Libro de Actas 6ª edición PhDay

Madrid, 7 de octubre de 2022

Programa de Doctorado en Óptica, Optometría y Visión

FACULTAD DE ÓPTICA
Y OPTOMETRÍA
UNIVERSIDAD COMPLUTENSE
DE MADRID

Índice

PRÓLOGO

Hemos llegado a la sexta edición de nuestro congreso, el 6º PhDAY-FOO, organizado por y para los doctorandos de la Facultad de Óptica y Optometría de la Universidad Complutense de Madrid. Se trata de un congreso gratuito en el que estos jóvenes científicos podrán presentar sus investigaciones al resto de sus compañeros predoctorales y a toda la comunidad universitaria que quiera disfrutar de este evento. Apunta en tu agenda: el 7 de octubre de 2022. Será un congreso presencial, pero que permitirá acceder y participar como ponentes a través de videoconferencia a los doctorandos con impedimentos justificados para acudir de forma presencial.

A través de varias sesiones de presentaciones orales y en formato póster, nuestros doctorandos mostrarán la gran diversidad y riqueza de líneas de investigación incluidas en nuestro programa de doctorado. Se pretende difundir el trabajo desarrollado por los doctorandos de nuestra Facultad y a la vez contribuir a mejorar sus habilidades comunicadoras como científicos.

Si acabas de matricularte por primera vez en el doctorado no debes faltar a esta jornada pues es una estupenda toma de contacto con la que será tu labor académica-investigadora en los próximos años hasta desembocar en la presentación de tu tesis doctoral. Y si ya eres un doctorando veterano, tu mayor experiencia te permitirá disfrutar y apreciar el gran trabajo que hay detrás de los minutos disponibles para cada presentación.

Además de los propios estudiantes de doctorado, serán especialmente invitados 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 seréis bienvenidos a este congreso donde podréis conocer de la mano de sus protagonistas la interesante investigación vinculada a nuestro Programa de Doctorado.

Desde el Equipo Decanal de la Facultad de Óptica y Optometría y en particular, desde mi puesto de 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 6ª edición en la que me estreno como Coordinadora del Programa de Doctorado (se han inscrito un total de 52 estudiantes, de los cuales 37 serán ponentes). Igualmente, me gustaría agradecer al Comité Organizador (Elena Diz Arias y Ángela Gómez Manzanares) toda su dedicación, ilusión y profesionalidad. Sin todos ellos sería imposible que congreso logre las metas propuestas.

Almudena Crooke Álvarez

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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 realizar parte de la organización de la 6ª Edición del PhDAY FOO. Permitiendo de esta forma adquirir nuevas competencias a la hora de participar en esta clase de eventos.

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. Siendo un congreso hecho por y para los doctorandos. Gracias nuevamente por la implicación en los plazos temporales tan ajustados de este año que ha sido atípico.

Agradecer también a las empresas colaboradoras por el apoyo ofrecido 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 pertinentes participantes.

COLABORADORES INSTITUCIONALES

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EMPRESAS COLABORADORAS

COMITÉ ORGANIZADOR

Elena Diz Arias

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Ángela Gómez Manzanares

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

COMITÉ CIENTÍFICO

Alba Martín Gil

Doctora en Optometría y Visión por la UCM. Profesora Ayudante Doctor del Departamento de Optometría y Visión de la UCM, donde imparte su docencia en el Grado en Óptica y Optometría ("Óptica Fisiológica"), así como en el Máster en Optometría y Visión ("Contactología Avanzada en clínica" e "Intervención optométrica en enfermedades de polo posterior"), del cual además desde el curso 2021-2022 es coordinadora. Respecto a su trayectoria investigadora forma parte del grupo de investigación Bioquímica del Ojo (Ocupharm-092077), y su actividad ha estado enfocada en el estudio de la implicación del sistema purinérgico y melatoninérgico en la fisiopatología del glaucoma y de la superficie ocular, así como en torno a la contactología avanzada y su efecto sobre la fisiopatología de la superficie ocular. Presenta por tanto un perfil multidisciplinar, clínico y básico, con extensa experiencia en atención primaria.

Cecilia Arnaiz Schmitz

Grado en Economía por la Universidad Complutense de Madrid en 2013 y Doctora en Ecología en 2018, con la tesis de mención internacional "Propuesta metodológica para la planificación socio-ecológica del territorio. Casos de estudio de gradientes urbano-rurales en la Comunidad de Madrid" por las Universidades Autónoma y Complutense de Madrid. Profesora Ayudante Doctora de la Facultad de Óptica y Optometría, adscrita al Departamento de Biodiversidad, Ecología y Evolución, Unidad Docente de Matemática Aplicada. Su línea de investigación se basa en el desarrollo y aplicación de procedimientos matemáticos, para identificar y cuantificar tramas socio-ecológicas. Miembro del Grupo Complutense, Sistemas Socioecológicos, paisaje y desarrollo local (ADAPTA).

Cristina Álvarez Peregrina

Doctora en Ciencias de la Visión por la Universidad Europea de Madrid (UE); Máster en Dirección de Empresas (MBA) por IEDE; Licenciada en Ciencias Químicas por la UNED y Diplomada en Óptica y Optometría por la Universidad Complutense de Madrid (UCM). En la actualidad es profesora e investigadora en la UCM. Su docencia se centra en las asignaturas de optometría II y IV, así como en Clínica I. En la parte investigadora, sus principales líneas de investigación son miopía, superficie ocular, optometría clínica, hospitalaria y salud pública, y visión y deporte. Es autora de más de 45 publicaciones en revistas indexadas.

Eduardo Cabrera Granado

Doctor en Física por la Universidad Complutense de Madrid en 2006 con la tesis titulada "Inestabilidades espacio-temporales en láseres de estado sólido". Durante su carrera investigadora ha realizado estancias postdoctorales en la Universidad de Duke (2008) y en el Instituto Max Planck para la Física de Sistemas Complejos (2010). Actualmente es Profesor Titular de Universidad de la Facultad de Óptica y Optometría de la UCM desde 2018, donde imparte asignaturas relacionadas con el área de Óptica Física del Grado en Óptica y Optometría. Su labor investigadora se encuentra dentro del área de óptica no lineal y óptica ultrarrápida.

Laura de Diego García

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.

Laura Rico del Viejo

Doctora en Óptica, Optometría y Visión por la Universidad Complutense de Madrid (UCM) y Doctora en Ingeniería Biomédica por Wroclaw University of Science and Technology (WRO). En los últimos años su actividad profesional se ha centrado en la coordinación y monitorización de ensayos clínicos. Actualmente, Profesora Ayudante Doctor en el Departamento de Optometría y Visión de la Facultad de Óptica y Optometría de la UCM y su actividad investigadora está centrada principalmente en la superficie ocular, ojo seco, envejecimiento, interacción lente de contacto-ojo y lentes intraoculares.

Miguel Ángel Sánchez Tena

Doctor en Óptica, Optometría y Visión en 2011 por la Universidad Complutense de Madrid y Máster en Bussines Administration (MBA) por la Universidad Europea de Madrid. En la actualidad, profesor ayudante doctor en la Universidad Complutense de Madrid en el Grado en Óptica y Optometría y Máster de Optometría y Visión, impartiendo las asignaturas de Clínica y Envejecimiento del Sistema Visual. Autor de más de 40 publicaciones en revistas científicas indexadas nacionales e internacionales y comunicaciones orales/póster en congresos internacionales.

PONENCIA INVITADA

LA ILUMINACIÓN Y EL COLOR COMO FORMA DE VIDA

En esta charla, el Dr. Javier Muñoz de Luna hablará sobre su experiencia como estudiante de doctorado en la UCM y sobre la utilidad de los estudios de doctorado en la industria.

Hará un repaso de las tecnologías y conocimientos aprendidos durante los distintos trabajos de investigación que se llevaron a cabo como parte del doctorado y mostrará algunos proyectos industriales en los que se aplicaron.

Javier Muñoz de Luna recibió su doctorado en 2016, con una tesis titulada "*Sistemas de iluminación de altas prestaciones aplicados a bienes de interés cultural*".

Actualmente trabaja diseñando, fabricando e integrando sistemas optoelectrónicos para la medida de la contaminación de los coches en tiempo real en vías de circulación de alta densidad. Además trabaja como freelance en distintos proyectos relacionados con el diseño, integración y pruebas de sistemas de visión en infrarrojo.

PROGRAMA CIENTÍFICO

6ª Edición PhDAY- FACULTAD DE ÓPTICA Y OPTOMETRÍA 2022

07 de Octubre de 2022

PROGRAMA CIENTÍFICO 6ª Edición PhDay- FACULTAD DE ÓPTICA Y OPTOMETRÍA 2022	
9:00-9:15 h. INAUGURACIÓN	
Vicedecana de Posgrado e Investigación. Coordinadora de Doctorado en Óptica, Optometría y Visión: Almudena Crooke Álvarez	Salón de Actos
9:15-11:00 h. COMUNICACIONES ORALES. PRIMERA SESIÓN	
Coordinan: Dra. Alba Martín Gil Dra. Laura Rico del Viejo Dra. Laura de Diego García	Salón de Actos (Optometría y Visión)
Coordinan: Dr. Eduardo Cabrera Granado Dra. Cecilia Arnaiz Schmitz	Aula 16 (Óptica y Visión)
11:00-11:45 h. PAUSA PARA CAFÉ Y SESIÓN DE POSTERS	
Coordinan: Dr. Eduardo Cabrera Granado Dr. Miguel Ángel Sánchez Tena	Hall FOO (Óptica, Optometría y Visión)
11:45-13:15 h. COMUNICACIONES ORALES. SEGUNDA SESIÓN	
Coordinan: Dr. Miguel Ángel Sánchez Tena Dra. Cristina Álvarez Peregrina Dra. Laura Rico del Viejo	Salón de Actos (Optometría y Visión)
12:15-13:00 h. COMUNICACIONES ORALES. TERCERA SESIÓN	
Coordinan: Dra. Laura de Diego García Dra. Alba Martín Gil	Aula 16 (Óptica y Visión)
13:15-14:00 h. CONFERENCIA INVITADA *(patrocinada por Miranza)*	
Dr. Javier Muñoz de Luna	Salón de Actos
14:00 h. Entrega de Premios y Clausura	
NOTA: las sesiones desarrolladas en el Salón de Actos serán retransmitidas por videoconferencia	

DESGLOSE DEL PROGRAMA

9:00-9:15 h. Inauguración PhDay

SALÓN DE ACTOS

Vicedecana de Posgrado e Investigación. Coordinadora de Doctorado en Óptica, Optometría y Visión: Almudena Crooke Álvarez

