classified according to the Clinical Myopia Profile recommendations [2] The statistical analysis was carried out using SPSS 27.0 software (SPSS Inc., Chicago, Illinois).The prevalence was calculated with a 95% confidence interval and to assess statistical significance, a cut-off point of $p \leq 0.05$ was considered.

Results: In 2020, the prevalence of myopia in children was 20.1%. It was found that between 2019 and 2020, the myopia rate did not change ($p > 0.05$; CI: 0.80-0.83). The myopia rate increased significantly with age ($p \leq 0.001$) being lower in younger children.

The time spent in near vision and the use of digital devices increased with age ($p \leq 0.001$).There was an association between the time spent in near vision and the use of digital devices with in increased myopia prevalence. (OR: 0.87, CI: 0.85-0.90; $p \leq 0.001$). Regarding time outdoors, the longer the time of exposure to sunlight, the lower rates of myopia ($p \leq 0.001$)

Conclusions: The myopia prevalence in Spain children aged between 5 and 7 years reached the 20% in 2020. In addition, a tendency to myopization was found in children spending more time in near vision and with the use of electronic devices. The prevalence of myopia decreased for longer sunlight exposure.

Keywords: myopia; children; prevalence.

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The relationship between diameter and vascular tortuosity in healthy retinas, diabetic retinopathy and glaucoma

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Purpose: The main objectives of this work are to study the influence of retinal image resolution on the measurement of two vascular parameters: diameter and tortuosity, in healthy retinas, diabetic retinopathy and glaucoma, and to establish relationships between both parameters.

Methods: A base of 45 retinal images classified into healthy retinas [1], diabetic retinopathy (DR) and glaucoma (15 images in each group), taken with the same retinograph CANON CF–60 UVi and with the same size (3504 x 2336 pixels), has been used in this study to analyze the diameter and tortuosity of the vessel of each retina. Four different sampling factors (Original, 0.75, 0.5 and 0.25) were applied to these images to study the influence of image resolution on the measurement of both parameters in different groups of retinas. A MATLAB algorithm called ARIA is used to measure the diameters and tortuosity (Arc-Chord) of each vessel detected in the retinal images for different resolutions [2]. Then, the joint probability distribution of the diameters and tortuosity is calculated and their correlations between the different groups are analyzed.

Results: The joint probability density of diameters and tortuosity changes between healthy and glaucomatous retinas, exhibiting a decrease in vessels with both low and high diameters, as well as highly tortuous vessels. These changes are more pronounced at higher resolutions and less noticeable at lower resolutions. In the case of diabetic retinopathy, the results revealed an increase in vessels with small and tortuous diameters at higher resolutions, gradually decreasing as the resolution decreases. Likewise, the results showed the presence of negative correlations between vessel diameter and tortuosity that vary with image resolution; therefore, the percentage of retinas exhibiting significant correlation ($p < 0.05$) also changes between the group of healthy and pathological retinas. Example of the results obtained from the diameter-tortuosity analysis in healthy and pathological retinas in high resolution images shown in Figure 1.

Conclusions: The impact of image resolution on both diameter measurement and retinal vascular tortuosity has been substantiated. Furthermore, a correlation between vessel diameters and tortuosity has been observed in both healthy and pathological retinas (higher in glaucoma than DR).
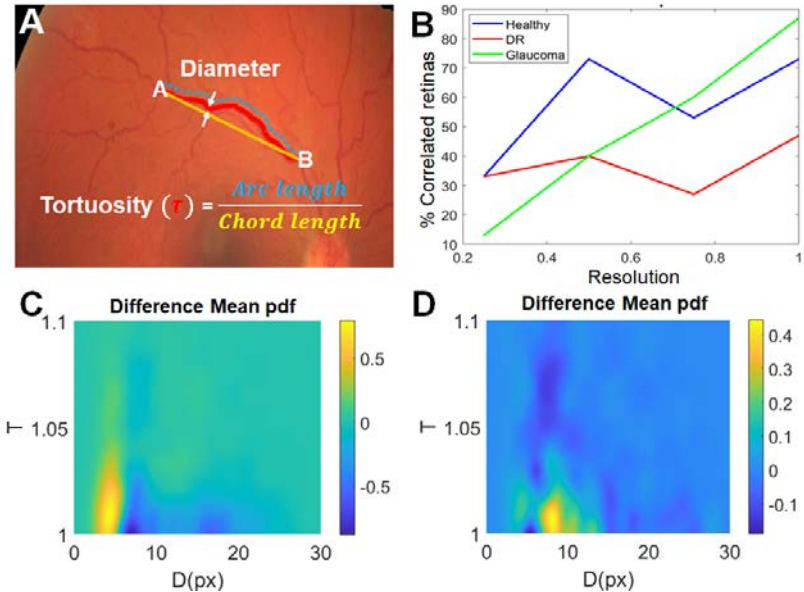
Figure 1. A) shows the relationship between diameter and retinal vascular tortuosity. B) % of retinas with significant correlation (Spearman correlation vs resolution). C) Representation of the difference mean probability distributions of the diameters and tortuosity of the retinal vessels, difference between healthy retinas and DR, D) difference between healthy retinas and glaucoma.

Keywords: Diameter, Tortuosity, Correlation.

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Color Encription Servereles Application: Uses Cases

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Purpose: In today's information-driven age, safeguarding data transmission is critical, particularly in projects like EyE [2], which analyzes space images to predict COVID-19's impact. This paper suggests an inventive approach using colored QR codes for secure and efficient data encryption and transmission in a serverless [1] desktop plataform, offering improved security and efficiency.

Methods: Our approach leverages OpenCV to create high capacity colored QR codes, achieved by combining red, green, and blue channels. We've implemented encryption where each color value signifies specific data, ensuring security even if intercepted. We determine the color composition with a specific αs value and RGB values as depicted in Equation 1:

$$\square = \square\square\ \square\ \square\ +\ \square\square\ \square\ \square +\ \square\square\ \square\ \square\ (1)$$
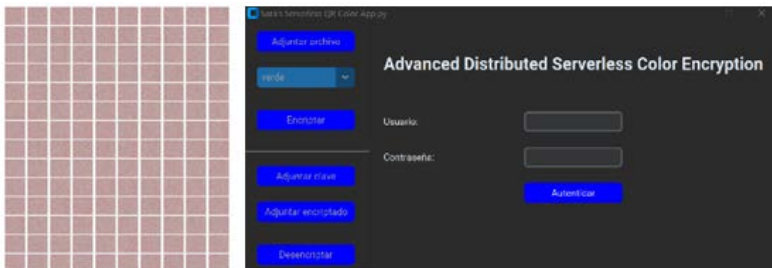
Results:

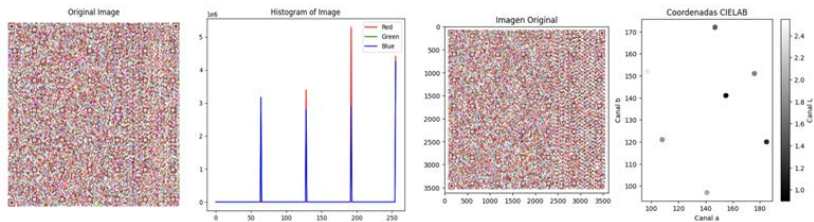Figure 1: (Right)QR obtained from the application. (Left) Application.

Figure 2: Histogram and CIELab coordinates from the QR codes.

Figure 1 shows the results obtained from the Equation 1 to combine the QR codes. Figure 2 shows the results from analysing the colorimetric parameters. Both shows a periodic color.

Conclusions: This research has shown a new paradigm to encrypt data. It has been analysed colorymetric in order to know its main characteristics. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No.101007638.

Keywords: Encryption, QR codes, serverless.

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Device for recording light exposure in humans

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Purpose: the current research aims to conduct a field study to define the degree of chronodisruption of the different factors that make up the light history (light exposure, in intensity, quality and time) and how this history may or may not be determinant in studies that analyze the effects of inhibition of melatonin secretion produced by ocular light exposure [1][2].

In a first stage and what is presented in this summary, is to have a device that allows monitoring the light history to which individuals are subject. The designed equipment must measure the illuminance and the emission spectrum in a plane parallel to the user's face, also store the measured information and record the day and time of data collection, be autonomous and portable.

Methods: for the design and manufacture of the device, an Arduino Pro Mini 3.3V and the AS7341 spectral sensor were used as a light measurement device. The spectral response of the sensor covers approximately 350 nm to 1000 nm with 8 channels centered in the visible spectrum, one in the near infrared and one general channel covering the entire spectrum. It incorporated a voltage regulator, an I2C clock module, a microSD card reading module and a 3.7 V / 1000 mA / h battery. Finally, an optical diffuser model "KIMOTO 100 PBU" that uses a double-sided diffusion coating with a Haze of 89.5% and a transmission of 66%.

A calibration process of the device was carried out in the laboratory, using an optical table, a light source calibrated in luminous intensity, a lux meter and a spectroradiometer as reference instruments for comparison. The device was tested in real conditions and in autonomous operation. These tests were performed over a 4-hour period, setting the sensor to take measurements every five minutes.

Results: the results obtained in the laboratory can be seen in Figure 1.1. For illuminances it is concluded that there is an almost perfect relationship between the reference luxmeter and the manufactured device, with a correlation coefficient (r) of 0.996. Additionally, a general correction factor for illuminances of 0.2996 was determined, which allows an average error of 4% to be obtained in a range between 0 and 600 lx.
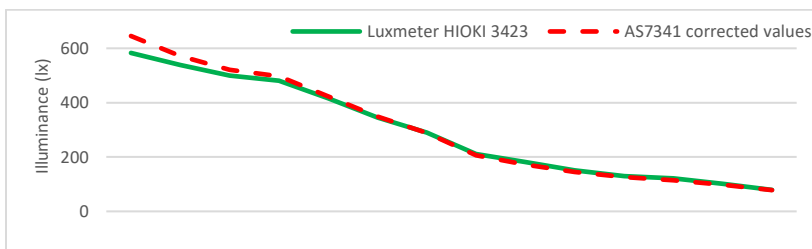
Figure 1.1 *Comparative results between luxmeter and manufactured device*

Conclusions: the manufactured device meets the essentials to monitor light exposure and generate the light history of its users. The results obtained allow to obtain very reliable illuminance values but with a limited dynamic range, the sensor saturates around 3000 lx, which is a challenge if you want to use it for outdoor applications. In relation to spectral measurements, the calibration process and its subsequent analysis are pending.

It is essential to be able to advance in a code that allows the device to adjust the gain automatically. The sensor manufacturer makes available a document called "AS7341 Auto Gain & Optimization" that should be explored as a continuation of this work.

Keywords: light, health, dosimeter.

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Impact of several hydrophobic monomers on the properties of hydrogels contact lenses

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Purpose: It is said that the oxygen permeability (Dk) of conventional hydrogels is dependent on their water content, and several experimental laws have been deducted linking the water content with the Dk (1,2). This study aimed to evaluate the effect of different hydrophobic monomers on the physical properties (DK, Young´s modulus, and contact angle) of conventional dimethylacrylamide (DMAA)-based lenses with similar water content.

Methods: Five hydrogels based on DMAA of mid-water content were synthesized, mixed with one hydrophobic monomer. The hydrogels A, B, C, D, and E are respectively composed of the following hydrophobic monomers: Cyclohexyl methacrylate (CHMA) for A, Benzyl methacrylate (BzMA) for B, Isobornyl methacrylate (IBMA) for C, Styrene (S) for D and tert-butyl Styrene (tBS) for E. A conventional hydrogel CL (Gentle 59®, mark'ennovy, Madrid, Spain) was selected for control. Dk was evaluated using the polarographic method given by the ISO standard 18369-4 (3). The Young modulus and the contact angle of these lenses were measured, applying respectively tensile tests on the Instron 3343 tensiometer (Instron, Norwood, USA) and the sessile drop technique with the KRÜSS Drop Shape Analyzer DSA25S (Krüss, Hamburg, Germany).