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

SALÓN DE ACTOS (Optometría y Visión)

Coordinan: Dra. Alba Martín Gil; Dra. Laura Rico del Viejo; Dra. Laura de Diego García

- Changes in accommodative and binocular function following phakic Intraocular lens for high and low-to-moderate myopia. *Mª Esther López Artero*
- Effect of gender, age and race on ocular biometry. *Mame Diatou Toure Sarr*
- Comparative clinical evaluation of a new isofocal intraocular lens against monofocal intraocular lens*. Carla Charbel*
- Use of eye tracking devices in the vision field: A systematic review. *Leonela González Vides*
- Evaluation of retinal vasculature by OCT angiography in type II diabetes. *Nadia Mínguez Caro*
- Changes in iridocorneal angles after EVO Visian ICL phakic lens implantation. *Jesús Beltrán Murcia*
- Schlieren phase-shifting method for soft toric contact lenses measurement. Elena Durán Prieto *(on-line)*

AULA 16 (Óptica y Visión)

Coordinan: Dr. Eduardo Cabrera Granado; Dra. Cecilia Arnaiz Schmitz

- Customizing tear film dynamics for different patient characteristics. *Darshan Ramasubramanian*
- Comparison of primary facilities for traceable BSSRDF measurements. *Pablo Santafé Gabarda*
- Statistical characterization of macula and color retinal vasculature. *Asmae Igalla El Youssfi*
- Eye fixations and reading time are affected by the power distribution of progressive power lenses: an eye-tracking study. *Pablo Concepción Grande*
- Development of bidirectional reflectance scale in near infrared. *Néstor Tejedor Sierra*
- Development of e-Health technologies for big data analysis in contact lens. *Youssef Marrakchi Chikri (on-line)*
- Colour QR serverless distributed architecture. *Sara Ignacio Cerrato (on-line)*

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

Hall FOO

Coordinan: Dr. Eduardo Cabrera Granado; Dr. Miguel Ángel Sánchez Tena

- Measures of accommodative function in secondary school Year 9 and Year 13: a 4-year longitudinal study. *Esther Mármol Errasti* (Optometría y Visión)
- Analysis of the CISSve scores pre and post visual therapy in patients clinically diagnosed with convergence insufficiency. *Carlos Pérez Garmendia* (Optometría y Visión)

- Meibomian gland contrast measurement. *Elena Diz Arias* (Optometría y Visión)
- Objective refraction in a new isofocal intraocular lens. *Lidia María Pérez Sanz* (Optometría y Visión)
- Changes induced in the tear film after cataract surgery. *Rocío Rodríguez Vila* (Optometría y Visión)
- Establishing an experimental model for the study of myopia progression. *Gonzalo Valdés Soria* (Optometría y Visión)
- Biometric and biochemical changes after light deprivation in an animal model. *María Romaguera Plannels* (Optometría y Visión)
- Effect of obesity on visual function. *Carolina Moreira Estebaranz* (Optometría y Visión)
- Effect of the type of lens implanted on quality of life under different lighting conditions. *Inas Baoud Ould Haddi* (Optometría y Visión)
- Characterization of the anterior pole in a general population group without ocular pathology. *Jorge Donís de la Torre* (Optometría y Visión)
- Dynamics of contrast sensitivity recovery after photoreceptor bleaching. *Melisa Remis González* (Optometría y Visión)
- Identification of clinically relevant biomarkers in primary human trabecular meshwork cells exposed to TGF-β2 and mechanical strain. *Azza Dammak* (Bioquímica)
- Central nervous system regeneration: towards axonal guidance using biofunctionalized silk fibroin fibers as scaffold. *Cristina Castro Domínguez* (Neurociencia. Óptica)
- High dynamic range hyperspectral reflectance with application to Dalí s artwork: “Two figures (1926)”. *Ángela Gómez Manzanares* (Óptica)

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

SALÓN DE ACTOS (Optometría y Visión)

Coordinan: Dr. Miguel Ángel Sánchez Tena; Cristina Álvarez Peregrina; Dra. Laura Rico del Viejo.

- Changes in peripheral refraction according to soft contact lens design for the control of myopia. *Julia Bodas Romero (on-line)*
- New experimental and computational tools for multifocal contact lens designs. *Alicia López Raso (on-line)*
- Novel hydrogel contact lenses based on DMAA and HFPMA with high oxygen permeability. *Clara Lim (on-line)*
- Visual quality assessment and comparison of different scleral lens designs. *Ana Privado Aroco (on-line)*
- Development of multifocal contact lens patient reported instrument: item-bank design. *Elsa Albero Ros (on-line)*

12:15-13:00 h. Comunicaciones orales. Tercera sesión

AULA 16 (Optometría y Visión)

Coordinan: Dra. Laura de Diego García; Dra. Alba Martín Gil

- Characterization of the meibomian glands in patients with allergic conjunctivitis and its relationship with histaminase. *Jimmy Fernando Reyes Domínguez (on-line)*
- Protocol to follow to take measures in the entitled research effect of the elasticity module of soft contact lenses on the morphology and function of the meibomian glands. *Jorge Giovanni Vargas Velasco (on-line)*
- Pilot test of the entitled research effect of the use of artificial tears on the tear film and the conjunctive for different fixation

requirements, in healthy young adults. *Jairo Giovanni Rojas Yepes (on-line)*

13:15-14:00 h. Conferencia invitada

SALÓN DE ACTOS

Dr. Javier Muñoz de Luna

14:00 h. Entrega de Premios y Clausura

SALÓN DE ACTOS

PONENCIAS ORALES

Elsa Albero Ros

Jesús Beltrán Murcia

Julia Bodas Romero

Carla Charbel

Pablo Concepción Grande

Elena Durán Prieto

Leonela González Vides

Asmae Igalla El Youssfi

Sara Ignacio Cerrato

Clara Lim

Mª Esther López Artero

Alicia López Raso

Youssef Marrakchi Chikri

Nadia Mínguez Caro

Ana Privado Aroco

Darshan Ramasubramanian

Jimmy Fernando Reyes Domínguez

Jairo Giovanni Rojas Yepes

Pablo Santafé Gabarda

Néstor Tejedor Sierra

Mame Diatou Toure Sarr

Jorge Giovanni Vargas Velasco

Development of multifocal contact lens patient reported instrument: item-bank design.

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Purpose: The number of multifocal contact lens (MCL) users have experienced a significant growth in recent years [1]. The selection of the optimum presbyopic lens and reducing the presbyopic contact lens (CL) drop out rate and chair time is now a challenge [2]. Different evaluation techniques such as defocus curves, contrast sensitivity or reading speed are the usually chosen to provide reliable and valid data of the MCL performance [3]. However, it has been suggested that it is unwise to rely on initial consulting room tests to predict the success of MCL [2]. To find additional indicators for the MCL success is essential. Moreover, healthcare models have been experiencing changes, starting to pay special attention to the experiences of the patients. As for this, the inclusion of patient-reported outcomes (PROs), when evaluating the benefit of medical treatments and devices, is starting to be a requirement [4]. Consequently, the aim of the present study is to develop a valid and reliable computer adaptive testing (CAT) based PRO instrument for measuring the patient's perspective of the MCL performance.

Methods: The development of the new CAT-based PRO instrument will follow the next phases: content development (I), pilot testing and item calibration (II), validity and reliability (III) and cross-cultural adaptation to English (II). For the Item-Bank content development five phases were conducted to identify the content: (a) Qualitative review of the literature and existing PRO optometric instruments; (b) Focus groups with presbyopic patients and optometric experts; (c) Review of social media on the subject; (d) Classification and selection of items; (e) experts review.

Results: A total of 615 items were identified. The items were classified in 8 domains: Activity limitation (142 items); Visual symptoms (267 items); General symptoms (10 items); Ocular surface symptoms (84 items); Convenience (53 items); Emotional well-being (42 items); Economic issues (5 items); Cognitive

issues (12 items).

Conclusions: After a rigorous systematic identification through the different resources, 8 main domains were found to be important in the MCL performance for the presbyopic population. The 615 items found will be calibrated by performing Rasch-analysis among the responses provided to the items included in the item bank, to develop the CAT-based MCL-PRO instrument.

Keywords: Presbyopia, PRO instruments, Multifocal Contact Lenses.

References

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CHANGES IN IRIDOCORNEAL ANGLES AFTER EVO VISIAN ICL PHAKIC LENS IMPLANTATION

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PURPOSE.

Changes in ocular structures when implanting phakic lens (pIOL) must be known to define the correct fitting and size of the lens. The aim of this study is to describe how temporal and nasal iridocorneal angles vary over time after implantation of the EVO Visian ICL pIOL. A retrospective observational cohort study has been carried out to learn about the changes in these structures.

SETTING.

Clínica Rementería. Madrid. Spain.

MATERIAL AND METHODS.

This retrospective cohort study was conducted with patients who had implanted pIOL for myopia correction from 2015 to 2017 in Clínica Rementería, Madrid, Spain. Eyes of patients who underwent refractive surgery and complete the 12-month postoperative follow-up were included in this study. The inclusion criteria were age 21 years or older; stable refraction during the last 12 months; preoperative refraction within the pIOL power range (from -0.50D to -18.00D); anterior chamber depth measured from the corneal endothelium 2.80mm or greater; endothelial cell density > 2200 cells/mm2; clear crystalline lens; IOP between 10 and 21 mmHg.

By using OCOS® (STAAR Surgical Co.) both the pIOL power calculation using its modified vertex formula, and the size based in WTW and ACD from endothelium were calculated. Preoperative WTW and ACD were obtained by using the rotating Scheimpflug imaging system of the Pentacam HR system (Oculus, Wetzlar, Germany).

Postoperative temporal and nasal iridocorneal angles, AV- Anterior Vault (distance between endothelium and anterior surface of the pIOL) and PV- Posterior Vault (distance between posterior surface of pIOL and anterior surface of crystalline lens) in microns were measured using Visante AS-OCT (Carl Zeiss Meditec, Inc., Ireland) 1 month and 12 months postoperatively. All measurements were obtained in the horizontal meridian and under controlled luminance conditions: 1.17 lux for the scanning room and 2.08 lux the luminance of Visante AS-OCT. These luminances were measured using IsoTech 1335 Luxometer (TES Electrical Electronic Corp. Taipei, Taiwan).

For surgical implantation of the pIOL EVO Visian® ICL™, the patients' pupils were dilated 30 minutes prior to surgery. All surgeries were performed using topical anesthesia. Provisc viscoelastic material (Alcon® Surgical, Fort Worth, Texas, USA) was introduced into the anterior chamber and the pIOL EVO Visian® ICL™ lens was injected into the posterior chamber through a temporary 3.2mm incision. Viscoelastic material was removed from the anterior and posterior chambers by irrigation/aspiration with CENTURION® Vision System (Centurion) (Alcon® Surgical, Fort Worth, Texas, USA) phacoemulsification equipment using a balanced salt solution. All incision were closed by stromal hydration. Post-surgical protocol consisted of topical antibiotics and steroids.