Results: The Dk values (average±standard deviation) were 17.0±2.8, 31.0±4.3, 24.2±0.2, 25.4±1, 15.9±0.3 and 32.0±2.8 Fatt Dk units for the Gentle 59 and the materials A, B, C, D and E respectively. While the water contents were similar (59.0±0.6, 63.0±0.0, 59.9±0.4, 62.2±0.2, 59.6±0.1, 59.8±0.3 % respectively), the highest values of the Dk was reached by materials A and E, represented twice the minimum value. The mechanical properties varied on quite large ranges, reaching respectively for Gentle 59 and materials A, B, C, D and E: 0.283±0.016, 0.466±0.0747, 0.210±0.034, 1.666±0.007, 0.510±0.021 1.066±0.385 MPa. The materials C and E were quite rigid compared to other lenses. The contact angles were respectively: 49.0±0.7, 81.0±0.7, 84.0±0.0, 77.5±2.1, 74.5±2.1, 91.0±1.4 °. The contact angles were higher for the hydrogels synthetized compared with the control lens.

Conclusion: The present findings confirm that the type of hydrophobic monomer used during fabrication can induce quite remarkable changes in the final properties of the lens, particularly Dk ones. Thus, lens A, containing CHMA as the only hydrophobic monomer, presents a higher Dk than the control lens. Although the CHMA monomer provides an adequate Young´s modulus to the lens, it fails to achieve good wettability.

Keywords: Contact lens materials, hydrogel, oxygen permeability

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Study of two different devices used to measure the contact lens central thickness

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Purpose: Contact lens thickness can influence comfort, lens stabilization, and oxygen permeability. However, the exact value of the central thickness corresponding to each contact lens prescription is not usually reported in the parameter specifications of the different laboratories [1]. In the literature, the gold standard device to measure the thickness of contact lenses in air is the Electronic Thickness gauge (ET-3). Nevertheless, the Nikon projector (V-12B) was used in this study to measure the thickness of lenses immersed in saline solution. The aim of this study was to evaluate the correlation between the ET-3 and V-12B projector devices when measuring the central thickness of single vision and multifocal contact lenses, and to prove whether there are variations in the measurements when the lenses are in air or wet.

Methods: The central thickness of twenty single vision and multifocal (MF) commercial contact lenses were measured by the same operator and under a temperature control of 21ºC. First, the lenses were measured in air with the ET-3 device. The lenses were placed on a steel sphere, a metal bar contacted the lens, and the measurement was made [2]. Then a central slice of the lens was cut with a razor blade [3] and the thickness was measured transversely with a micrometric screw with the Nikon projector V-12B. Both ET-3 and V-12B instruments had a recent valid calibration report developed by their respective manufacturing companies. Every lens was measured three times with each device and under repeatability conditions. The statistical analysis was performed with the programs Statgraphics Centurion XVIII® and MATLAB.

Results: The General Linear Model (GLM) analysis with Statgraphics showed no statistically significant differences between instruments at 95% confidence ($p > 0.05$). There was lower standard deviation in the measurements with the ET-3 device. Results with a Bland-Altman test showed a horizontal bias line close to zero with no statistical significance. A deeper analysis was also performed to compare the thickness of similar multifocal contact lenses of different brands with the same spherical power and addition. The analysis made between 1-day Acuvue Moist MF and Dailies Total 1 MF of +3.00 D spherical power showed statistically significant differences ($p<0.05$). However, when Dailies Total 1 MF and Clariti 1 day MF of -9.00 D spherical power were compared (figure 1, right) no statistically significant differences were found.
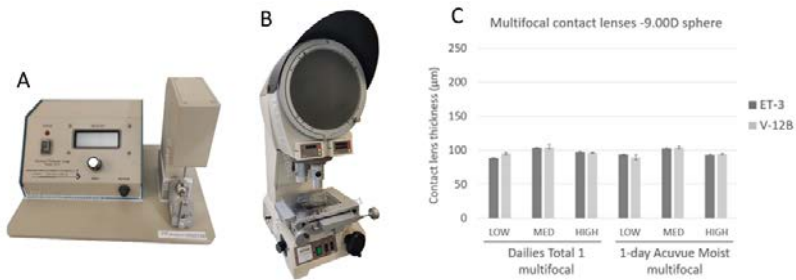
Figure 1. A) Electronic Thickness gauge (ET-3). B) Nikon projector (V-12B). C) Contact lens thickness of Dailies total 1 MF and 1-day Acuvue Moist for a -9.00D spherical power

Conclusions: The analysis indicated that both instruments, the ET-3 device and the Nikon Projector V-12B, were interchangeable with each other, and they were able to measure the central thickness of contact lenses in a repeatable manner, no matter if the measurement conditions were in air or wet. Whether the lens additions were high, medium or low, they did not influence the central thickness results, either for positive or negative sphere power values.

Keywords: ET-3 device, V-12B projector, thickness, contact lens.

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Development of e-Health technologies for Big Data Analysis: application to blink dynamics

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Purpose: To analyze the eye blinking dynamics of different patients in different environmental conditions [1]. The research will use a mobile application designed to capture videos of users' eye, as well as collects data of air contaminant found in the atmosphere and, registers temperature, humidity, wind, and rain precipitation variables from the different weather stations depending on the users' location. The final purpose is to measure the difference in blinking amplitude (b) and dynamic (α), using the Power Spectral Density function of the blinking measure algorithm. ($PSD = 10^b f^\alpha$).

Methods: The collection of the video is done using a self-made App that extracts with the video recording interface the environmental conditions of patients residing in Community of Madrid [2]. In order to know comfort and mental state of the patient, a small questionnaire is also present on the application and has been answered before each video recorded by the patient. To extract the blinking measurements, a Matlab algorithm has been developed to assess jointly with the app, the extraction of valued data to find the different variables that are significantly correlated to the blinking amplitude and dynamics. The blink function is then obtained from each video patient where the time of the video appears on the abscissa axis and the position of the upper eyelid in respect to the lower eyelid appears on the ordinate axis. The Power Spectral Density $PSD = 10^b f^\alpha$ is obtained for the blink function where α characterize the blinking dynamics and b the blinking amplitude. Three subjects participated in this study. Patients are in good health and do not have any known mental illness or disease that influences the patient's normal blinking.

Results: After analyzing 32 videos from the 3 different subjects, we found out that the blinking dynamics amplitude factor "b" is significantly correlated to the humidity considering the data available of all the video of patients (correlation factor equal 0.41 using Spearman method, p<0.05). Analyzing separately each patient, we found out that the alpha and beta parameters of all videos have a mean value of -1.18 and -0.57 respectively and the three different samples corresponding to each patient (alphas and betas categorized depending on the patient) using the Wilcoxon rank sum test revealed that the medians of alpha value for patients 1 and 3 are not consistent to each other.

Figure 1: b factor of Power spectral density versus relative humidity of 32 blinking eye videos from 3 different patients.

Conclusions: The extraction of information related to the blinking dynamics, besides the interval and duration, may offer an objective means to assess the comfort of the patient [3]. Studying the difference between results on blinking characteristics of the same patient in a similar controlled environment with similar mental state, can provide conclusions with a higher volume of data. Finally, comparing the blinking characteristics and weather data helps to identify the environmental variables that causes changes on the blinking [2].

Keywords: E-Health App, contact lenses, blink characteristics.

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Functional and Structural Retinal Changes in Swiss Mice

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Purpose: Albino mice have multiple ocular affectations such as pronounced decrease in photoreceptor density in the central retinal zone (Jeffery, 1997). Often, when albino animals are purchased from farms, some of them come with visual problems related to albinism that could negatively impact research when studying the retina. Therefore, the aim of this study was to investigate the proportion of animals with visual problems found on farms and to determine the functional and structural retinal changes.

Methods: We used 64 male Swiss (CD-1) mice at 22 weeks of age. To assess retinal functionality, full-field electroretinography (ERG flash) was performed under scotopic and photopic conditions. In vivo retinal structure analysis was conducted using SD-OCT Spectralis. Immunohistochemical techniques were used on retinal sections to comprehensively analyze the retinal structure of the different study groups. We used anti-cone arrestin for cone structure observation, anti-rhodopsin for outer segments of rods, anti-Protein kinase C-α (PKC-α) for bipolar cells, anti-Brn3a for ganglion cells, anti-Iba-1 for microglia, and anti-GFAP for macroglia (astrocytes and Müller cells).

Results: Among albino mice, we found differences in photopic and scotopic responses using ERG flash, finding animals with normal vision (sham) (28), animals with low photopic and scotopic vision (3), others with photopic vision only (27), and completely blind mice (6). Under scotopic conditions, the amplitude and latency of the b-wave decreased in groups with low photopic and scotopic vision and in those without photopic vision, while the response was abolished in completely blind mice compared to sham mice. The a-wave and b-wave showed a similar pattern for the mixed response. Under photopic conditions, the b-wave and flicker was abolished in all groups except in sham group. OCT images showed a normal appearance in the most of the groups, while completely blind mice exhibited an absence of the outer retinal layers. In the sham group, a continuous and regular band corresponding to cone-type photoreceptors was observed. This band displayed irregularities in groups with low photopic and scotopic vision, as well as in mice without photopic vision. In blind mice, it was reduced to an almost non-existent band. The pattern observed for rods was similar, with a diminished band in mice experiencing vision alterations and complete loss in completely blind mice. In the inner retina, it was observed the complete and normal structure of bipolar cells in both sham

animals and those with low photopic and scotopic vision, while in animals without photopic vision and completely blind mice, the thickness of the inner nuclear layer was reduced. In ganglion cells, no changes were observed in the different study groups. In sham animals, microglial cells were restricted to a few cells located in the outer plexiform layer (OPL), inner plexiform layer (IPL), and nerve fiber layer (NFL). In contrast, in the other groups, these cell forming continuous rows across all layers and exhibiting characteristic signs of microglial activation. In sham animals, astrocytes were limited a thin band in the NFL. In animals with low photopic and scotopic vision and those without photopic vision, this band was thicker than in sham mice, indicating astrocyte activation. This was more pronounced in completely blind animals, where vertical GFAP+ columns corresponding to reactive Müller glia were also observed.

Conclusion: It is important to conduct visual tests on CD-1 animals, especially ERG, before conducting studies to ensure whether they have visual impairments that may affect the results of the projected work.

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pH measurements with Fiber Optic Gratings for *in-situ* planetary exploration

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Purpose: The interest in the search for life and habitability in planetary exploration makes necessary to implement *in-situ* instrumentation that can analyze chemical, biological and environmental parameters, being the pH an indicator that provides information of astrobiological interest. The work is centred on the pH sensor development by deposition of polyvinyl alcohol (PVA)/polyacrylic Acid (PAA) hydrogel on different kind of gratings fabricated in an optical fiber.

Methods: The study is carried out with three kind of fiber optic sensors to demonstrate the feasibility for planetary exploration, by monitoring the Dip Wavelength Shift (DWS) with an optical interrogator (Micron Optics, si255). The Fiber Bragg Gratings (FBGs), widespread used as temperature and strain sensors, that have been already validated in a CubeSat mission developed by INTA;. The Long Period Gratings (LPGs), which were submitted to a gamma radiation test showing no degradation and demonstrating their capability to be used as a payload with an in-situ calibration system [1]. Finally, the Tilted Fiber Bragg Gratings (TFBGs), which show advantages from the packaging point of view. LPGs and TFBGs in comparison with FBGs, are sensitive to the surrounding refractive index [2], making them a good choice for developing instrumentation to detect and analyze chemical and biological markers.

The three kind of fiber optic sensors have been calibrated in temperature from -5ºC up to +70ºC ± 0.01ºC with a temperature calibrator (SIKA TP381165) since the temperature affects the sensors response.

The FBGs are used to monitor the temperature during the measurements. The DWS of LPGs and TFBGs has been measured in the presence of different surrounding refractive index using commercial refractive index liquids and ad-hoc solutions. In addition, the ad-hoc refractive index solutions were measured with an Abbe refractometer at 35ºC, since the experimental measurements are performed at a stable temperature of 35ºC ± 0.1ºC using a PID (Proportional Integral Derivative) controller.