The collected data were saved in a Microsoft Excel worksheet (v.8, Microsoft Corporation, Redmond, WA, USA). For the statistical analysis all data were processed and analyzed using IBM SPSS Statistics V25 Software (IBM, Armonk, New York, USA). Kolmogorov-Smirnov test and t-student were performed to confirm data normal distribution. Pearson Correlation was also used to confirm statistic relationship among variables ($p<0.001$).

RESULTS.

38 eyes of 19 patients were analyzed preop and postop 1 months and 12 months after surgery. The preoperative mean results for temporal angles were 43.579°±6.85° and for nasal angles 45.63±6.70°. 1 month postop mean value of temporal angles was 28.18°±5.20° and the mean value of nasal angles was 27.58±4.08°; a mean decrease of 15.43°±7.24° for temporal and 17.69±7.84° for nasal angles was observed for this period of time. 12 months after surgery the mean values for temporal and nasal angles were 30.91±5.23°and 29.64±5.15°, implying a reduction of 13.18±8.52° for temporal and 16.42±8.49° for nasal angles.

The PV and AV obtained 1 month postop was 509.74±208.41µm and 2497.32±264.65µm respectively. The results for PV and AV 12 months postop were 415.09±190.90µm and 2686.29±243.05µm respectively.

CONCLUSIONS.

Temporal and nasal iridocorneal angle values are reduced after pIOL implantation during the first month after surgery because the lens pushes forward the iridian structures causing this angular decrease; 12 months after lens implantation, the iridocorneal angles tend to recover and open up; this could be explained by the increase of the Anterior Vault. The angles on the temporal side tend to be more open than the angles on the nasal side.

Posterior Vault decreases during the first year, due to the settling of the lens in the sulcus; while the Anterior Vault increases, but not in the same proportion, because Posterior Vault value is affected by pupillary dynamics, accommodation and CLR.

KEYWORDS. ICL. Phakic lens. Iridocorneal angles.

Changes in peripheral refraction according to soft contact lens design for the control of myopia

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Purpose: Several research studies focus on the mechanism by which the progression of myopia is slowed down. It is believed that it could be caused by retinal peripheral defocus. Nowadays, there are different treatments to slow the progression of myopia, such as orthokeratology contact lenses, soft contact lenses with peripheral defocus, ophthalmic lenses or drugs such as atropine [1,2].

The aim of this study is to determine the changes in peripheral refraction according to the use of soft contact lenses for myopia control with 10 different lens designs.

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 10 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.

For the measurement of peripheral refraction, the Grand Seiko open-field autorefractometer, WAM - 5500 (Shigiya Machinery Works, Takamatsu-shi, Kagawa-ken, Japan) was used. It was placed at 2.5 metres away from a test that uses 3 mm diameter LED lights to indicate to the participant at what angle they should fix their vision. This test was also performed for near vision, in horizontal and vertical axis. It evaluates the central 60° of the retina (from 30° nasal to 30° temporal) in steps of 5°. The test was performed after 10 minutes of contact lens insertion.

Statistical analysis was performed using SPSS software version 25.0 (SPSS Inc., Chicago, IL, USA). For this analysis only the right eyes were analyzed.

Results were considered statistically significant when p-value < 0.05.

Results:

The results were evaluated in vector form M, J0 and J45 of each lens for each angle. Regarding to distance vision results, statistically significant differences ($p<0.05$) were found in the M component from 10° to 30º temporal for 5 of the 10 studied lenses, all of them being multifocal or dual focus design.

In relation to the results obtained in near vision for the horizontal axis, only 3 of the 10 lenses studied showed statistically significant differences ($p<0.05$) in the M vector, from 10° to 30º temporal, all of them being a multifocal design. However, the results obtained in near vision for the vertical axis showed statistically significant differences ($p<0.05$) from 15º to 20º (upper and lower) for 4 of the 10 lenses studied, two of them were EDOF design, and the other two were multifocal.

Conclusions: The contact lenses studied created retinal peripheral defocus. The contact lenses that create the most myopic peripheral defocus were multifocal lenses. The results obtained from this study also showed that contact lens decentration could influence the measurement of peripheral refraction, and further studies are needed to determine how this parameter influences myopia control.

Keywords: Soft contact lenses, myopia control, peripheral refraction.

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Comparative clinical evaluation of a New Isofocal intraocular lens against Monofocal intraocular lens.

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Introduction: Cataract, lens opacification, is the most common treatable cause of loss vision and blindness worldwide.(1) Opacified lens extraction and intraocular lens (IOL) implantation, are still the main management approach to cataracts. In this term, monofocal IOLs are the most commonly implanted.(2)
Given the high demand from patients for spectacle independence, multifocal IOL are becoming more and more used, providing satisfactory far, intermediate and near vision.(2) The goal is to create lens that provides good vision for different distances, although for this purpose the visual quality may decrease and photopic phenomena may appear when compared to monofocal lenses.(2) The EDOF (Extended Depth of Focus) technology is the most recent marketed, and has been developed with the aim of improving visual quality especially in intermediate vision (2) by creating a single elongated focal point to enhance the depth of focus.(3)
Aim: The aim of the present study is to investigate visual outcomes of an EDOF IOL (Isopure 1.2.3®) in comparison to a monofocal IOL (Micropure 1.2.3®) developed by the same manufacturer (PhysIOL, Belgium).
Methods: 50 cataract patients were recruited and received bilateral implantation, divided into two groups, one implanted with Isopure 1.2.3, device under investigation, and the control group implanted with Micropure 1.2.3, based on 1:1 randomization given by the electronic data capture. Each patient attends a total of maximum 11 visits over 12 months.
First, monocular best corrected distance visual acuity (CDVA), under photopic luminance conditions (85 cd/m^2) on the first implanted eye, was compared between both groups.
As secondary study endpoint several parameters was checked as manifested refraction, monocular and binocular distance corrected intermediate visual acuity (DCIVA), aberrometry outcomes, defocus curve, outcomes of halos and glare simulator, binocular contrast sensitivity under photopic and mesopic conditions (H3cd/m^2) as well as under mesopic conditions with a glare source.

Subjective outcomes are obtained by standardized questionnaires (QoV, PRSIQ, Catquest). Statistically significant difference was set at a level of 0.05.

Results: Mean corrected distance visual acuity (CDVA) postoperatively, at the 330-420 days visit, was -0.02±0.07 and -0.05±0.06, respectively in the group implanted with Isopure and the control group, no statically significant difference were found. CDVA with low contrast at 4m, 80cm and 66cm was respectively 0.32±0.09, 0.63±0.13 and 0.69±0.11 in the study group and 0.26±0.1, 0.53±0.15 and 0.59±0.16 in the control group (p value 0.024, 0.011 and 0.019 respectively).
The defocus curve shows a better intermediate vision with Isopure, with difference statistically significant at 1m (p-value: 0.048). (Fig.1)

Conclusions: The preliminary results show that the lens with Isofocal design provides better visual outcomes for intermediate distance, conserving a good far distance quality of vision, measurements compared to a monofocal lens.

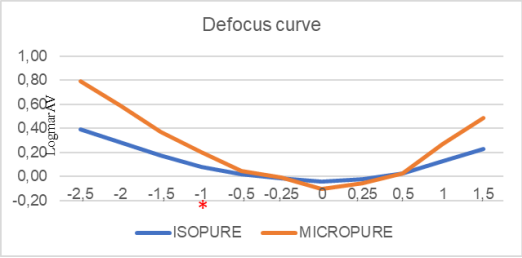

Figure 2 Defocus curve 6 months postoperatively.

Keywords:
EDOF extended depth of focus, IOL intraocular lens, Isofocal.

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Eye fixations and reading time are affected by the power distribution of progressive power lenses: an eye-tracking study.

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Purpose: Blur induced at the lateral regions of progressive power lenses (PPL) is responsible for swimming effects, unwanted distortion, and dizziness in dynamic visual conditions. But, also, it can affect reading skills and eye movements characteristics (1,2). We propose the use of an eye-tracking (ET) system to evaluate differences among PPLs with different power distributions. So, the goal of this research was to evaluate reading time and eye fixations at different distances while participants wore 3 different power distributions of PPLs using eye-tracking technology.

Methods: A prospective observational double-mask study was carried out on 28 presbyopic subjects (17 men and 11 women) with a mean age of 55±7 (from 46 to 65 years). All participants had normal vision and wore spectacles with PPLs up at least 6 months before starting the study. Reading time, fixation count, total fixation duration, and average fixation duration were analyzed for 3 experimental conditions: reading with a PPL optimized for near vision (PPL-Near), a PPL optimized for distance vision (PPL-Distance) and a PPL balanced for general use (PPL-Balanced). Subjects were asked to read aloud several texts with similar difficulty levels and the same letter size (Visual acuity=0.4logMAR) displayed on a digital screen at 5.25m and 0.37m. A chinrest was used to avoid head motion and force participants to look through the central and lateral regions of each PPL. A wearable eye-tracker system (Tobii-Pro glasses 3, Tobii AB, Sweden) with a sample rate of 50Hz was used to record binocular pupil position. The pupil position of participants was processed to obtain reading time and eye fixation characteristics using Tobii Pro Lab Software (Tobii AB, Sweden). Statgraphics centurion XVII.II Software was used for statistical analysis. The significance level was set at 0.05.

Results: At near-reading vision, PPL-Near showed a statistically significant lower reading time, less fixation count, and lower total duration of fixations in comparison with PPL-Balanced and PPL-Distance (Table 1). At distance-reading vision, PPL-Distance provided statistically significant lower reading time and lower total duration of fixations in comparison with PPL-Balanced and PPL-Near (Table 2).

Conclusions: Fixation characteristics and reading time are affected by the power distribution of PPLs. A PPL designed with a wider near region provides better near-reading performance while a PPL with a wider distance region performs better at the distance-reading task. Thus, the power distribution of PPLs affects users' performance at the vision-based tasks.

Keywords: Progressive power lenses, eye-tracker, eye fixations.

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Table 1. Reading time and fixations characteristics for near-reading vision.

	Reading time (s)	Total duration of fixations (s)	Average duration of fixations (s)	Fixation count
PPL-Near	36±8	25±7	0.23±0.67	110±28
PPL-Balanced	41±16	27±14	0.23±0.69	120±33
PPL-Distance	44±12	29±8	0.23±0.63	130±37
P-value	P<0.001*	P=0.020*	P=0.440	P<0.001*

Table 2. Reading time and fixation characteristics (for distance-reading vision.

	Reading time (s)	Total duration of fixations (s)	Average duration of fixations (s)	Fixation count
PPL-Distance	51±11	41±10	0.46±0.23	100±40
PPL-Balanced	53±10	43±10	0.44±0.22	110±40
PPL-Near	55±13	45±11	0.46±0.23	120±50
P-value	P=0.004*	P=0.010*	P=0.576	P=0.137

SCHLIEREN PHASE-SHIFTING METHOD FOR SOFT TORIC CONTACT LENSES MEASUREMENT

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Purpose: To validate the results of power of soft toric contact lens measured using the mentioned method using Schlieren phase – shifting method (NIMO TR1504).

Methods: 56 soft toric contact lenses made in silicone hydrogel material (Filcon 5 (60) [75%]) were measured in the NIMO TR1504 in wet conditions. This instrument considers the contact lens and liquid refractive index. To avoid spherical aberration influence, due to the design itself, optical zone diameter was set as 4,5mm. Spherical (Sph), toric (Cyl) and spherical equivalent (SE) power were considered for the assessment. The analysis to find any correlation between measurements and the nominal power were preformed using Matlab.

Results: Spherical equivalent measured is highly correlated with the nominal one (0.998; p-value<0.05). Spherical power is also correlated with nominal spherical value (0.981; p-value<0.05) but not with the toric nominal power (0.074; p-value>0.05).

Nominal and measured values showed a high lineal fitting as shown in figure 1.

Conclusions: The results achieved with schlieren phase-shifting method are valid and match with the nominal power, with was considered the target since it was the power written in contact lens label. However, it is observed some small amount of offset in the measurements. These differences have been also found previously in the literature [1] and could be explained due to the method of measurement and or calculations made by the own instrument software [2].

Schileren phase-shifting method is a suitable instrument for soft toric contact lens measurements. Further investigations should be made to understand the reason of the offset found.

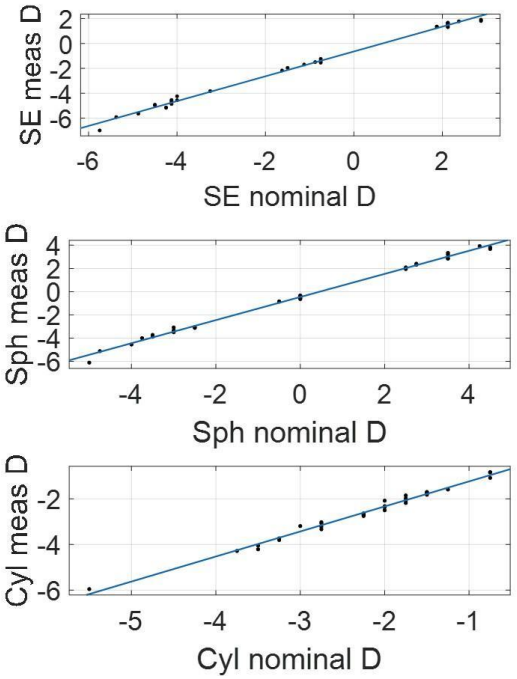

Figure 3. Lineal fitting of spheric equivalent (top), sphere power (middle) and cylinder (down) measured vs nominal in diopters (D).

Keywords: Soft Toric Contact Lenses, NIMO

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Use of eye tracking devices in the vision field: A systematic review

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Purpose: Eye tracking (ET) as a research tool is growing in popularity among researchers from different disciplines including health care. Since these devices use eye movements to collect data, it is interesting to learn about their application in vision sciences. This systematic review aims to know the use of eye tracking devices in the vision field and the main areas of application and metrics used during the last ten years.

Methods: **Design.** The preferred reporting item for systematic reviews and meta-analysis (PRISMA) was used to report this review. The search was run in January 2022 and rechecked in July 2022. Three databases were used to select studies: Scopus, Web of Science, and PubMed. Specific descriptors were selected, and the following search strategy was used: ((eye track**) AND (visual acuity)) AND (eye movements) AND (assessment) NOT ((drugs) NOT (psychology). Some inclusion and exclusion criteria were applied consistently throughout the process, those criteria were: 1) papers published between 2017 and 2022, 2) titles and abstracts related to the vision field, 3) studies applied in humans, 4) studies where eye tracking devices had been used as part of their methodology, 5) papers published in Spanish or English and 5) article types as a conference paper and journal article were included. Studies with animals or cognitive and psychological sciences related were excluded, also editorials and reviews. The study filter was performed by two independent reviewers, using those inclusion criteria.

Results: The search process in the three databases provided a total of 1340 papers. After the application of inclusion criteria 175 full-text studies were assessed for eligibility, of which only 141 were finally included.

Eye trackers application areas. The search performed allows finding scientific publications in which eye tracking devices are used, these were analyzed and

classified in the following areas: nystagmus (n=4), exotropia (n=4), visual acuity (n=7), visual field (n=9), amblyopia/strabismus (n=8), technology/visual equipment/virtual and augmented reality (n=21), binocular vision (n=2), vergences/phorias/ heterophorias (n=10), eye movements/processing speed/gaze stability (n=22), ocular pathology/low vision (n=22), assessment/diagnosis/rehabilitation/training (n=31), surgery (n=3), refractive error (n=59), Reading (n=9), driving (n=2), sport vision/locomotion (n=2) and oculomotor deficits (n=2).

Main devices used. The analyzed studies report the use of many. The most used devices are the Eyelink and the different models of the Tobii company. These devices are characterized by a measurement capability from 60 Hz and up. The devices report using corneal reflex eye recognition techniques using infrared light [1]. In some of the research, the use of eye tracking systems was incorporated into other devices as in the case of the SLO and the microperimeter, using eye tracking as a secondary resource that contributes to the main procedure being performed [2].

Main metrics used. The main metrics reported in the studies are fixations, saccades, smooth pursuit, microsaccades, and fixation stability. Also, the number of movements, frequencies, time duration are recorded. [3]

Conclusions: The use of eye tracking devices in the vision field has had exponential growth in the last ten years, they have been used both in ophthalmology and optometry. According to the results, they are mainly used in the visual evaluation, visual training, characterization of ocular pathologies, and obtaining basic ocular motility data. Since these devices extract specific data from the visual system, scientific and systematized research in the field should be promoted and take advantage of the facilities they offer and analyze their potential use in different areas in the optometry field to facilitate and improve clinical application processes.

Keywords: eye tracking technology, eye movements, vision sciences

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Statistical characterization of macula and color retinal vasculature

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Purpose: The goal is to validate the use of principal component analysis and the Mahalanobis distance statistic to characterize the difference between the macula of healthy and pathological retinas (RD Diabetic Retinopathy, Glaucoma, G. and Age-related Macular Degeneration, AMD), and changes in retinal vasculature color as pathology indicator.

Methods: Databases of images already classified by pathologies are used together with a control group. From these, the area of the macula is selected and subjected to a principal component analysis (PCA) for the groups of healthy and pathological retinas. This analysis allows the original images to be broken down into as many (main components) in decreasing order of their variance, in such a way that the first components summarize the main characteristics of the group. This allows quantifying the homogeneity of the group through the most relevant component (PCA1) and the areas that vary the most in the images through the Mahalanobis distance (D) [2-3]. It measures the distance of each pixel of the images to the mean value pixel of the control group in units of variability of the control group, quantified by matrix covariance S between control images. For the pathological groups, the pixels with distances greater than 95% of control ones are taken as abnormal. For macula, gray scale images are considered. A new Mahalanobis distance can be calculated for each pixel color Dc of pathological segmented retinal vasculature using the matrix covariance between RGB channels of control vascular pixels and abnormal point colors are selected.

Results: PCA1 with a similar spatial structure for the macula was found, representing 86% (control), 75% (G), 68% (RD) and 39% (AMD) (greater variability between pathological macules) of variance. The Mahalanobis distance shows exudates for RD, with large areas for G, although with less relevance (D values of almost half that for RD). For AMD we have both large affected areas and very high values of D (see Figure 1). Regarding the vasculature, the most altered color channel is green with a ratio of mean values to control (1.8 ± 0.3 for G and 1.9 ± 0.3 in RD) followed by blue (1.4 ± 0.4 in G and 1.5 ± 0.4 in RD). The affected vasculature percentage changes among retinas with a mean of 2.69% for G and 19.67% for RD (values as high

as 45.96%). The affected area is around the optic disc for G and for RD it is mainly the arteries. The mean Dc normalized by the control threshold is 1.2 for RD and 1.3 for G for abnormal color pixels. Examples of normalized Dc vascular maps are shown in Figure 1.

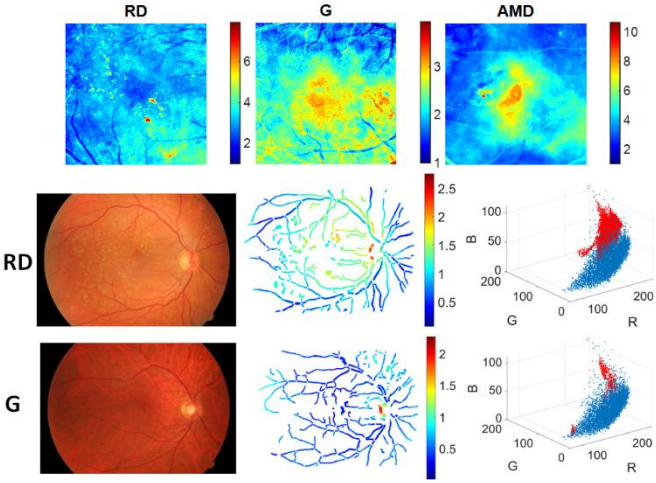

Figure 1: Mahalanobis distance, D,normalized by the control threshold for the macular zone (top); D>1, abnormal areas. The central and lower images show, from left to right, the analyzed retina (left), the Dcnormalized by the control vasculature (center) and RGB for Dc normalized >1 (control, blue dots, abnormal, red dots)

Conclusions: The Mahalanobis statistical distance allows characterizing abnormal areas in various pathologies and its value quantifies the degree of abnormality. For the vasculature, color changes occur mainly in arteries for the DR with large degrees of extension. The most altered channel is the green one (centered around 550 nm), which could suggest a connection with the hemoglobin light absorption.

Keywords: Retinal vessel color, Mahalanobis distance, retinal pathology quantification.

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Colour QR Serverless Distributed Architecture

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The QR codification[1] is a kind of codification which has information, and it is built to share information by scanning a dotted square image with the mobile phone.