In order to develop a fiber optic pH sensor, a PVA/PAA hydrogel film (~ 2 μm thickness) has been deposited on the gratings and the first measurements from pH 1 to 10 have been performed; with ad-hoc solutions using HCl and NaOH. The refractive index of the polymer changes depending on the pH value, since the polymer shrinks in the presence of H^+ and swells in the presence of OH^- groups [3]; the response is recorded in the DWS.

Results: Both LPGs and TFBGs present a good sensitivity to the surrounding refractive index; The LPG shows a total DWS of 24.69 ± 0.02 nm from refractive index 1 to 1.4270 and TFBG has a total DWS of 0.366 ± 0.001 pm from refractive index 1 to 1.4366. For pH measurements, the LPG shows a good sensitivity in a pH range from 1 to 10, with a total DWS of 3.20 ± 0.02 nm.

Conclusions: The experimental results show that LPGs and TFBGs coated with PVA/PAA film are a good choice as pH sensors. The aim of the future work is to submit the pH sensors to an ionizing radiation test to verify that the polymer does not suffer degradation in a harsh environment similar to the one encountered in future *in-situ* explorations in astrobiology studies.

Keywords: pH sensor, Long Period Grating (LPG), Tilted Fiber Bragg Grating (TFBG).

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Evaluation of retinal vasculature by OCT Angiography in type II diabetes

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Purpose: To date, the gold standard test to assess retinal vasculature is fluorescein angiography (FA). New less invasive diagnostic methods are appearing, such as optical coherence tomography angiography (OCTA) [1, 2]

We propose to analyze the foveal avascular zone (FAZ) and macular vascular density (VD) using OCTA in type II diabetic patients compared to healthy subjects.

Methods: We performed a cross-sectional comparative study between 3 diagnostic groups: diabetic patients without diabetic retinopathy (no DR), patients with mild diabetic retinopathy (mild DR) and healthy control subjects to analyze parameters of the retinal vasculature.

Patients over 18 years of age were included and those in whom it was not possible to obtain good image quality were excluded.

We analyzed 552 eyes of 287 patients (59.06% male and 40.94% female), who underwent a complete ophthalmological exam.
We also analyzed other variables of interest such as glycosylated hemoglobin (HbA1c), duration of diabetes mellitus (DM), type of treatment for DM and presence of other diseases.
The OCTA (Carl Zeiss Cirrus 5000) images of the macula were acquired using 3x3mm and 6x6mm scanning protocols and also of the optic disc using a 4.5x4.5mm cube protocol.

Results: In our study the analysis of the central 3mm of the FAZ showed a higher area value in the mild DR group (mean 0.29) with statistically significant difference between the 3 groups (P=0.025) and between the mild DR group ans the group without DR (P=0.018). The perimeter showed a higher value in the mild DR group (mean 2.4) with statistically significant differences between the 3 groups (P=0.003) and between the mild DR group and those without DR (P=0.005
Vessel density in the central 3 mm was higher in the control group (mean 20.71) with statistically significant differences between the 3 groups (P<0.001), between controls and no DR (P<0.001) and between no DR and mild DR (P=0.008). When analyzing the FAZ in the central 6 mm, no statistically significant differences were found in the area and perimeter in any of the comparisons; The density of vessels in the central 6 mm was higher in the

control group (mean 18.06) with statistically significant differences between the 3 groups (P<0.001) and between no RD and controls (P=0.004).

Conclusions: The area of the FAZ shows a significant increase in patients with mild DR compared to controls. Macular vascular density analysis shows a significantly higher percentage in healthy patients compared to diabetic patients.
OCTA can be a useful tool for early diagnosis and follow-up of diabetic patients.

Keywords: Optical coherence angiography; diabetes mellitus; diabetic retinopathy.

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Optical and aberrometric evaluation of a new enhanced monofocal intraocular lens with isofocal optic design

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Purpose: Extended depth of focus (EDOF) intraocular lenses provide a continuous range of vision minimizing photopic phenomena such as halo and glare. However, some intraocular lenses provide a limited increase in the range of vision and do not fully meet the criteria established by the American Academy of Ophthalmology,[1] so they are called enhanced-monofocal intraocular lens (EM-IOL). These lenses also include strategies such as the modification of the spherical aberration to expand the depth of focus and allow some degree of spectacle independence.

The ISOPure lens (BVI medical, Liège, Belgium) is an EM-IOL based on a 100% refractive mechanism, with an optic design based on the isofocal concept, a patented polynomial technology.[2]

Therefore, this study aims to evaluate the clinical and aberrometric performance of the ISOPure lens and compare it to a monofocal control lens from the same manufacturer, featuring an identical platform and material (MicroPure, BVI medical, Liège, Belgium).

Methods: Prospective, comparative, and randomized clinical study. 28 eyes of 28 patients were randomly assigned to either group. Monocular visual acuity (VA) was measured at distance and intermediate under photopic and mesopic conditions. Aberrometry was analyzed using the OPD-Scan III for 3.0, 4.0, 4.5, and 5.0mm pupils. Contrast sensitivity defocus curve was measured for 3.0mm and 4.5mm pupil size. Modulation transfer function (MTF) and strehl ratio (SR) was assessed with a double-pass system. All measurements were taken 3 months after surgery.

All values were analyzed with SPSS version 28 program and a significance level p-value <0.05 was considered.

Results: Under photopic conditions intermediate VA was better for the ISOPure lens (p<0.05). Uncorrected intermediate visual acuity for ISOPure lens was 0.13±0.07logMAR and 0.19±0.11 at 80 cm and 66cm, respectively. Corrected-distance intermediate visual acuity was 0.17±0.09logMAR and 0.22±0.10logMAR, respectively. Meanwhile, no differences were found between groups under mesopic conditions, with the loss of 1-2 lines of VA for both lenses.

No differences were found for corneal aberrations between groups. Internal and total aberrations were higher for the ISOPure lens, finding the biggest difference between the two lenses in the primary spherical aberration (SA). For ISOPure, the SA increased when the pupil size increases, being the maximum SA obtained at 5mm, with a value of -0.49±0.11microns. For MicroPure, the internal SA at 5mm was -0.13±0.08microns.

Contrast sensitivity defocus curve and optical quality showed similar behaviour for both lenses, with MTF higher than 30c/deg in both groups.

Conclusions: The isofocal lens enhances intermediate visual acuity without affecting distance visual acuity under photopic conditions. Moreover, there are no differences in visual quality between the ISOPure and MicroPure lenses, despite the former exhibiting higher internal and total aberrations than the monofocal model.

Keywords: Enhanced-monofocal, isofocal, spherical aberration

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Light diffusion models in aerosols

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Purpose: This project focuses on the behavior and properties of light in different environments immersed in aerosols: fog, pathogens and/or smoke.

Modelling and simulation of retroreflected light in foggy environments:

The hypothesis is based on modifying the beam structure. Instead of illuminating the entire scene, the relevant areas would be delimited. This would reduce the appearance of veil luminance achieving an improvement in the contrast with respect to the background of the scene.

To study the behavior of light we used the "Lambert-Beer" law. For this purpose, the "Mie" dispersion model is used, since the fogs can be considered as large particles [1].

Optical fog model:
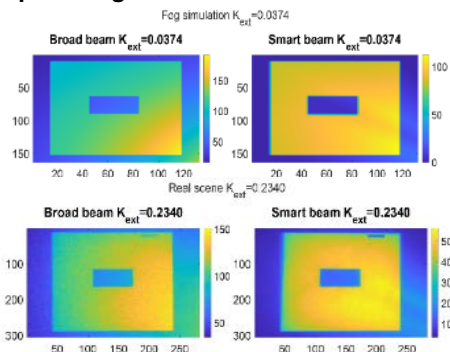
We have developed a software in matlab. This software generates a volume composed of elementary fog cubes. Next, we developed an experimental phase to validate the simulation. We recreated fog conditions by constructing a chamber. We obtained the luminance value of the scene veil and, applying the "Weber" contrast fraction calculation [2].

| Contrastes	Haz ancho	Haz inteligente
Escena simulada K_{ext} =0.0374 m^{-1}	1.37	20.40
Escena K_{ext} =0.0374 m^{-1}	4.33	21.98

Geometrical limits for UV-C inactivation of pathogen:

The inactivation of pathogens by UV-C depends on how the light propagates within the medium in which the microorganism is immersed. We have evaluated the behavior of UV-C when incident on spherical geometries and/or spherical caps. We have analyzed these facts using geometrical optics and software [3].
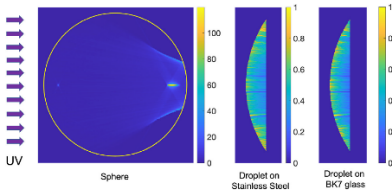
We used TracePro. We have performed two simulations: the behavior when it hits a sphere and when hits a spherical casquet.

UV inactivation limits:
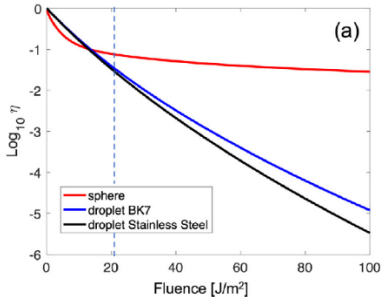
We calculate pathogen inactivation using a characteristic fluence value of 4.7 J/m^2 effective for SARS-CoV-2 at 254 nm. Sphere geometry shows a sharp drop in inactivation at low fluences. Droplet geometry metallic substrates redirect energy, resulting in higher inactivation compared to dielectric substrates.

Conclusions: We have developed software to simulate the interaction of light in foggy nighttime scenarios, supported by an experimental environment of complete darkness and fog to validate our simulation. In addition, we have applied geometrical optics concepts and illumination engineering techniques to study pathogen inactivation, identifying challenges related to the geometry of collimated light sources and evaluating the optical properties of substrates and culture media in biomedical experiments with droplets deposited on flat substrates.

Keywords: light propagation, fog scattering, inactivation pathogen

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Advances in Blink Dynamics: Age-Related Changes

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Purpose: This study aims to characterize blinking behavior in both younger subjects and presbyopic subjects and discern any disparities between them using experimental methods.

Methods: In this study, blinking behavior characterization encompassed both younger subjects (average age of 26.1 ± 4.17) and presbyopic subjects (average age of 51 ± 5.57). The blinking characterization employs high-speed cameras with a frame rate of 500 frames per second to record the voluntary blinking of subjects [1]. The captured video footage was subsequently converted into individual frames, and subjected to noise reduction using principal component analysis algorithms [2]. Using a specialized software known as PIVlab, integrated with MATLAB, we tracked the movement of the eyelids, focusing on the center of the eyelid as it produces the maximum blink speed. This analysis yielded crucial data on blink speed, which led us to determine other parameters such as acceleration, power per unit mass exerted by the eyelids, work per unit mass, and mechanical impulse per unit mass done by the eyelids[1]. We applied a statistical significance difference test to the eyelid velocity at each point in time, comparing the young and presbyopic groups using MATLAB.

Results: Our findings revealed statistically significant differences ($p < 0.05$) in eyelid blinking characteristics between younger and presbyopic subjects, during the upstroke of the blink cycle (see Figure 1). Additionally, younger subjects displayed elevated eyelid acceleration and power per unit mass during voluntary blinking in comparison to their presbyopic counterparts [3]. These findings imply that age-related variations in blink dynamics might have significance when contemplating the stability and movement of the contact lenses in presbyopic individuals.
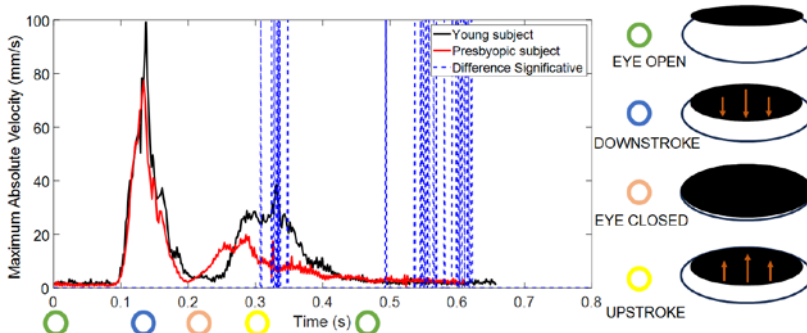
Figure 1. Left side - Average of the maximum velocities observed among younger and presbyopic groups with the result of the hypothesis test and the circles shown at the bottom of the plot represent four phases of the blink cycle with the first cycle repeating at approximately 0.45 seconds; Right side - Four phases of the blink cycle.

Conclusions: This study highlights distinct differences in eyelid blinking behavior between younger and presbyopic subjects, emphasizing the influence of age on blink dynamics. Our results indicate that there are significant age-related variations in blink characteristics, particularly during the upstroke phase of voluntary blinking, where younger subjects exhibit higher velocities, accelerations, and power per unit mass. These findings, supported by statistical analysis, have implications for understanding age-related changes in blink dynamics, which may contribute to our broader understanding of ocular health and function including the CL wearers.

Keywords: Blink dynamics, high-speed camera, age-related changes.

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Sports visual analysis in UEFA referees

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Purpose: In recent years, there has been a growing interest among athletes regarding the significance of visual skills in sports performance (1). Sports vision is a rapidly expanding field within ophthalmology and optometry (2).

Methods: This study was conducted over a span of 10 years during the training camps of UEFA (Union of European Football Associations) referees, aiming to analyze visual skills in order to enhance refereeing performance on the field. A descriptive and retrospective study was carried out. In the initial phase, we considered the following variables: gender, age, referee type, refraction, visual acuity, NPC (near point of convergence), stereopsis, color perception, pupillary assessment, retinal evaluation, and intraocular pressure. The statistical analysis will be carried out with the SPSS program. The results of the continuous variables are presented by their mean and standard deviation. For categorical variables, the results will be presented by their percentages and frequencies.

Results: A total of 976 exams were conducted, of which 613 were main referees and 362 were assistant referees. 93.81% were male, and 6.19% were female. The average age was 34.87 ±4.6 years. Among them, 60.82% were emmetropic, 14.33% were hyperopic, and 24.85% were myopic. The average distant visual acuity under typical refereeing conditions for both the right and left eyes was 1.088 ±0.18 and 1.1 ±0.16, respectively. The average near visual acuity was 1.0019 ±0.13 for the right eyes and 1.0036 ±0.11 for the left eyes. The NPC was measured using the accommodative stimulus, with an average break value of 3.23 ±2.19 cm and a recovery value of 5.36 ±2.69 cm. These values are within the standard 3cm for break and 5 cm for recovery. Stereopsis was measured using the Random Dot test, with an average value of 33.39 ±50.66 arc seconds. Color perception was evaluated using the Ishihara test. 96.79% had normal color perception, while only 3.21% showed partial or total color alterations, a percentage lower than the general population's 8%.
In the pupillary assessment, only 4 presented a pupillary alteration. 92.77% showed no anomalies in the retinographies. 1.89% had choroidal atrophy spots related to myopia, 2.67% exhibited signs of vascular injury, edema, hemorrhage, or exudation, and finally, 2.67% showed lesions related to the optic disk and nerves, such as pallor and atrophy. The average IOP for the right and left eyes was 15.90 ±2.65mmHg and 16.05 ±2.62 mmHg, respectively.

Conclusions: The results indicate that the visual skills measured are optimal for refereeing. In the next phase of the study, other specific visual abilities of the sample will be analyzed.

Keywords: sport; vision; referee

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The temporal course of contrast sensitivity recovery following a bleach measured under photopic and mesopic luminance conditions in healthy adults.

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Purpose: Cone dark adaptometry is a valuable clinical tool for detecting and monitoring various conditions due to its sensitivity and efficiency in measurement. This study aims to determine the optimal luminance conditions and staircase procedures for evaluating the temporal course of macular contrast sensitivity recovery following a bleach, as well as establishing the ideal protocol for evaluating cone-mediated mesopic adaptation.

Methods: The dynamics of the contrast threshold (CT) recovery following a photopigment bleach were psychophysically measured for five minutes in twenty-four healthy adults (23.7 ± 3.7 years old). The stimuli utilized were low-spatial-frequency sine-wave gratings (1 cycle-per-degree). Each subject underwent six tests, wherein three luminance levels (0.1, 1.0, and 10 cd/m²) were combined with two modified staircase procedures (3-down/1-up and 2-down/1-up) to estimate CTs. The test order was randomized and conducted across two visits, with a 15-minute washout period between tests. Outlier detection techniques were employed to verify the sample's integrity. Non-linear exponential-based optimization was utilized to fit CT recovery functions, estimating the time constant (τ, seconds) of cone sensitivity recovery and the final CT (CTf, log units). Classical and heteroscedastic ANOVA analyses were performed to assess the effect of test conditions.

Results: The 2-down/1-up staircase facilitated denser point sampling of CT measurements compared to the 3-down/1-up procedure. Under the lowest luminance test condition, the CT recovery was characterized by more irregular functions in both staircase procedures compared to other luminance levels. Mean cone τ increased (21.7, 42.5, and 72.0 seconds ($p < 0.001$)), and CTf worsened (-1.99, -1.85, and -1.47 log units ($p < 0.001$)) as the luminance level decreased. The best fit (median $R^2 = 0.87$) was achieved under 1 cd/m² mesopic luminance conditions. No statistically significant differences were observed in mean cone τ and CTf between the two staircase procedures.

Conclusions: The optimal protocol for assessing cone-mediated mesopic adaptation is achieved with a luminance level of 1 cd/m² and a 2-down/1-up staircase procedure.

Keywords: psychophysical method, luminance, staircases procedures.

Characterization of the meibomian glands in patients with allergic conjunctivitis and its relationship with histaminase

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Purpose: The dysfunction of the meibomian glands generates an affectation in the lubrication and wetting of the ocular surface, resulting in inflammatory responses, which must be treated effectively and immediately. To determine the morphology and function of the meibomian glands in patients with allergic conjunctivitis and its relationship with the concentration of histaminase found on the ocular surface.

A descriptive, prospective, cross-sectional study is proposed in a population of patients diagnosed with allergic conjunctivitis [1] and attending consultations at the Optometry Clinic of the University of La Salle, who will be evaluated for the morphology of the Meibomian glands in addition to tear evaluation using the Oculus Keratograph 5.

Methods: All participants will sign a written informed consent after explaining the research and two questionnaires will be applied: Visual Function Questionnaire (VFQ-25) and The Ocular Surface Disease Index (OSDI).

The evaluation of patients will be adjusted to the management of two teams:
1. Oculus Keratograph 5, where aspects such as: Meniscometry, NIKBUT, thickness will be analyzed using the TF Scan, R Scan and Meibo Scan modules. of the lipid layer and dynamics of the tear film, ocular redness and morphology of the meibomian glands.

2. I-Profiler (Zeiss aberrometer), to perform the analysis and quantification of the type of aberrations that may occur on the ocular surface of patients diagnosed with allergic conjunctivitis according to Zernike polynomials [2].

Finally, the patients will undergo a non-invasive evaluation of the concentration in the tear film of histaminase and determine its relationship with the alterations or damage of the ocular surface in allergic conjunctivitis [3]. The technique to use is an enzyme-linked immunosorbent assay test (ELISA).
The project will follow the principles of the Declaration of Helsinki, resolution 8430 of the Ministry of Health that regulates research in humans in Colombia and will also be subject to evaluation and approval by the ethics committee of the Faculty of Health Sciences of the La Salle University.

Results: At PhDay 2023, I am interested in presenting advances and partial data related to the type of aberrations that have been found so far in patients evaluated with the I Profiler

Conclusions: Information pending at the end of the investigation.

Keywords: Allergic conjunctivitis, ocular surface, tear film.

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Effect of the use of artificial tears on the tear film and the conjunctive for different fixation requirements, in healthy young adults - Results of the investigation

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Purpose: Increasingly frequent near vision tasks are being performed by children and older people throughout the day that require their attention to be focused on short distances. It has been shown that all these activities decrease the frequency of blinking, and that blinking is often incomplete. In order to solve this problem, more and more tears are appearing on the market that try to adapt to the needs of the subjects.

This study aims to analyse whether all activities cause the same discomfort to patients, as well as whether all tears respond in the same way in different situations.

Methods: Prospective cross-sectional clinical study in which we studied the changes in the ocular surface and tears of 36 patients (6 of them controls) recruited at the Optometry Clinic of the Universidad de la Salle in Bogotá (Colombia), after subjecting them to different fixation activities and after instilling them with different types of artificial tears. The mean age of the subjects was 22.5 ± 3.6 years (range 19 to 32 years, 80% of them male and 20% female). Each patient was seen on 3 occasions, each visit lasting 3 hours. The protocol followed on all visits was the same and is detailed below.

We began with the T0 assessment, which consisted of the initial tear and ocular surface assessment using the Keratograph (the measurements taken were tear meniscus height, NIKBUT, tear film dynamics and assessment of ocular redness). Artificial tears were then instilled: in the right eye a tear with sodium hyaluronate was instilled, while in the left eye the tear was composed of carboxymethylcellulose and glycerine. After 10 minutes from the instillation of the tear, T1 measurements were taken, which consisted of the same measurements taken in T0.
Next, the pacintes will proceed to the development of a fixation activity: reading on paper, working on a mobile phone and finally using a computer. One hour after the start of the fixation activity, the preset parameters are measured again with the Keratograph. The patients then spend a further 1 hour carrying out the fixation activity they were doing. After this time, the patient will again be evaluated with the Keratograph. The measurement of the eye order was randomised in all shots.

Results: Statistical analysis was developed using an SPSS statistical package. The parameters analysed were the types of visual activity and the intervention times. Analysis of variables was performed with a two-factor repeated within-subjects ANOVA (analysis of variance). Differences were considered statistically significant when the p-value was less than 0.05 with a confidence interval of 95%.

The results obtained were as follows:
- There are no significant differences at 95% (G - G p = 0.293) in the behaviour of the tear meniscus height of the left eye, during fixation activities for each evaluation time.
- There are significant differences at 95% (G - G p = 0.022) in the behaviour of the NIKBUT of the left eye, in fixation activities, between reading on paper and mobile or cellular, giving a mean difference of 1.575 seconds, p = 0.027.Obtaining the worst results, when the subjects performed fixation tasks with paper.

Conclusions: As conclusions of this work, it can be extracted that:
- Healthy young adults, during the development of different fixation requirements on electronic devices and paper, the ocular surface characteristics were similar without and with the instillation of artificial tears.
- The different fixation requirements did not influence tear meniscus height values for any of the groups, times and fixation requirements evaluated.

Keywords: tears, fixation requirements, ocular surface, artificial tears

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Form-deprivation myopia induction to assess purinergic signalling on rabbit posterior pole

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Purpose: Since there is no evidence regarding the biochemical pathway of pharmacological and optical treatments to slow down myopic growth,[1] the objective of this research is the study of the molecular mechanisms involved in the progression of myopia and if metabotropic purinergic receptors (P2YRs) play a role in this complex process.

Methods: Monocular form deprivation myopia (FDM) was induced on 4-week-old pigmented rabbits during a 45-days period. Prior and upon the completion of the experimental procedure, retinoscopy refraction and topography were performed after 3 drops every 10 minutes of sodium cyclopentolate instillation. Western blotting was used to evaluate the expression of metabotropic $P2Y_4$, $P2Y_6$ and $P2Y_{11}$ receptors in scleral tissue. Concentrations of ADP, ATP, Ap_4A and Ap_5A nucleotides and dinucleotides were quantified in the sclera, retina, and vitreous humour through high-performance liquid chromatography (HPLC). All the procedures received approval from the relevant Research Ethics Committee at UCM in Spain. Data was then analysed with GraphPad Prism 9 (Boston, USA). $p < 0.05$ was considered statistically significant.