Purpose:

The purpose of this thesis is to save the amount of the information of the QR codes and multiply the information on the QR. We have tested if the information disposal in the QR codes is saved meanwhile there are combined. To accelerate the process of encoding and decoding we have used the serverless distributed architecture.

Methods:

Firstly, three QR codes of different colours will be programmed. One of the QR codes in red which has RGB coordinates (255,0,0), other of the QR codes in green which has RGB coordinates (0,255,0) and other in blue which has RGB coordinates (0,0,255). This QR codes have the following information:

- Hola.
- Hello.
- Hi.

Figure 1: Red, green and blue QR codes

These QR codes will be encoded and decoded to evaluate if the information is maintained.

Secondly, this process will be updated to a serverless platform[2], in this case, Amazon Web Services (AWS) to accelerate the process of encoding and decoding.

Results:

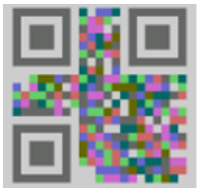

Figure 2: QR with all information

Table 1: Colour combination with its RGB coordinate normalized

Color combination	R Coordinate	G Coordinate	B Coordinate	Hue
C1	1	0	0	Red
C2	0	1	0	Green
C3	0	0	1	Blue
C4	1	1	0	Yellow
C5	1	0	1	Purple
C6	0	1	1	Cyan
C7	0	0	0	White
C8	1	1	1	Black

Conclusions:

One of the main conclusions was that there is not a loss of information in the process of encoding and decoding. And the second was that the serverless accelerates the process.

Keywords: Colour, QR, serverless

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Novel hydrogel contact lenses based on DMAA and HFPMA with high oxygen permeability

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Purpose: The oxygen permeability (Dk) of a contact lens is known to be a key property to allow the normal metabolic activity of the wearer's eye. Currently to reach high Dk, hydrogel contact lenses (CL) are based on silicone, but the latter one is not always well tolerated by the wearer and can be uncomfortable. The aim of the study was to develop an alternative high oxygen permeable material.

Methods: Two hydrogels based on Dimethylacrylamine (DMAA) of high-water content were synthesized using HexaFluoroisoPropyl MethAcrylate (HFPMA) and CycloHexyl MethAcrylate (CHMA). A conventional hydrogel CL (Gentle 59®, mark'ennovy, Madrid, Spain) was selected for control. The Young modulus and the contact angle of these lenses were measured, using the tensile test with the Instron 3343 tensiometer (Instron, Norwood, USA) and the sessile drop technique with the KRÜSS Drop Shape Analyzer DSA25S (Krüss, Hamburg, Germany), respectively. Dk values had been estimated using the polarographic method as stipulated by the ISO standard 18369-4.

Results: The Dk values (average ± standard deviation) were 18.8±0.4, 49.3 ± 4.3 and 63.6 ± 6.3 Fatt Dk units for the Gentle 59, hydrogel based on CHMA and hydrogel based HFPMA respectively. The Dk of the hydrogel based on HFPMA was higher than the one based on CHMA and the Gentle 59. The contact angles of the Gentle 59, the hydrogel with CHMA and HFPMA were 45°±4.2, 94°±8.5 and 106.5°±0.7respectively. The novel materials synthetized showed a higher contact angle than conventional CL. Finally, the Young modulus of Gentle 59, of hydrogel with CHMA and of hydrogel with HFPMA reached 0.323±0.019, 0.466±0.074 and 0.106±0.008 MPa, respectively, which are all modulus within the range of currently commercialized lenses.

Conclusions: The incorporation of HFPMA increased the oxygen permeability of the hydrogel. This material is a promising candidate for making new non-silicone contact lenses.
Keywords: Contact lens, hydrogel, oxygen permeability

Changes in Accommodative and Binocular Function following Phakic Intraocular Lens for High and Low-to-Moderate Myopia

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Purpose: Despite the great refractive change produced by myopia surgery with phakic intraocular lens (p-IOL) implantation and the tendency of myopic patients to have a greater accommodative lag than emmetropic or hyperopic patients with spectacle correction;(1, 2) there is no research comparing the accommodative and binocular changes between patients with different degrees of myopia implanted with p-IOL.(3)

We performed a prospective comparative cohort clinical study to evaluate accommodative and binocular function of p-IOL implantable collamer lens (ICL) in high and low-to-moderate myopia.

Methods: Myopic patients who underwent Visian® p-IOL ICL™ (STAAR Surgical Company, Monrovia, CA) implantation were divided into two groups based on the spherical equivalent (SE): high-power (SE ≤ -6 D) and low-to-moderate (SE > -6 D).

Inclusion criteria were myopia from -0.75 to -20 D and regular astigmatism lower than 1.50 D, age from 18 to 40 years, corrected distance visual acuity (CDVA) better than 20/25. Amblyopia, strabismus, accommodative dysfunction, previous strabismus or intraocular surgery, absence of binocular vision, anterior segment pathologic conditions, or pharmacological treatment with side effects on accommodative function were excluded.

The amplitude of accommodation (AA) with the push-up method,(4) monocular accommodative facility (MAF) measured in cycles per minute (cpm),(5) distance and near ocular deviation, near convergence amplitude, near point convergence (NPC),(6) stereopsis, and accommodative convergence/accommodation (AC/A) ratio, were assessed before surgery, 1 week and 1 month postoperatively.

Statistical analysis was performed by SPSS software (v.22.0, SPSS Inc. Chicago, IL) for each variable´s data. For the monocular variables, only data from the right eyes will be presented (7) The p-value threshold for statistical significance was set at 0.05.

Results: The study enrolled 38 patients with mean age 29.8 ± 4.7 years (range 21 to 38 years). The high-power group included 19 patients (mean preoperative SE -7.82 ± 1.18 D) and the low-to-moderate group with other 19 patients (mean preoperative SE -4.57 ± 1.06 D). Both groups improved to mean residual refractive error 0.18 ± 0.34 D and 0.09 ± 0.26 D at 1 month after surgery, respectively (p<.001). There was a significant decrease in AA in both groups between preoperatively and 1 week (p=.001; p=.008, respectively) and 1-month follow-up (p=.001; p=.008). MAF increased but there were no statistically significant differences. NPC blur showed statistically significant changes in both groups between preoperatively and 1 week (p<.001; p=.001) and 1-month follow-up (p<.001; p=.002). For the rest of the binocular measurements, no statistically significant postoperative changes were found in any group.

Conclusions: Accommodative and binocular function did not change after p-IOL ICL implantation in healthy patients with low-to-moderate or high myopia, except a decrease in the AA.

Keywords: Phakic Intraocular Lens, Myopia surgery, Accommodative and Binocular function.

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New experimental and computational tools for multifocal contact lens designs

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Purpose: Multifocal contact lenses emerge as a solution for presbyopia applications. They are normally designed devoting different pupil areas to different prescription powers. The aim of this work is to develop new experimental methods and computational tools to characterize and improve multifocal contact lens designs.

Methods: First, a total of 396 multifocal contact lenses (MFCL) of 4 different laboratories were measured with NIMO TR1504. NIMO is a device based on the phase-shifting schlieren method used to estimate the power profile and power map of contact lenses. Published results show that NIMO seem to be accurate and useful for the study of MFCL [1]. In this study, each lens was measured 3 times under the same conditions (1188 lens measurements in total). Power profiles and power maps obtained with NIMO were analyzed with MATLAB to study the statistical variations between the power profiles of each lens meridian (principal component analysis-PCA). In order to include off-axis points and dependence of lens prescription on pupil size in the visual quality analysis, Zemax OpticStudio was used [2]. Finally, a thermal camera was used to characterize the spreading of the lipid layer of the tear film on different eyes in order to assess its influence over tear film dynamics that could affect the fitting of different contact lens designs.

Results: Power profiles given by NIMO can be grouped in two types: step monotonic profile (where the far, intermediate and near zones were clearly visible) and progressive monotonic profile, where the profiles change continuously at the same rate (figure 1-a,b). Statistical analysis of the lens meridians enables to distinguish the part of the power map with rotational symmetry, the asymmetries introduced in the manufacturing process and the random power noise entered by the measuring instrument. In figure 1-c, the power variations with rotational symmetry represent 74.73% (1st PCA) of the total, the asymmetries introduced by the manufacturing process17.4%, and the noise of NIMO on the power map 7.74%. The probability distribution of the

noise is close to a Gaussian curve with mean zero and standard deviation of 0.12 D. Similar results are found in the rest of the lenses analyzed.

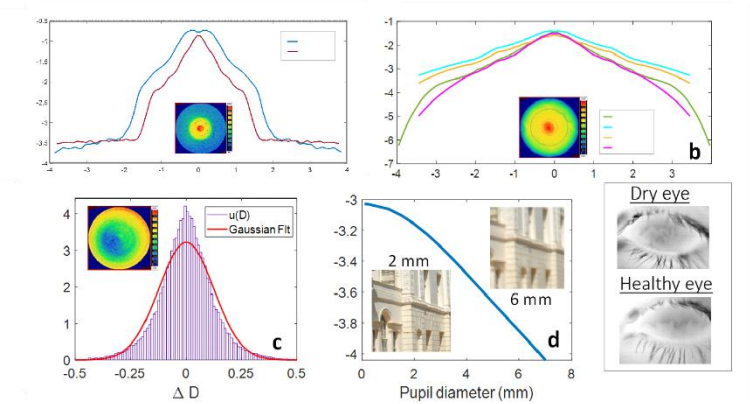

Figure 1: Power profiles of MFCL (a,b), noise of the NIMO power map (c), MFCL sphere with pupil sizes (d) and tear film thermal images (e)

The prescription perceived by the patient who is wearing a MFCL depends on his/her pupil size, and there is not a standard calculation to make this estimation. To give an objective procedure, the lens can be simulated in Zemax and its prescription can be obtained from the best image plane for each pupil size. (Example figure 1-d). In addition, this allows us to simulate the image quality, the Depth of Focus (DOF) from the calculation of the Visual Strehl ratio based on the optical transfer function (VSOTF) [3], and the peripheral vision. Finally, figure 1-e shows the difference in the lipid layer of the tear film distribution between a dry and a healthy eye.

Conclusions: NIMO was assessed to study MFCL power maps. Statistical analysis can separate noise and manufacturing asymmetries. Zemax is used to study MFCL visual quality in a more extensive way than is currently done.

Keywords: NIMO, power map, Multifocal Contact Lens, Zemax simulations.