Results: Significant progression of myopic refractive error was observed following 45-days of light deprivation ($p = 0.044$), causing in a difference of -3.31 ± 1.46 dioptres on the deprived eyes compared to baseline. Topometric data showed significant corneal flattering at endline for both deprived and control eyes ($p = 0.0004$), without changes in the astigmatism values ($p > 0.05$). Protein levels of $P2Y_4$ receptor exhibited a substantial increase ($p = 0.012$), while no significant fluctuations were detected for $P2Y_6$ and $P2Y_{11}$ receptors. The concentration of ADP, ATP and Ap_5A in the sclera and retina of myopic eyes presented a slight increase, whereas in the vitreous humour their levels decreased when compared to the control eyes ($p > 0.05$). Ap_4A levels remained unchanged in all the studied tissues ($p > 0.05$).
Conclusions: In this context, we highlight P2YRs as a novel intracellular pathway involved in progressive myopia, presenting a potential target for the development of new pharmacological interventions to slow down myopic growth.

Keywords: Myopia, purinergic signalling, form deprivation myopia.

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Effect of the elasticity module of soft contact lenses on the morphology and function of the meibomian glands

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Purpose: Show progress of the data found in the research effect of the elasticity module of soft contact lenses on the morphology and function of the meibomian glands.

To characterize the morphology and function of the meibomian glands in participating patients, before and after the adaptation of soft silicone hydrogel contact lenses with different elasticity moduli in patients between 18 and 40 years old who attend the Optometry Clinic from the University of La Salle.

Secondary objectives:
- Characterize the tear film (meniscus height, lipid layer NIKBUT and film dynamics) in participating patients, before and after fitting soft silicone hydrogel contact lenses with two different modulus of elasticity.
- Compare conjunctival redness in participating patients, before and after wearing silicone hydrogel soft contact lenses with different modulus of elasticity.

Materials and methods: A descriptive observational study is proposed in a population of people over 18 years of age and up to 40 years of age, called young adults.
The refraction of the patients may be between +1.00 and -4.00 of spherical power and up to -2.75 the cylinder, in order to be able to preserve symmetry in the thickness of the contact lenses to maintain the modulus of elasticity, this because, the greater the thickness the modulus will increase. (1)

Measurements were made to a group of patients who signed the informed consent in order to determine the understanding of the test to be performed, resolution of concerns about the Project, time it takes to complete each process and to define the management protocol with the Keratograph 5M and the duration of each test.
• The second part consisted of completing the Ocular Surface Disease Index questionnaire, in which it was determined if there was any concern with its completion, and knowing the time for recording the requested information. (2, 3)
This process made it possible to:
• The data collection format
• The data consolidation format for statistical analysis

Conclusions:

The results of the test allowed:

• Identify problems with the research project

• Estimate research costs and calculate the duration of the evaluation of the participants.

Expected Results: It seeks to find the effect of the modulus of elasticity of soft contact lenses on the morphology and function of the meibomian glands, the results will contribute to visual and ocular health professionals and the contact lens industry.

Keywords: Preliminary study, Feasibility study. Tear film. Meibomiam glands. Keratograph.

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Design of Optical Instrumentation for Space Applications

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Introduction: Optics has been involved for many years in space applications, either as a method of research and exploration or as payloads in satellites. There are many applications of optics in space, from scientific research to the development of new technologies. Today, due to the restrictive conditions of operating in space and the difficulty of design because of the demanding scientific and technological requirements of this type of missions it continues being a research challenge.

In this context, the development of nanosatellites is growing because of their small size, low cost and ease of launch and therefore it is necessary to miniaturize the optical instrumentation. For this purpose, a research work based on the design of compact optical instrumentation to be embarked on CubeSats is being carried out.

Considering the wide variety of instruments in the field of optics, this research work is focused on the design and analysis of different configurations of compact multispectral spectrometers. Spectrometers have multiple applications, from the determination of properties and chemical composition of substances to the study of the properties of stars and celestial bodies in astronomy [1].

Purpose: A research work based on the design and performance analysis of different configurations of compact multispectral spectrometers that can be used in space missions is being carried out.

Optical system: A spectrometer is an optical instrument used to measure and analyze signal spectrums. Its main function is to collect the incoming light, disperse it spectrally and form monochromatic images of the input signal. The typical configuration of a spectrometer consists of an entrance slit, refractive or reflective collimating optics, a dispersive element, collector optics which can also consist of mirrors or lenses and a sensor in the image plane [2]. In this type of optical instruments, the dispersive element is the most important because it diffracts the light. The most commonly used element is usually a diffraction grating but there are also others such as grisms which combine the advantages of prisms with those of a diffraction grating. Depending on the application, the spectrometers may also need to include other optical elements such as depolarizers or filters.

These optical systems have to be embarked on nanosatellites and therefore their volume and mass must be reduced. The miniaturization of the optical systems implies the use of reflective or refractive optics or a combination of both. On the other hand, the selection of the materials and optical elements such as filters, lenses, diffraction gratings and depolarizers is very important as they have to operate in the hostile space environment.

An interesting application is the use of compact multispectral spectrometers for the analysis of greenhouse gases. These gases can be measured by absorption spectroscopy because they absorb solar radiation in different regions of the electromagnetic spectrum.

In this type of atmospheric applications, it is very important to eliminate the polarization of light in order to obtain accurate measurements. Rayleigh scattering caused by air particles is a strong source of polarization [3]. Due to this undesired polarization, absorption spectrometers need to include other optical elements in their configuration such as scramblers (depolarizers). These elements have a particular behavior and moreover, since they would operate in space, they have to be properly qualified and characterized. For these reasons, a more detailed study of their efficiency and optical behavior has been carried out.

Conclusions: The field in which this research work is based is very interesting and innovative. It is focused on analyzing miniaturized optics instrumentation for space missions allowing to learn more about the possibilities of optical design of spectrometers in future missions.

Keywords: CubeSat, spectrometer, depolarizers

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PONENCIAS EN FORMATO PÓSTER

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Evaluation of the light-adapted response of the full-field electroretinogram in high myopia

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Purpose: This study aims to determine the impact of high myopia on the light-adapted response of the full-field electroretinogram (ff-ERG).

Introduction: The ff-ERG is an electrophysiological test that measures the global electrical response of the retina. It is useful in evaluating structural changes in both the retina and the optic nerve. High myopia (HM) involves structural changes at the level of the retinal pigment epithelium, choroid, and sclera that can compromise visual function and predispose to the development of pathological myopia with characteristic alterations such as posterior staphyloma or myopic macular degeneration. These anatomical changes in HM can modify the ERG response. For instance, a reduction of the b-wave in the dark-adapted ERG has been found to be related to an increase in axial length (AXL), suggesting an earlier rod dysfunction.

However, generalized function of the cone system has been measured through light-adaptation (LA) estimates. The LA ERG collects cone and bipolar cell-OFF activity (from the a-wave) and cone-ON and bipolar cell-OFF activity (from the b-wave). A reduction in the a-b ratio indicates a post-phototransduction or post-receptor cone system dysfunction. Considering these factors, the structural modifications in HM may affect the response of the LA ERG, causing functional changes at visual levels in these subjects.

Methods: A systematic review was conducted with a structured search in the MEDLINE database, analysing a total of 379 articles. The main objective was to evaluate changes in the LA ff-ERG response in subjects with high myopia and to determine the influence of axial length on this response and on structural variations produced in HM.

Results: Three articles were selected where variations in the response of LA FF-ERG in subjects with HM were found. The variations obtained between these subjects and different comparative groups are detailed.

Conclusion: There are modifications in the light-adapted response of ff-ERG in HM subjects that could be determined by structural changes at the photoreceptor level.

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Central Nervous System Regeneration: Towards axonal guidance using biofunctionalized silk fibroin fibers as scaffold

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Purpose: following an injury, the limited regenerative capacity of the central nervous system poses challenges for recovery [1]. Biomaterials, such as biofunctionalized silk fibroin fibers, provide a potential solution. In this study, we have demonstrated the effective guidance of neuronal axon growth by these fibers. Furthermore, the biofunctionalization of these fibers with adhesion peptides enhances their guiding capabilities. This implies that these fibers may find application as implants in spinal cord injuries, enhancing treatment prospects by facilitating the reconnection of damaged end.

Methods:
- Extraction and purification of silk fibroin (SF): *Bombyx mori* cocoons were degummed and dissolved to extract the protein. The solution was dialyzed to remove residues, and then concentrated through reverse dialysis [2].
- Silk-based high-performance fabrication: silk fibroin fibers were manufactured using the straining flow spinning (SFS) technique, which mimics the natural spinning process of the silkworm [3].
- Biofunctionalization of SF fibers: the fibers were biofunctionalized with RGD (fibronectin) and IKVAV (laminin) peptide using crosslinkers (EDC - NHS) [4].
- **Cell cultures:** Human neuroblastoma SH-SY5Y cells, differentiated into neurons using a protocol based on retinoic acid (RA) and brain growth neurotrophic factor (BDNF) for 11 days, were used as a model to study axonal guidance on fibers. The guidance studies were further complemented using primary cortical neurons extracted from E14 mouse embryos.
- **Data analysis procedure:** the progress was documented using an inverted light microscope. For primary mouse cortical neurons, immunocytochemical staining was performed using BIII-tubulin and GFAP antibodies.
- **Determination of axonal guidance:** axonal alignment was quantified using the "guidance factor" (φ_G), which measures the degree of alignment by counting axon intersections with grid lines on culture images [5].
- **Statistical procedures:** a significance level of $p < 0.05$ was chosen. GradPad Prism software was used for all statistical tests.

Results:
 - Biofunctionalization of FS fibres by EDC/NHS crosslinking technique: analysis of variance (ANOVA) showed significant differences (p<0.0001)

between the control fibres and the fibres biofunctionalized with the fluorescent RGD (RGD-FITC) and IKVAV (IKVAV-FITC).

   - Determination of φ_G: SH-SY5Y cells were used to evaluate φ_G as a quantitative measure of axonal guidance on both polystyrene plates and SFS fibers over 6, 11, and 18 days. φ_G values close to 1, indicate random growth. In contrast, φ_G values exceeding 1, indicate significant directional axonal growth.

   - Axonal guidance studies in line cell: this study involved seeding SH-SY5Y cells on substrates with non-functionalized or biofunctionalized fibers (RGD or IKVAV), with a control group on polystyrene. At day 6, differentiated cells on the fibers exhibited axon growth along the fiber orientation, contrasting with isotropic growth on polystyrene. Non-functionalized fibers showed highly significant differences (P-value < 0.0001) compared to the control, while fibers functionalized with RGD and IKVAV peptides exhibited somewhat lower differences (P-value < 0.01). At 18 days, these differences in growth orientation (φ_G) remained consistent between the fiber substrates and the polystyrene control.

   - Axonal guidance in primary culture neurons: The study also cultured mouse cortical cells on nonfunctionalized and biofunctionalized SFS fibers, demonstrating that φ_G was close to 1 for cells on polystyrene (isotropic growth) but greater than 1 for cells on fibers (directional growth). Additionally, biofunctionalization influenced axonal alignment.

Conclusions:
   - Biofunctionalization of the fibers is possible through the EDC/NHS.
   - Neurons adhere and elongate following the fibres as a guide.

Keywords: spinal cord injury, regeneration, biomaterials

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Effect of violet radiation on the visual system: Animal experimentation

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Introduction: It is recognized as the use of activities with violet radiation is increasing in recent years being implemented in schools and kindergartens used in a formative or playful way. These activities are based on the Snoezelen sensory stimulation model, a model originated in the 70s by Jan Hulsegge and Ad Verheul with the aim of stimulating people with cognitive deficits for therapeutic purposes [1]. In this way, the Snoezelen method has served as the basis for the design of rooms where only visual stimuli of violet light are used, thus experiencing the so-called "magic of Black Light" [2].

However, there is very little information for its implementation in schools. This, added to the lack of knowledge about the possible damage that exposure to this radiation (violet radiation) can cause in the visual system, indicate the need for a study that informs the competent authorities of the data obtained and helps in the creation of regulations that regulate its use.

Purpose: To know the influence of violet radiation on the function of the visual system in animal experimental animals.

Methods: In this study, the exposure of animals to violet radiation has been carried out. The animals were kept and cared for in accordance with current regulations for the use of experimental animals accepted by all Spanish scientific institutions.

The animal model selected for this work was the C57BL/6J mouse.

Prior to the exhibition it was necessary to enable the space creating a totally dark environment to avoid radiation outside the experiment.

In the pilot test, the sample consisted of two C57BL/6J mice. In subsequent tests, three experimental groups were carried out with the following composition:

-Experimental group 1: Eight mice, females and males between 50 and 89 days of age with an average weight of 20.9 grams.

-Experimental group 2: eight female mice, between 40 and 60 days old with an average weight of 18.6 grams.

In the animal installation, before the start of the experiments, the experimental animals maintained their circadian rhythm before the corresponding exposure to white light and darkness in periods of 12h/12h, respectively.

Table 1: Hours and exposure times Experiment 1 and Experiment 2.					
	Exposure time (hours)				Exposure time (days)
	White light	White light + violet radiation	Violet radiation	Darkness	
Pilot test (2 mice)	12		4	8	4
Experiment 1 Box 1 (4 mice)			12	12	30
Experiment 1 Box 2 (4 mice)	12		4	8	30
Experiment 2 Box 1 (4 mice)	16		8		47
Experiment 2 Box 2 (4 mice)		16	8		47

Both groups underwent electroretinographic analysis during all exposures in periods of between 7 to 10 days.

Subsequently, the electroretinographic results were analyzed and compared.

The procedure for the statistical analysis carried out has been carried out with the T-Student test.

Results: There are significant differences in periods 3 and 4 for exposure 2.

Conclusions: There is a decrease in visual function when exposed to violet radiation.

Keywords: Violet Radiation, Black Light, Snoezelen.

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Correlation between lens vault and lens rise among myopic andhyperopic population

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Purpose: The anterior pole descriptive parameters are useful in the study of glaucoma and for the calculation of intraocular lenses in refractive surgery. There is a lack of evidence regarding the relationship of these parameters with each other. The aim of this study is to find correlations between lens vault (LV) and lens rise (LR) in a sample of healthy eyes.

Methods: This is a descriptive study. Two hundred and thirty eight healthy patients were recruited in an eye care center in Madrid (Spain). The sample was divided into four groups, according to refractive error: hyperopia, low-myopia (below 3D), mid-myopia (between 3D and 6D) and high-myopia (above 6D). Anterior chamber images were obtained with Anterion Swept Source Optical Tomography Coherence (Heidelberg). The LV is the distance between the anterior lens surface and the perpendicular point delimited by the spur to spur distance. The LR is the distance between the anterior lens surface and the perpendicular point delimited by the angle to angle distance. A comparison between LV and LR was performed in every group.

Results: A sample of 13 hyperopic (+4.06±1.84D), 22 low myopic (-1.27±1.24D), 79 mid myopic (-4.53±0.93) and 124 high myopic (-7.74±2.34D) patients were recruited. A significant strong positive correlation was found between LV and LR in all myopic groups (rho=0.939, 0.803 and 0.823, respectively. p<0.01). A non-statistically significant mid-correlation was found in the hyperopic group (rho=0.636. p>0.01).

Conclusions: There is a positive significant correlation between LV and LR in the myopia groups. A mid but non-significantcorrelation was observed in the hyperopia group, probably due to the low number of subjects. LV, as defined in Anterion OCT, seems to vary proportionally with LR.

Keywords: Anterior pole, Lens vault, Lens rise**.**

Contrast study of the Meibomian glands

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Introduction: Meibomian Glands (MG) are responsible for synthesizing and secreting meibum, this substance is the main component of the lipid layer of the tear film, acts by promoting its stability, preventing its evaporation, providing a uniform optical surface and acts as a lubricant for the eyelids during blinking. [1]

Some alterations in the MG imply a deficient production of meibum, which is directly associated with modifications of the tear film that cause multifactorial diseases related to these glands. [2]

It is necessary to carry out a structural and functional evaluation of MG for an early and correct diagnosis of related pathologies.

To evaluate MG, specialized imaging techniques are used. The most commonly used technique for the observation of MG is non-contact meibography with infrared (IR) light, this technique allows to see specific details of the MG, provides quantitative measurements, in addition to structural appearance, shortening, distortions or atrophy. [3]

The OCULUS Keratograph 5M (K5M) is considered the gold-standard device and employed infrared diodes of 840 nm to visualize glands.

In this study it will be observed the variation of contrast throughout the day between neighboring glands, known as interglandular contrasts (CINTER) and within the same gland, known as intraglandular contrasts (CIN).

Purpose: Observe the variation of contrast in MG throughout the day.

Methods: Eight participants were enrolled in this pilot study, all the participants were previously informed about the characteristics of the study and the tests that was carried out.

The inclusion criteria were:
- Men and women over 18 years of age
- Participants who have given written informed consent

Those participants with ocular inflammation, systemic medication usage, or presenting a disease that could impact ocular health and a history of eye trauma or surgery (including corneal refractive surgery) were excluded from the study.

- Experimental methodology:
    - Clinical tests
    - Examination of the ocular Surface
    - Capture images of the MG with the Keratograph 5M

- Computational methodology
  - Image processing with Matlab program
  - Excel
  - SPSS

Meibography images were taken every two hours from 8 am to 8 pm, the instrument that used was K5M which illuminates the glands with quasimonochromatic IR light centred on 840 nm, and, also, incorporates an IR camera to image the Meibomian glands, together with a software that improves the contrast of the images.

Result: It is expected to observe variation in contrast throughout the day in each of the participants, because the meibum is transported within the gland by the action of the eyelid muscles during blinking and this can vary the appearance of the glands as well as glandular contrast.

Conclusions: Studying the variation of contrast in MG throughout the day, it is expected to know more about the morphology and function of the MG.

Keywords: Meibomian glands, meibography, ocular Surface, contrast.

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Adverse Effects of Tamoxifen on the Anterior Ocular Pole

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Purpose: To determine the ocular effects caused by the use of tamoxifen (TMX) as a treatment for breast cancer.

Methods: This is an observational, prospective, and longitudinal study.

The sample will include women over 18 years of age previously diagnosed with breast cancer who start treatment with TMX. Those with ocular pathologies such as dry eye, ectasia, corneal or anterior surface alterations, or previous ocular surgery will be excluded from the study.

Recruitment and measurements will be taken at the Hospital Sanitas La Moraleja in gynecology and ophthalmology consultations, respectively.

Patients will be recruited at the end of their gynecological consultation when TMX treatment is prescribed. If they meet the inclusion/exclusion criteria, and after signing the informed consent form, measurements of the study variables will be taken at time zero (t0). Subsequently, the assessment will be repeated after one month (t1), three months (t3), and one year (t12) for follow-up.

The objective refraction will be obtained with the autorefractometer, and the high-contrast visual acuity will be measured with the best optical compensation; if necessary, subjective refraction will be carried out with trial glasses. The Keratograph 5M will be used to study the health of the anterior pole, obtaining objective information on the topography, the state of the tear film (height of the tear meniscus, lipid layer, and non-invasive tear break-up time), the redness of the bulbar and limbal conjunctiva, meibography, and pupillary reflex. Additionally, subjectively, the patient will complete the ocular surface disease index (OSDI) questionnaire incorporated into the same device, as well as the McMonnies test and the VF25 - VF14 quality of life questionnaire.

The patient will continue with their scheduled check-ups with the gynecologist and will be informed of the following visits, as well as being provided with a report on the evolution of the treatment. In the event of any anomaly being detected, an immediate referral will be made to the specialist with whom we collaborate for check-ups.

The sample size will be determined from a pilot study using GRANMO v7.12 software for a significance level $\alpha=0.05$ and a contrast power of 0.90 ($\beta=0.10$). SPSS statistical software will be used for data analysis. The normality of the variables will be assessed using the Kolmogorov-Smirnov test.

Keywords: Breast cancer, tamoxifen, dry eye.

Eye movements in visual search tasks in people with central vision loss

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Purpose: Bilateral loss of the foveal regions in both eyes may generate difficulty in focusing on targets mainly in near vision tasks. The behavior of extraocular motility was analyzed in people with central vision loss during target search and compared with healthy patients as a control group.

Methods: Inclusion criteria were persons older than 18 years, with central vision loss in both eyes and minimum visual acuity of 1.0 LogMar. 17 subjects (12 women, 5 men, age 58.9 ± 10.1) and 17 age-matched controls participated. An infrared light eye-tracker with a frequency of 60 Hz was used. The test was performed in front of a 23-inch computer screen at 60 cm from the subject. The visual search paradigm was used, creating a test consisting of 32 visual search tasks, each presented with gray background (RGB 226, 226, 226) to control pupillary size, 31 distractors, and 1 black target (RGB 0,0,0). The total number of fixations to perform each task, total number of saccades, pupillary diameter, duration of fixations, and time to find the target were measured. Parametric results were expressed as means and standard deviation and nonparametric results as medians and interquartile range; for comparison between groups the t-test was used for parametric data and the Mann-Whitney U test for nonparametric data. A p-value <0.05 was considered statistically significant.

Results: When analyzing the data and establishing a comparison between the group of patients and controls showed a statistically significant difference in the time to find the target (p=0.000), the number of fixations (p=0.000) and the number of saccades (p=0.000) and no difference is found in the duration of fixations (p=0.0521) and pupillary diameter (0.052) (Table 1).
The difficulty to focus stimuli in the fovea, may generate a greater number of fixations and saccades in order to try to compensate for the loss of central field, so the person tries to scan more in space in order not to lose any area, usually without any specific pattern [1], mainly when they are not clear about their preferential retinal locus and do not know their zone of best fixation [2], so it requires more effort for the person and may be related to poor oculomotor control, which can be improved with training [3].

Table 1. Metrics of eye movements in a visual search task

	Median TFT (IR)	Median Fix (IR)	Median Sac (IR)	Mean FD ± SD	Mean PD ± SD
Patients	96,46 s (270,71- 40,63)	13,35 (49,00- 5,47)	8,9 (3,38- 1,98)	191,53 ms	2,65 mm
Controls	15,72 s (44,27-7,77)	7,25 (9,81-4,14)	2,89 (10,50-1,96)	174,33 ms	2,61 mm
T-test				p=0,521	p=0,052
Mann-Whitney test	p= 0,000	p= 0,000	p= 0,000		

p<0.05
TFT: Time to find the target / Fix: Number of fixations per task / Sac: Number of saccades per task/ FD: Fixation duration / PD: Pupil diameter / IR: Interquartile range / SD: Standard deviation

Conclusions: The results suggest that a central vision loss may require people to perform a greater number of fixations and saccades to find a target, which implies a longer time in performing tasks and may have a high impact on their daily life.

These patients may be candidates for visual rehabilitation to train eccentric vision, fixation stability, improved search patterns and more effective access to information in their environment.

Keywords: eye-tracking, central vision loss, eye movements.

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Characterization of Spectral Response Function Using the Slanted-Edge Method

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Purpose: The estimation of solar-induced chlorophyll fluorescence (SIF) via remote sensing spectrometers requires high spectral resolution and advanced retrieval methods [1]. Calibration procedures have been examined using monochromators, the response of which must be known for the characterization of the instrument Spectral Response Function (SRF) [2].

This research aims to develop a spectral slanted-edge pattern using a monochromator. The pattern is captured using a hyperspectral pushbroom imager. The ISO 12233:2023 [3] algorithms designed for determining the spatial response of cameras can be adapted to measure the SRF.