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Development of e-Health technologies for Big Data Analysis in contact lens

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Purpose: Development of an App for e-health to study the quality and comfort of contact lenses. The application will include a video recording interface, an access to air contamination data using the localisation of the smartphone and a connection to a questionnaire that patient has to answer about the comfort and quality of vision during the use of contact lenses. To achieve this objective, an analysis of the patient video extraction features as blinking rate, quality, speed and duration, pupil, iris diameter among others features, will be required using the Matlab software environment. The final purpose is to find correlations between the comfort of the patient using a certain type of contact lenses and the environmental and weather conditions.
Methods: HTML5, CSS3 and JavaScript are used with Angular and Ionic libraries [1] for a hybrid application on Web, IOS and Android (mobile phones). It connects with nearby free access weather stations, collecting only environmental pollution data. From videos of the patient face taken at that moment, programs in the MATLAB environment are used to locate the eyes (Viola-Jones algorithms) [2] and analyze the frequency and duration of the blinks [3], based on mean value of video image rows in time. In addition, adding patient questionnaires, it is expected to collect joint data for later analysis in the MATLAB environment with an online server and various Big Data techniques.
Results: The application collects data and videos and are saved in a server. The videos are processed using Matlab algorithms. The mean duration of the blink for different patient videos is 0.44±0.11 seconds with a standard deviation similar to the standard deviation value obtained for each patient (0.13 seconds). The main difference between videos is the interval between blinks, with a mean value of 6.7 seconds, but with large standard deviation (7.7 seconds). The time duration of each video varies between 40 and 100 seconds. In Figure 1, the application programmed is shown as well as the link where the video is located.

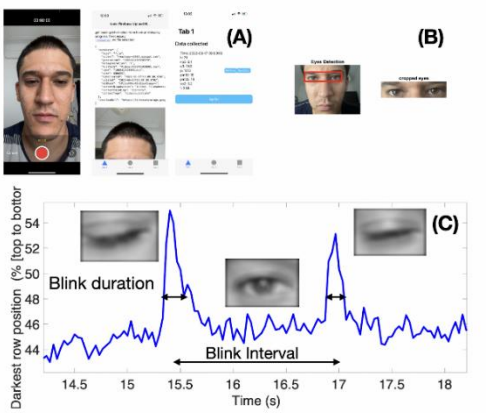

Figure 1: (A) E-Health Application and video recording interface and Air Contamination Data. (B) Viola-Jones Algorithm. (C) Blink interval and duration calculation.

Conclusions: The characterisation of the comfort and fit of contact lenses depends on a large number of factors, so the development of an application that collects both physical and behavioural data has a great importance. Hence, it is important to have an instrument that collects data in real time on a large number of patients for subsequent analysis using statistical techniques. The use of the algorithm designed in Matlab with videos taken by smartphone gives a plus to the current ways used to extract features from a video [4]. The ease of use is a plus given to the study that allows an instant collection at any time needed of data from the patient. The algorithm used in Matlab is robust and fast and can process data from a large number of patients. The computational resources needed are minimum and the algorithm is considered efficient respect to other ones used for the same purpose.

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

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Evaluation of retinal vasculature by OCT Angiography in type II diabetes

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Purpose: Although fluorescein angiography (FA) is the gold standard diagnosis tool to evaluate retinal vascularization newer modalities like Octical Coherence Tomography and Angiography (OCTA) offers quantitatively evaluation of both retinal vascular blood flow and retinal vasculature without the need of intravenous injection of dye(1)
We performed a cross- sectional comparative study with 3 groups (diabetic patients with mild DR(2,3), diabetic patients without DR and healthy controls) to analyze retinal vasculature parameters.

Methods: We included patients older tan 18 years without any ocular or systemic disease (healthy group) or with type II diabetes (diabetic patients with mild DR and diabetic patients without DR). Patients where good image quality was not possible to obtain were excluded. We calculated the sample size considering the differences between groups previously reported by others authors. A sample of 60 patients for each group was obtained.
A complete ophthalmological study was performed in all the 287 patients (552 eyes) including best corrected visual acuity and color fundus retinography.
We analyzed systemic variables as glycosylated hemoglobin (Hb1Ac), time since diabetes onset, type of DM treatment, presence of arterial hypertension, dyslipidemia or other current diseases.
We performed OCTA (Carl Zeiss Cirrus 5000) image acquisition with 3x3mm and 6x6mm macular cube angiography protocol and 4,5x4,5mm optic disc angiography. To evaluate the choroid, a high-definition line with enhanced depth imaging (EDI) technology was performed. Outcome measures were the foveal avascular zone (FAZ), vessel density (VD), acircularity index (AI), fractal dimension (FD) and vessel diameter index (VDI).

Results: We analyzed a total of 287 patients (552 eyes), 59,06% being males and 40,94% females with a mean age of 59,32.
Results pending of statistic analysis.

Conclusion: Conclusions pending of data analysis and interpretation.

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

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VISUAL QUALITY ASSESSMENT AND COMPARISON OF DIFFERENT SCLERAL LENS DESIGNS

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Purpose: In the fitting of scleral lenses, we can frequently find a decentering of the lenses, resulting in the optical axis of the lens and the visual axis not coinciding (1-3). The main disadvantage of this decentering is that produces a decrease in optical and visual quality, as it increases higher order aberrations (such as vertical and horizontal comas) (4), as well as inducing a prismatic effect in the patient's vision. A longitudinal, prospective, mulicentric study was performed to compare the visual performance of two multifocal scleral lens designs, with conventional-optics and decentered-optics, and a monofocal design.

Methods: Twenty adult patients (51.9 ± 3.8 years) with regular corneas participated in this study voluntarily after signing the written informed consent, which explained the purpose and procedures of the study. The clinical evaluation was performed at the Optometry Clinic of the Complutense University of Madrid (Spain) and the project was approved by the Clinical Research Ethics Committee (CEIC) of the *Hospital Clínico San Carlos* of Madrid. Patients were fitted with three Onefit MED® scleral lens designs: a monofocal design (MS), a conventional multifocal design (CMS) and a multifocal design with the optical zone decentered (DMS), following the manufacturer's fitting guide. The decentration of the DMS lenses was calculated from the pupillary center by image processing using Matlab software. The following tests were performed: binocular defocus curves, contrast sensitivity for different spatial frequencies (CSV-1000 test), stereopsis (Titmus test), aberrometry (Visionix VX110) and subjective quality of vision and comfort (visual analog scale). Values were analyzed and are presented as mean ± SD. A p-value<0.05 was considered statistically significant.

Results: In far, BCVA (in LogMAR units) with MS lens was 0.09 ± 0.10, being -0.11±0.08 for CMS lens and -0.13 ± 0.06 for DMS lens ($p > 0.05$). A statistically significant improvement was obtained for intermediate BCVA with DMS lens, -0.13 ± 0.06 and CMS, 0.08 ± 0.07, compared to MS lens, 0.33 ± 0.24 ($p < 0.05$). For near vision, significant better performance was also obtained with the DMS design compared to CMS and MS, obtaining values of 0.09 ± 0.16, 0.21 ± 0.14 and 0.61 ± 0.29, respectively ($p < 0.05$). In contrast sensitivity for different spatial frequencies, statistically significant differences were found for a spatial frequency of 6cpd between the MS and CMS designs ($p < 0.05$) and between the MF and DMF designs ($p < 0.05$). At the 12 cpd frequency, differences were found between MF and CMF ($p < 0.05$). Finally, for 18 cpd there were differences only between MF and CMF designs ($p < 0.05$). In stereopsis, no statistically significant differences were found between any of the three designs MF 72.1 ± 52.13, CMF 67.4 ± 32.63 and DMF 58.3 ± 23.83 sec arc ($p > 0.05$), but clinically the best values were obtained with the DMF design. As for aberrometry, no differences were found in spherical aberration or horizontal coma between the three scleral lens designs, but differences were found in vertical coma aberration, where the DMF design showed better values than the other two designs ($p < 0.05$). Finally, for subjective vision, a significant statistical improvement was also found with the DMS design (79.67 ± 7.02) compared to CMS (67.33 ± 7.63) and MS lens (67.33 ± 7.63) ($p < 0.05$).

Conclusions: Multifocal Scleral lens is an important clinical and scientific field we must explore. Decentered-optics multifocal scleral lens shows better visual performance than conventional multifocal design.

Keywords: scleral lens, multifocal, optic quality.

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Customizing Tear Film Dynamics for different patient characteristics

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Purpose: The characterization of the tear film is of vital importance in numerous areas of visual optics due to its influence on dry eye, etc. This study aims to use experimental patient characteristics to adapt different mathematical models of tear film dynamics to different patients and situations (contact lens fitting and so on).

Methods: The dynamics of tear film were simulated with a precorneal tear film mathematical model with various conditions such eye fully open after blinking, during blinking, or ever of contact lens motion. Some of these models were implemented in proper software developed in MATLAB. After blinking, the tear film model was simulated using the standard parameters and model given in [1-2], introducing the geometric (tear meniscus) and physical parameters of the tear (viscosity). It allows us to adapt them to different patients' and dry eye conditions. The tear meniscus height was measured with Optical Coherence Tomography (OCT) (figure 1-A) for different patients. The patient blinking velocity was measured from video recordings according to MATLAB PIVLab application [3] and introduced into the tear film model. Contact lens motion could be added to the pre-corneal tear film with standard patient blinking.

Results: The results for tear film thickness with the eye fully open show a tear thinning over time with an additional drop before each meniscus (Figure 1-D1). The model uses different viscosity values that depend on the patient's health of the eye. For a healthy eye, viscosity values are averaged at around 5.95 mPa-s whereas, for a dry eye patient, viscosity values are averaged at around 30 mPa-s [4]. With the increase in viscosity, the results show that there is tear thinning in the central portion of the eye compared to the healthy eye. When introducing the real eyelid movement (Figure 1-C) and comparing it with the nominal values taking given in [2], the film is thicker towards the moving end during the movement of the upper lid from the bottom to the top of the eye, thins near the ends during the interblink, and again thickens during the movement from top to bottom. The main difference between different blinking velocities is near both eyelids (upper and lower tear meniscus), with a time

difference of around one micron amplitude before the upper lid meniscus (Figure 1-D2).

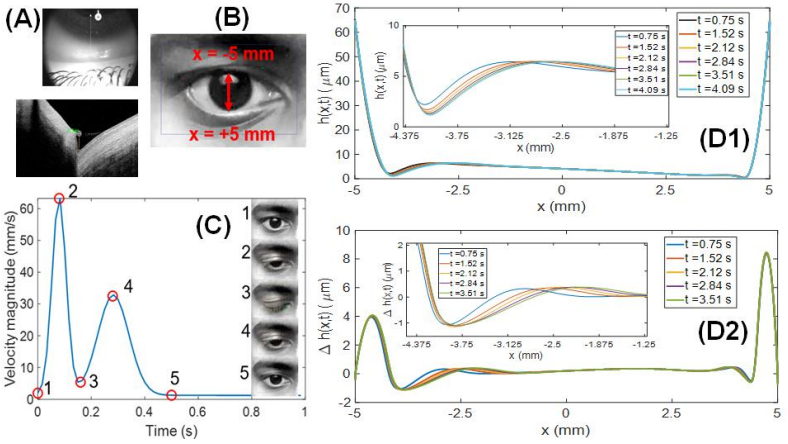

Figure 1: (A) Tear meniscus from OCT, (B) Space coordinates for the models, (C) Fitted eyelid velocity for a patient, (D1) Tear thickness in space and time for parameters [2], (D2) Tear thickness difference with a real measured patient.

Conclusions: For dry eye conditions the models show that the surface tension of the tear increases, causing less tear stability. The main changes for patients' measured parameters case are the magnitude of upper and lower eye meniscus and time variations in a closer region to the center of the eye. This could be of interest for the simulation of contact lens fitting. Because model space data are given in time, dynamic characterization can be done.

Keywords: Tear Film dynamics, blinking models, contact lens fitting.

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CHARACTERIZATION OF THE MEIBOMIAN GLANDS IN PATIENTS WITH ALLERGIC CONJUNCTIVITIS AND ITS RELATIONSHIP WITH HISTAMINASE

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Purpose: The research seeks to analyze, using Oculus Keratograhp 5, the existence of any dysfunction in the Meibomian glands, which may affect the lubrication and moisturization of the ocular surface, in patients with allergic conjunctivitis and its relationship with the presence of histaminase in tears.

A descriptive, prospective, cross-sectional study is proposed in a population of patients diagnosed with allergic conjunctivitis and who attend the Optometry Clinic of La Salle University. On this occasion I want to delve into the measurement of the aberrations that a patient with allergic conjunctivitis may present at the ocular level, as a contribution to PhDay-FOO 2022.

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 the patients will comply with the following steps:

The tear film and the function of the Meibomian glands will be evaluated in both eyes, with the TF Scan module (Meniscometry, NIKBUT, lipid layer thickness and tear film dynamics), the R Scan module (analysis of ocular redness presented by the patient) and finally the Meibo Scan module (evaluate the morphology of the Meibomian glands)

By means of the Zeiss I Profiler equipment, the measurement of the aberrations that may occur at the ocular level will be carried out in patients with allergic conjunctivitis [1], classifying the results according to the Zernike polynomials [2].

Histaminase concentration will be measured by enzyme-linked immunosorbent assay (ELISA) technique. This test is non-invasive.

Results: As progress, the research already has the approval of the Ethics Committee of the Faculty of Health Sciences of the University of La Salle, approval of the research committee of the University of La Salle and approval by the Directorate of the Optometry Clinic for the use of equipment and assessment of patients.

The project will follow the principles of the Declaration of Helsinki, resolution 8430 of the Ministry of Health that regulates human research in Colombia

Conclusions: Information pending at the end of the investigation.

Keywords: Allergic conjunctivitis, ocular surface, tear film.

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PILOT TEST OF THE ENTITLED RESEARCH EFFECT OF THE USE OF ARTIFICIAL TEARS ON THE TEAR FILM AND THE CONJUNCTIVE FOR DIFFERENT FIXATION REQUIREMENTS, IN HEALTHY YOUNG ADULTS

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Purpose of presentation

Within the research process, the relevance of the application of a pilot test is not evident. Show the great importance of the development of a pilot test in the research process. Emphasize and explain in detail the development of the pilot test of the investigation

Methods:
Prospective cross-sectional clinical study in a population of young adults, aged between 19 and 35 years.

Proposed Protocol: Three evaluations of the tear film and the conjunctiva will be carried out, in three days, with a difference between them of at least 8 days. Each day the participant will have acute exposure to fixation activities (1).

The subjects will answer the OSDI questionnaire (2) and will be evaluated with the Keratograph 5M. (3)

Before starting to evaluate the research participants, a pilot test was carried out, which consisted of applying the designed protocol, in a small group of people.

The pilot test of the research was done at different times, because the selected subjects must carry out several steps during their participation in the research. The previous partial tests were carried out on each occasion with 5 subjects.

- In the first place, a pilot test was carried out with the completion of the informed consent in order to determine the comprehension of the reading, resolution of the concerns about the Project, signature of the document by the participant and the witnesses and the total time it takes to make this process complete.
- The second part consisted of carrying out the initial test of the completion of the Ocular Surface Disease Index questionnaire, in which it was determined if there was any concern with its completion, and knowing the time for the registration of the requested information.
- Next, the next step was to define the care protocol with the Keratograph 5M and the duration of the selected test. At this point it was necessary to carry out 7 previous tests to define the final protocol to be carried out with this equipment.

After completing the aforementioned, the general pilot test began, with 10 subjects, assessing each of the participants on three occasions (on different days).

This allowed to perform:

- The data collection format
- The data consolidation format for statistical analysis

Conclusions:

The results of the pilot test allowed:

- Identify problems with the research project
- Estimate research costs and calculate the duration of the evaluation of the participants
- Determine sample size
- Identify the statistical test to apply for the analysis of results

Keywords: pilot test, preliminary study, feasibility study.

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Comparison of Primary Facilities for Traceable BSSRDF Measurements

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Purpose: To date, no traceable measurement of the Bidirectional Scattering-Surface Reflectance Distribution Function (BSSRDF) exists, and, therefore, there is no standard for the measurement of this quantity. Two primary facilities for traceable BSSRDF measurements have been developed in two different metrology institutes, the Institute of Optics of the Spanish National Research Council (IO-CSIC) [1] and the French National Conservatory of Arts and Crafts (CNAM), and their results measuring the BSSRDF of the same three translucent samples have been compared to propose a standard. With this standard, the scale of the BSSRDF will be able to be transferred to other measuring systems.

Methods: The measurement setup of both facilities is based on a goniospectrophotometer, but there is a main difference regarding the detection system used in each case. In the goniospectrophotometer developed at CSIC, a Complementary Metal-Oxide-Semiconductor (CMOS) camera is used as a detection system, while in the goniospectrophotometer developed at CNAM, the detection is made by a luminancimeter.

This comparison consists in the measurement of the BSSRDF of three translucent samples with different levels of translucency: almost opaque (sample A), translucent (sample B) and almost transparent (sample C). The samples were measured with an illumination wavelength of 550 nm at three different in-plane measurement geometries: 0º illumination – 45º observation, 45º illumination – 0º observation and 60º illumination – 15º observation.

Results: The BSSRDF of the proposed samples has been measured according to the measurement model of each facility. The obtained results show that the measurements on samples A and C (almost opaque and almost transparent) with the facility developed at CNAM are very noisy; in the first case because of the few scattering events inside the volume of the sample, and in the second case because of the high loss of transmitted light.

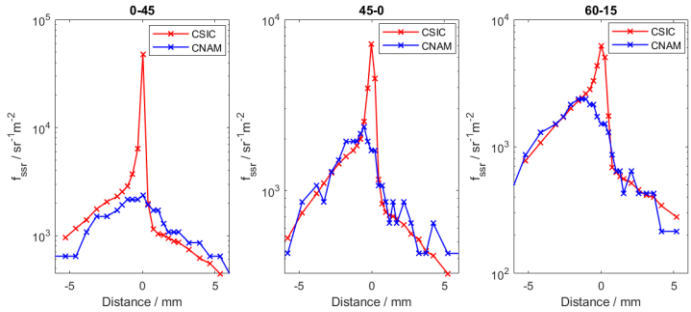

Fig. 1. BSSRDF results on the most translucent sample for CSIC (red) and CNAM (blue) measurements.

Nevertheless, there is a good agreement on the results of sample B, which are shown in Fig. 1. The absolute value of the compatibility between the obtained values at CSIC and CNAM is lower than 1 for all the measurement geometries at all positions on the sample surface that are outside the irradiated area (i.e. where the reflected light comes only from scattering events occurred in the volume of the sample).

Conclusions: According to the obtained results, the sample selected for being proposed as a BSSRDF standard is the sample B, and its standard BSSRDF value is the one measured at CSIC, since the method used by CNAM has an uncertainty too high. In this way, it is recommended to use cameras instead of luminancemeters for measuring BSSRDF. This standard can be used to transfer the BSSRDF scale to other measuring systems and obtain its calibration factor.

Keywords: BSSRDF, scattering, comparison.

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DEVELOPMENT OF BIDIRECTIONAL REFLECTANCE SCALE IN NEAR INFRARED

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Purpose: Because of the relevance on near infrared spectral interval in materials surface characterisation, it is becoming necessary to have a scale to be able to carry out the Bidirectional Reflectance Distribution Function (BRDF) measurement in that spectral range. This function describes the emerging radiance with respect to the incoming radiance on a surface when the incidence is directional.

Methods: The scale has been developed using a highly reflective and diffusive ceramic sample, whose BRDF has been measured using our gonio-spectrometer [1] in the wavelength interval located between 800 nm and 1700nm. This system contains an illuminating system consisting of a laser driven light source (LDLS), a monochromator and an optical system that conducts the radiant flux to the sample. The positioning system realizes the incidence and collection directions and consists of a robot arm together with a rotating plataform, where the detection system is located. This is essentially an InGaAs photodiode, with a precision aperture fixed to it to define the area of incidence on the detector surface.

The equation used to measure the BRDF [2] was:

$$f_{\mathrm{r}}^{s}(\theta_{\mathrm{i}}, \phi_{\mathrm{i}}; \theta_{\mathrm{r}}, \phi_{\mathrm{r}}; \lambda) = \left(\frac{S_{\mathrm{r}}}{S_{\mathrm{d}}}\right)\left(\frac{1}{\omega_{\mathrm{r}} \cos\theta_{\mathrm{r}}}\right);$$

when the d subscript indicates the photodiode signal for the incidence radiation, whereas the r subscript indicates the signal reflected by the sample. The equation also involves the collection solid angle (ω_{r}) that is

measured directly using the photodiode-sample distance and the precision aperture diameter that defines the detector acceptation radiation cone, and the cosine of the polar angle of collection (θ_r).

Results: In the Figure 1 the BRDF measurement results and his uncertainty for the 0º 45º geometry are shown, the PRD value for the reference is represented as well.