Methods: The methodology was implemented on spectrometers, specifically the Headwall Hyperspec® high-resolution chlorophyll fluorescence (CFL) spectrometer was selected for this study. It consists of 2160 spectral bands, stepped 0.05 nanometers within the range of 670 to 780 nm. The referenced SRF shows a Full Width at Half Maximum (FWHM) ranging from 0.1 to 0.2 nm. The pushbroom imaging technique involves the sequential acquisition of spectral and spatial information by continuously scanning a stationary scene, generating two-dimensional images through the accumulation of one-dimensional across-track readings over time (along-track), called "frames".

The experimental setup involves a Czerny-Turner monochromator. A turntable-mounted grating provides temporal spectral modulation. A collimator-projector system targets the beam to the input of CFL. By synchronizing the spectral modulation with the frame acquisition time of the sensor, parameters can be adjusted to induce a spectral slope of 1 to 5 degrees for the slanted edge of image made with along-track pixels by rows and spectral bands by columns. This slope is managed by the equation:

$$\alpha = \tan^{-1}\left(\frac{t_s \cdot \Delta\lambda_M}{t_{Frame} \cdot \Delta\lambda_{CFL}}\right)$$

Here, α means the angle of inclination of the edge in the image, which is formed by the along-track lines and spectral bands focused onto a single across-track pixel. The step time (t_s) and the drive step size in wavelength ($\Delta\lambda_M$) are settings of monochromator. Correspondingly, for the CFL, the frame period (t_{Frame}) and the bands step ($\Delta\lambda_{CFL}$) are utilized.

The columns within the resultant image carry spectral information, and the processed edge can be linked with the line spread function, as measured by the ISO 12233:2023 algorithms, representing the SRF of across-track pixel.

Results: The figure 1 depicts results derived from ISO12233 processed data. Circle points represent normalized super-sampled edge, centered at spectral band 1080 and aligned with the field of view's center (nadir). Crosses indicate corresponding normalized SRF. A line of dots exposes an ideal Gaussian response, centered at 1079.3 with a 2.9 spectral bands FWHM – when multiplied by spectral band step, yielding 0.15 nanometers.
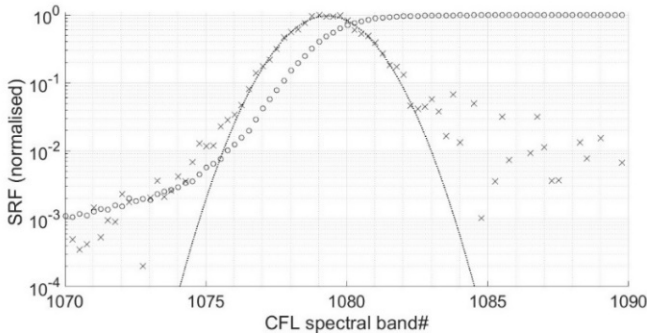

Figure 1. SRF obtained for CFL pixel across-track at nadir.

Conclusions: The proposed method enables SRF measurement of CFL using a spectral slanted-edge pattern.

Keywords: SRF, hyperspectral, Edge

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Validity of tests used for the diagnosis of Accommodative Excess

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Purpose: There is a lack of agreement on the diagnostic criteria for accommodative anomalies, including accommodative excess [1].

Failure with positive lenses in the monocular accommodative flexibility (FAM) test is considered one of the fundamental tests, but there are other clinical signs that can be affected [2,3].

Our aim is to analyse the validity (ROC curves, sensitivity, and specificity) for the diagnosis of Accommodation Excess of the following tests: Binocular Accommodative Flexibility (BAF), Fused Cross Cylinder (FCC), MEM dynamic retinoscopy (MEM), and Negative Relative Accommodation (NRA).

Methods: This was a prospective study. Participants were 142 subjects who were in 2nd year of ESO at the CEU San Pablo school in Madrid. The accommodation variables measured were monocular and binocular accommodation flexibility (MAF and BAF), accommodative response (AR) by FCC and MEM, and negative relative accommodation (NRA).

FAM was taken as the reference standard and ROC curves were performed for the other diagnostic tests: BAF, FCC, MEM and NRA. Sensitivity and specificity were then calculated for each of the accommodative tests analysed.

ROC curves were performed using IBM SPSS software version 27.

Sensitivity values were obtained by dividing the number of subjects with AE provided by both the tested test and the reference test (true positives from the tested test) by all positive results provided by the reference test (true positives plus false negatives from the tested test).

The specificity values were obtained by dividing the number of subjects with no AE provided by both the tested test and the reference test (true negatives from the tested test) by all negative results provided by the reference test (true negatives plus false positives from the tested test).

Results: The accommodative tests with the highest area under the curve (AUC) were, in order from highest to lowest: BAF, FCC, MEM and NRA.

The BAF test has a high sensitivity (0.88) and specificity (0.97). FCC test has a very good sensitivity value (0.90) and a good specificity value (0.79). MEM test has a very low sensitivity value (0.22) and a very good specificity value (0.96).

NRA test has a low sensitivity value (0.32) and a very high specificity value (0.97).

Conclusions: MEM retinoscopy and NRA tests have low sensitivity for the detection of Accommodative Excess and should not be used for the diagnosis of this condition.

Keywords: accommodative excess, sensitivity, specificity

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RapiDA V1: Repeatability

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Purpose: Dark Adaptation (DA) refers to the slow recovery of visual sensitivity in the dark, mediated primarily by rods, after being exposed to intense or prolonged illumination. How our eyes adapt to darkness may be a key biomarker of retinal health. It has been shown that DA is slower in aging and in age-related eye diseases such as macular degeneration (AMD), and that there is therefore a delay and decreased sensitivity in the rod response in such cases.(1)

RapiDA is an instrument that measures in real time rod-mediated DA, i.e. the recovery of rods after being exposed to bleaching.(2)

This study is carried out to determine the repeatability of rápida in young and older healthy subjects.

Methods: The sample consisted of 26 healthy adult subjects, workers at the center of the Faculty of Optics and Optometry of the Complutense University of Madrid. The test was repeated twice in order to know the repeatability of the instrument.

The measurements were carried out in the laboratory 16 of this faculty and on different days. It was necessary to adapt to darkness for 5 minutes in order to be able to perform the test with the adaptometer. The test was completed in total darkness, the subjects wore their usual optical correction and was performed monocularly, in the right eye. The eye was exposed to 20-30% photobleaching (36 Db) and the participant, while looking at a fixation point inside the eyepiece, had to press a button when a green arc-shaped stimulus located at 8º in the lower part of the eyepiece was detected. When the participant responded, the instrument itself automatically attenuated the stimulus and then increased it until it was detected again. At the same time, a graphical readout appeared which could be analyzed by the examiner.

To determine whether there was a correlation between the variables of greatest interest studied, ALPHA (cone-rod breakage time) and S2 (rod recovery slope), the interclass correlation coefficient was used with the SPSS program, considering those with a value equal to or greater than 0.8 to be strongly correlated.

Results: *Table 1* shows the correlation coefficient, lower and upper limit and p-value of the most relevant DA parameters provided by the instrument (S2 and ALPHA) in the first and second measurements for the 26 participants. As can be seen, there is no repeatability between the measures, since the correlation coefficient is far from the value 0.8. Furthermore, in the ALPHA parameter the

results are statistically different (p<0.05).

Interclass correlation coefficient					
	n	Correlation coefficient	Low limit	High limit	p-value
ALPHA	26	0,564	0.241	0.775	<0.001
S2	26	0.40	-0.339	0.408	0.420

Table 1. Interclass correlation coefficient of ALPHA and S2.

Conclusions:

1. Low repeatability is observed.

2. It is convenient to increase the sample for greater reliability and to study if possible changes in the flash intensity generate greater repeatability in the measurements.

Keywords: Dark adaptation, rod function, AMD

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Framework for evaluation of procedures for hdr luminance imaging measurements

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Purpose: Luminance distribution measurements with high dynamic range (HDR) are required for various applications (e.g. obtrusive light and glare evaluation of indoor and outdoor scenes [1] [2] [3]) where high contrast levels exist simultaneously in one scene.

The overall goal is to develop a methodology to evaluate by simulation the performance of different HDR image algorithms to provide accurate luminance measurements of those high-contrast scenes, when applied to luminance measurements from different cameras.

Methods: In order to accomplish this objective, different programs have been developed. As a first step, a virtual ground-truth (GT) scene needs to be created, which should coincide with the measurement of an ideal camera, devoid of experimental errors. Second, the camera response is modelled with the several types of error sources that occur in the measurement process, such as stray light, dark signal, nonlinearity, readout noise, blooming, smearing and other effects. Third, the process of camera calibration and measurement is modelled. The measurement includes the use of an HDR algorithm, where a sequence of multiple LDR images are acquired at different integration times in order to increase signal-to-noise ratio while avoiding saturation in the highest luminances, and then merged.

The evaluation of the virtual measurement from simulated camera response is based on going through the process inversely. i.e. correcting virtually from the camera response all those effects that can be corrected as for a real camera. This method allows the impact of the unreducible errors to be evaluated.

The final step is to compare the ground-truth scene with that determined by the virtual measurement.

Results: The main result is the developed software framework, which will be applied to understand how the different characterization and correction methods, camera characteristics, spatial luminance distributions, luminance ranges and HDR algorithms may affect luminance measurements with cameras, and also glare and obtrusive light assessment.

Conclusions: A methodology to evaluate by simulation the performances of different HDR image algorithms for providing accurate luminance measurements in high-contrast scenes has been developed to be applied to luminance measurements from different cameras.

A model-based software framework for generating an HDR luminance image from a sequence of multiple low dynamic range (LDR) images of a given GT scene has been developed with the aim of evaluating the luminance measurements with different luminance spatial distributions, luminance ranges, camera-related parameters and HDR algorithms.

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Influence of eye movements on academic performance: A bibliometric and citation network analysis

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Purpose: For many years it has been studied how eye movements influence reading and learning ability. The objective of this study is to determine the relationships between the different publications and authors. As well as to identify the different areas of research ocular movement.

Methods: Web of Science was the database for the search of publications for the period 1900 to May 2021, using the terms: "Eye movement" AND "Academic achiev*". The analysis of the publication was performed using the CitNetExplorer, VOSviewer and CiteSpace software.

Results: 4391 publications and 11033 citation net-
works were found. The year with the most publications is 2018, a total of 318 publications and 10 citation networks. The most cited publication was "Saccade target selection and object recognition: evidence for a common attentional mechanism." published by Deubel et al. in 1999, with a citation index of 214. Using the Clustering function, nine groups were found that cover the main research areas in this field: neurological, age, perceptual attention, visual disturbances, sports, driving, sleep, vision therapy and academic performance.;

Conclusion: Even being a multidisciplinary field of study, the topic with the most publications to date is the visual search procedure at the neurological level.

Keywords: oculomotor; motor skills; citation network; eye movements

Cone mediated dark adaptation: Developing a new test.

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Purpose: Dark adaptometry tests are very useful in the diagnosis and management of the retinal neurodegenerative diseases[1]. Although it has been shown that the loss of rod photoreceptors occurs before the loss of cones, foveal cones are also impacted during the initial stages of age-related macular degeneration. Our aim was to develop a test to assess cone-mediated dark adaptation (DA) based on the MOBILE-DA smartphone app[2].

Methods: The MOBILE-DA smartphone app for testing rod-mediated DA was modified to assess cone-mediated DA. Using an Android smartphone[2], and a 3º diameter achromatic flashing stimulus centered on the fovea, the measurements were made following an adaptive staircase of 0.007 cd/m2 level up – 0.009 cd/m2 level down. In a dark room, the smartphone was placed 40 cm from the subject, and the luminance thresholds were measured monocularly for 5 min following almost complete photopigment bleaching using a long-duration light exposure (60 seconds). Luminance Threshold (LT) recovery functions were fitted to an exponential decay model to determine the time constant (τ, seconds) of cone sensitivity recovery and final cone LT[3].

Results: The cone-mediated DA measured by the smartphone app resulted in τ of 91 ± 15 seconds; final cone LT of -2.29 ± 0.10 log cd/m^{2}, and R^2 of 0.96 ± 0.02. The time constant and final threshold values obtained through this app were comparable to those obtained through other established techniques.

Conclusions: The study shows that the smartphone app evaluating cone-mediated dark adaptation is a reliable tool recording luminance threshold changes during the process. These records suggest that the MOBILE-DA app is a well-suited tool for measuring cone-mediated dark adaptation.

Keywords: dark adaptation; luminance threshold, cones, rods, cone sensitivity recovery

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BTDF measurement of "thick" samples

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Purpose: Traditionally, the Bidirectional Transmittance Distribution Function (BTDF) has been used to describe the radiance, L_t, on the back surface of a "thin" sample due to the incident irradiance, E_i, on its front surface [1]. Nevertheless, recent BTDF measurements on samples with non-negligible lateral diffusion, or "thick" samples, have revealed a dependence of the BTDF on the irradiated area (A_i) and the measurement area (A_t). In this work, the BTDF of four "thick" samples with different scattering parameters has been measured varying A_i, and a general empirical relation between the BTDF and A_i has been found.

Methods: The measured samples have all the same thickness but they differ in the mean diameter and concentration of the scattering particles inside them. The BTDF, or more accurately the ratio between L_t and E_i, has been measured on the primary BTDF facility developed at the *Physikalisch-Technische Bundesanstalt* (PTB) [2]. A 642 nm laser was used for irradiating the samples at 0° from their normal direction and the detection was done also at 0° by an integrating sphere with a photodiode attached to it. The measurements were performed in an over-irradiation scheme ($A_i > A_t$), using different apertures on the irradiation system (diameters ranging from 6.1 mm to 30 mm) to generate different A_i while maintaining E_i, with a constant A_t on the sample back surface (5 mm in diameter).

Results: In Fig. 1 (left) the experimental results of L_t/E_i normalised to the value measured with the largest available A_i are shown for each sample. The results show that L_t/E_i increases for larger A_i and it seems to reach a constant value for "large enough" A_i, as expected according to the discussion provided in [3].
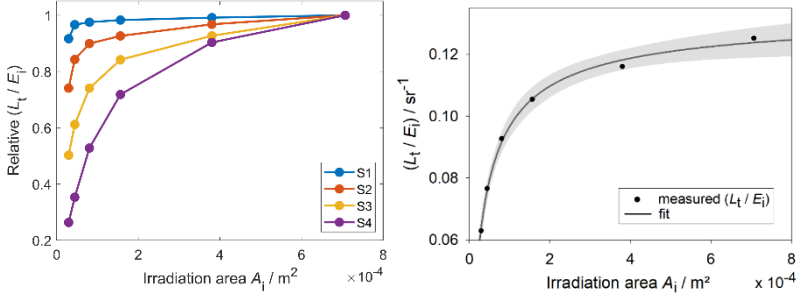
Fig. 1. (left) Measured values of L_t/E_i as a function of A_i normalised to the maximum for each sample and (right) measured values of L_t/E_i of sample S3 as a function of A_i fitted by the proposed empirical function. Grey bands depict the uncertainty component stemming from the fit only.

The relation of L_t/E_i with A_i depends on the different scattering properties of the samples, but with a similar behaviour that can be fitted by the following empirical function:

$$\frac{L_t}{E_i} = a\left(1 - \left(1 + \frac{b}{c}A_i\right)^{-c}\right), \tag{1}$$

with a, b and c as free parameters and A_i as the independent variable.

As an example, the measured L_t/E_i of sample S3 as a function of A_i is plotted in Fig. 1 (right), together with the fit from the proposed function in eq. (1).

Conclusions: The dependence of the BTDF on A_i has been studied for four "thick" samples and an empirical function to describe this variation was found.

It is expected that further studies on the physical meaning of the fitting parameters will allow the bidirectional transmittance of arbitrary samples to be quantitatively described.

Keywords: Scattering, transmittance, lateral diffusion.

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Involvement of the purinergic system in corneal healing and corneal permeability in a porcine *ex vivo* model.

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Purpose: To establish an *ex vivo* corneal healing and permeability model from porcine eyeballs to evaluate the involvement of purinergic signalling in these processes.

The failure in corneal epithelium regeneration could lead to issues like corneal opacity, infections, and even vision impairment or blindness, as this process is crucial for maintaining good visual quality (1). To enhance the understanding of this healing process and its contributing factors, several researchers have explored the effects of various molecules using different *in vivo*, *in vitro*, and *ex vivo* models (2,3). Also, the role of purinergic receptors has been studied, particularly P2Y2 and P2Y6, in cell migration, proliferation, and corneal permeability in rabbit models, with special focus on P2Y2 (4).

In this project, we will establish an *ex vivo* porcine model of corneal healing to assess the efficacy of contact lenses as delivery systems for potential treatments during these processes. The development of *ex vivo* models is necessary to reduce the use of laboratory animals used in science research, in agreement with 3Rs principle of animal experimentation (Replacement, Reduction, and Refinement). Considering the similarity that porcine tissues share with humans' tissues, it could be a better option for the development of corneal regeneration models and to explore the roles of purinergic signalling in corneal healing and to understand in depth the corneal barrier function.

Methods:
This thesis will design in two phases:

Phase 1: Identify the presence of purinergic receptors on the porcine ocular surface and characterize their role on corneal healing and permeability.

Eyeballs from common pig will be obtained from local slaughterhouse for human consumption. Animals will be both male and female and will have between 6 and 8 months and a weight between 90 and 150 kg.

To identify the purinergic receptors a protein identification assays will be designed based on immunodetection assays. These assays will be used to define in which tissues (specifically) these receptors are present.

Then the role of these receptor on corneal healing and permeability will be characterized in an *ex vivo* porcine model. The *ex vivo* porcine model will be established replicating the model created by Dr. Mario Crespo in his research at the Institute of Applied Ophthalmobiology (IOBA) of the University of

Valladolid. After eyeballs collection, the anterior segments will be separated and then the ocular surfaces will be placed in 6-well culture plates with this outer face up in culture medium maintained in an incubator at 371 C, 5% CO_2 and 95% humidity. To corneal healing assays, the wounds will be made by chemical injury using n-heptanol (undamaged corneal will used as negative controls). Finally, several pharmacological assays will be performed to evaluate the role of purinergic signalling on corneal healing and permeability.

Phase 2: Evaluate the efficacy of contact lenses as treatment to corneal wound healing by delivery of purinergic agonists and antagonists.
Several contact lenses delivery assays will be performed on an *ex vivo* porcine model to study the efficacy of purinergic agonists and antagonists' treatments, and it will be compared with topical delivery.
And finally, we will use the latest available version of SPSS software (IBM, USA) for statistical analysis.

Results: This project's results will have a significant scientific impact by introducing *ex vivo* porcine models for studying specific ocular surface disorders. These models will benefit our research group and foster new scientific projects.

Conclusions: In process.

Keywords: Corneal healing, *ex vivo,* purinergic signalling.

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Effect of Age on Ocular Biometry in an African Population

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Purpose: There are few studies that enable direct comparison of the ocular dimensions of subjects of different races[1-2]. Therefore, it is important to characterise the different ocular structures and visual parameters because in a globalised world it is easy for people of different races and ethnicities to come for routine check-ups. This characterisation makes possible to detect alterations or pathologies. There are many publications on the changes that the eyeball undergoes with age in the Caucasian and Asian population[3], but few or none on the African population[4]. Therefore, the aim of this study is to establish the basis for a characterisation study of the Senegalese population that will serve as a starting point for a more complete study.

Methods: This study was conducted with 233 subjects screened at the ¨Clinique Des Yeux¨ in Dakar (Senegal) during the period July to September 2023. Patients were grouped by age range, as shown in table 1 and 2. Patients included in this study met the following inclusion criteria: Senegalese persons of either sex who have always lived in Senegal, who have not undergone previous refractive surgery and have no previous ocular pathology. When patients arrived at the clinic, corrected and uncorrected intraocular pressure (IOP), central corneal thickness (CCT), pupillary diameters, keratometry (K1/K2) and objective refraction (Rx) were taken. All this was performed using NIDEK's TONOREF III equipment.

Statistical analysis was carried out using an SPSS statistical package. The parameters analysed were visual abilities as a function of age groups. The analysis of the variables was performed with an ANOVA (analysis of variance). Differences were considered statistically significant when the p-value was less than 0.05 with a 95% confidence interval. Data were considered statistically significant for $p < 0.05$.

Results: The results obtained are shown in the attached tables, in which it can be seen that both the keratometry values (k2), the pupilar diameter, as well as the refraction of the left eye, show statistically significant changes with age. This is consistent with previous studies showing that pupil size decreases with age, as does astigmatism, which is affected by changes in the force that the eyelid exerts on the cornea, which weakens with age. It has also been described that

refraction changes throughout life and is related to both anatomical and environmental changes related to the subject.

Age(years)	N	K1 RE (mm)	K2 RE (mm)	K1 LE (mm)	K2 LE (mm)	RX RE (mm)	RX LE (mm)
p-valor		0.16	0.32	0.22	0.04	0.56	0.11
0 to 9	8	43.9±2.1	45.2±2.1	43.9±1.8	45.5±2.4	-0.3±1.2	-0.6±1.6
10 to 19	11	43.6±1.7	45±1.7	43.7±1.6	45.1±1.8	-0.7±2.1	-0.7±1.1
20 to 29	25	42.3±1.4	43.6±1.4	42.45±1.3	43.7±1.6	-0.4±1.2	-0.3±1.3
30 to 39	38	42.5±1.6	43.3±1.6	42.63±1.5	43.5±1.6	-0.3±1.2	-0.3±1.2
49 to 49	24	40.2±1.6	40.5±1.7	40.25±1.7	41±1.7	0.5±1.5	0.0±1.7
50 to 59	25	42.9±1.4	43.7±1.5	42.98±1.3	43.8±1.5	0.25±1.3	0.5±1.2
60 to 69	24	43.2±1.5	44.1±1.5	43.4±1.5	44.4±1.6	0.1±2.3	0.4±1.9
70 to >	10	43.3±1.6	44.5±2.2	42.9±1.4	44.6±2.3	0.2±1.9	0.3±1.6

Table1. Average results obtained and their corresponding deviation. Own elaboration

Age(years)	N	IOP (mmHG)(RE/LE)	IOPC(mmHG (RE/LE)	CCT (um) (RE/LE)	Pupil Ø(mm)
p-valor		0.56/0.57	0.84/0.70	0.17/0.11	0.00/0.00
0 to 9	10	16.9±4/16.5±4	17.4±5/17.2±4	535±31/533±26	6.1.6±0.8/6.5±0.9
10 to 19	17	15.7±3/15.2±4	15.7±3/15.5±3	548±37/541±39	5.7±1.1/5.6±1.1
20 to 29	38	14.5±3/14.2±2	15.4±2/15±2	527±33/530±34	5.8±1.0/5.8±1.2
30 to 39	51	14.2±3/14.2±3	15±3/14.8±2	530±28/532±30	5.2±0.8/5.1±0.8
49 to 49	42	16.6±3/16.5±3	17±2/16.8±2	538±29/539±27	5.4±0.8/4.9±0.8
50 to 59	28	14.4±4/14.4±3	15.8±4/15.9±2	516±34/513±31	4.8±0.6/4.8±0.8
60 to 69	30	14.8±4/15.1±2	16.8±6/14.8±3	525±34/526±36	4.5±0.9/4.3±0.9
70 to >	13	15.8±5/14±4	16.8±6/14.8±3	532±27/526±26	3.9±0.9/4.0±0.7

Table2. Average results obtained and their corresponding deviation. Own elaboration

Conclusions: Work shows change in parameters very similar to those of other races and ethnicities. In the course of this work, it would be appropriate to amplify these analyses by comparing them with results measured in populations in other African countries and by comparing them with those studied in other countries on other continents.

Keywords: africans, characterization, age, ocular biometry

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