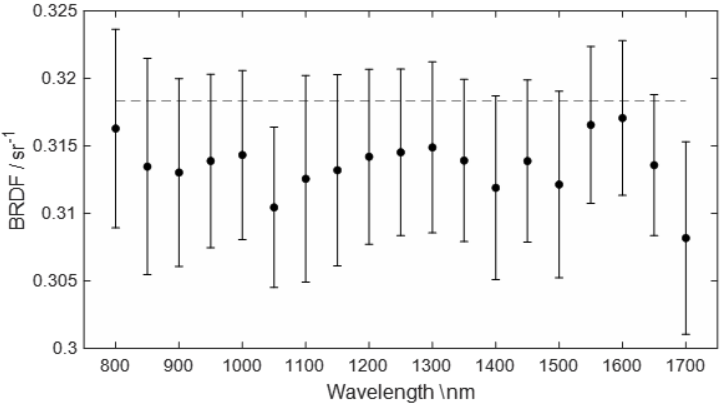

Figure 1. BRDF (θ_i=0º, ϕ_i=0º, θ_r=45º, ϕ_r=0º) and uncertainty of measured sample; the discontinous line indicates the value for a perfectly reflecting diffuser.

Conclusions: After the evaluation of the results, we can see that the method used to obtain the bidirectional reflectance is valid for establish a BRDF measurement scale in the near infrared spectral range, with and an expanded relative uncertainty of around 2%, that can be improved using a calibrated aperture.

Keywords: reflectance, bidirectional**,** infrared.

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Effect of Gender, Age and Race on Ocular Biometry

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Purpose: The goal of this thesis is the comparison of different biometric measurements in populations with different ethnicity, sex, age, and environmental condition.

Several studies have shown an association between ocular biometry, especially axial length (AL), with refractive errors.

Hosny, et al.[1] found that the corneal diameter, the spherical equivalent of refraction, and the depth of the anterior chamber (ACD) affects parameters like the AL. Also, Wang et al.,[2] carried out a study where the AL of 255 eyes were measured, an AL of 23.63 mm (±0.92) was found in hyperopes, 24.62 mm (±0.38) in emmetropic and 26.68 mm (±0.75) in myopic eyes.

Since these parameters can be influenced by race, ethnicity, and genetics, their differences between different populations may explain differences in refractive errors.

This is important for cataract surgery, where a customized calculation of the intraocular lens to be implanted is made.

Most of the formulas used for the calculation of the intraocular lens are based on "standardized" biometry.

Methods: A pilot study was carried out to calculate the sample size. The sample was composed of people of both sexes and ethnicities, over 18 years of age. Three study groups will be formed: two in Spain and one in Senegal. In order to assess the effect of long exposure to solar and artificial radiation, different parameters were evaluated, such as subjective refraction, lens transparency, axial length, corneal diameter, anterior chamber depth, and intraocular pressure. The most prevalent pathologies in the three populations will also be analyzed. Visual assessments were performed both in patients with previous ocular pathologies and in healthy people, as long as corneal transparency was not compromised. In addition, the quality of life of the patients will be evaluated through a validated questionnaire.

Inclusion criteria were

- People of both sexes.

- Over 18 years.

- With or without previous ocular pathologies (except pathologies that compromise media transparency)

Exclusion criteria were:

- People with ocular pathologies where there is no transparency of ocular media.

-With corneal or anterior surface alterations such as ectasias.

- People of mixed ethnicity

Results: a pilot study was conducted with 15 people from each group. With this sample, the main variable, which is the axial length, already shows significant differences between two of the three groups.

A 24.3027 15 Afro Europeos

A 24.2953 15 Caucasic

B 22.8960 15 Africans

Conclusions: As a conclusion for the moment, we can say that there is a clear difference between the ocular biometry of the different study groups, a larger sample would be needed to be able to reach a clearer conclusion.

Keywords: AXIAL LENGTH (AL) OCULAR BIOMETRY, RACE, GENDER, AGE

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PROTOCOL TO FOLLOW TO TAKE MEASURES IN THE ENTITLED RESEARCH EFFECT OF THE ELASTICITY MODULE OF SOFT CONTACT LENSES ON THE MORPHOLOGY AND FUNCTION OF THE MEIBOMIAN GLANDS

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Purpose of presentation
Define the protocol to follow to take measurements in the Oculus Keratograph 5, to carry out the same process with all the patients who participate in the research.

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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PONENCIAS EN FORMATO PÓSTER

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Cristina Castro Domínguez

Azza Dammak

Elena Diz Arias

Jorge Donís de la Torre

Ángela Gómez Manzanares

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EFFECT OF THE TYPE OF LENS IMPLANTED ON QUALITY OF LIFE UNDER DIFFERENT LIGHTING CONDITIONS

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Purpose: Cataract is the leading cause of reversible blindness and low vision worldwide. [1] In recent years, different types of intraocular lenses (IOLs) have been developed to improve vision and decrease dependency on glasses. [two]. The objective is to compare the effects on visual function and quality of life in patients who underwent cataract or refractive lensectomy with different types of lenses when subjected to photopic and mesopic light conditions.

Methods: The study design is observational, prospective, and cross-sectional. The sample population will be people who have undergone cataract surgery or refractive lensectomy with intraocular lens implantation in both eyes. First, a pilot study will be carried out to calculate the sample size in which people from each IOL group will be evaluated. To the sample size obtained, 10% will be added to cover possible losses. Both the pilot study sample and the final study sample will be recruited from the Ophthalmology Service. The sample will consist of three groups according to the lens implanted Tecnis Eyhance (Johnson & Johnson Surgical Vision, Inc., Santa Ana, EE.UU.), Isopure1.2.3 (PhyIOL sa/nv, Lieja, Bélgica) or Vivity (Alcon Laboratories, Inc, Fort Worth TX.). On the one hand, the inclusion criteria will be people of both sexes, over 18 years of age, implanted with the same type of IOL in both eyes, attending a consultation one month after surgery for discharge and having one of the three study lenses implanted binocularly. On the other hand, the exclusion criteria were subjects with ocular pathologies with retinal involvement, corneal or anterior ocular surface alterations or previous ocular surgery other than that performed to implant the IOL. The variables to be studied will be visual acuity with the EDTRS test at different

distances, far (4m), intermediate (66cm) and near (40cm). With the compensation required by the patient and with different lighting conditions. Contrast sensitivity in mesopic (3 cd/m2) and photopic (85 cd/m2) conditions with the CSV-1000. The perception of halos will also be measured with the Halo v.10 software of the University of Granada. And finally, a VF-14 quality of life questionnaire. The sample size will be calculated using GRANMO v7.12 software (significance level α=0.05 and power of contrast 0.90 (β=0.10)). Statistical analysis will be performed using the SPSS software package (SPSS version 28.0; IBM Corporation, Armonk, NY, USA). Normality of the data samples will be assessed using the Kolmogorov-Smirnov test. If a non-parametric analysis is obtained, the Wilcoxon test will be used. And a p-value of less than 0.05 will be considered as a criterion for statistical significance.

Results: The expected results of the present study are to find clinically significant differences between the mesopic and photopic condition. On the one hand by measuring visual acuity at the different distances and on the other hand by measuring contrast sensitivity between the different lenses. In addition, differences in halometry or pupillary diameter could be found in mesopic conditions. However, we have to wait for the results obtained after the study.

Conclusions: Based on the results we will be able to tell whether there are significant differences in the patient's quality of life and visual function when comparing different intraocular lenses in different lighting conditions.

Keywords: Cataract, intraocular lens, visual quality

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

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Purpose: after a spinal cord injury (SCI), the limited regenerative capacity of the CNS, along with the cytotoxic and pro-inflammatory environment and the glial scars formed after damage, make functional recovery after such an injury almost impossible. Given the complex nature of the injury, an approach combining the use of biomaterials with cells is needed to address this problem, nowadays lacking effective treatment [1]. We tested the hypothesis that by using high-performance silk-based fibres, manufactured using the SFS technique and subsequently biofunctionalized, axonal guidance is possible, which could lead to reconnection of injured axons in an SCI.

Methods:

- **Extraction and purification of silk fibroin:** *Bombyx mori* cocoons were degummed and dissolved to extract the protein. The solution was dialyzed to remove residues, and then concentrated through reverse dialysis.
- **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 silk fibroin fibers:** the fibers were biofunctionalized with RGD peptide using crosslinkers (EDC - NHS)
- **Cell cultures:** to assess the differences in the cellular adhesion and viability on the fibers, a study was performed with mesenchymal stem cells (MSCs) at 24h, 48h and 72h. 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: to check cell adhesion to the fibres, MSCs were stained with Calcein AM. In the case of the axonal guidance study with SH-SY5Y cells, the progress was documented using an inverted light microscope. Finally, for primary mouse cortical neurons, immunocytochemical staining was performed using BIII-tubulin and GFAP antibodies.

- Statistical procedures: a significance level of $p < 0.05$ was chosen. GradPad Prism software was used for all statistical tests.

Results:

- Biofunctionalization of FSS 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-FITC (RGD-FITC) using the crosslinking technique.

- Cell adhesion studies (MSC): regarding MSC adhesion on the fibres, statistically significant differences were observed at 24h ($p<0.05$), which disappeared at 48h and 72h.

- Axonal guidance studies: cells were successfully differentiated, and a tendency was observed in both cases, SH-SY5Y cells (Figure 1A) and primary cultured neurons (Figure 1B), to adhere to the fibres and elongate over them in the axial direction.

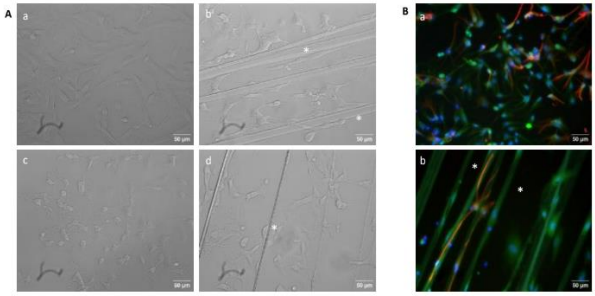

Figure 1. Axonal guidance images of SH-SY5Y cells (A) and primary cultured neurons (B) at 20X. (A): Inverted light microscopy images of SH-SY5Y cells undifferentiated (a) and differentiated (d) on plates and on control (b) and RGD biofunctionalized FS fibers (d). (B): immunofluorescence images of primary cultured cells from the cortex on plate (a') and on fibers (b'). Neurons are marked in green (tubulin BIII) and glial cells (GFAP) in red. Fibres are marked with (*).

Conclusions:

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

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Identification of clinically relevant biomarkers in primary human trabecular meshwork cells exposed to TGF-β2 and mechanical strain

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Purpose:

Glaucoma is the leading cause of irreversible blindness. The trabecular meshwork (TM) regulates intraocular pressure (IOP) through regulation of aqueous humor (AH). Elevated intraocular pressure (IOP) is a key pathological mechanism in primary open angle glaucoma, where fibrosis and age-related pathological changes prevent AH outflow, contributing to glaucoma pathophysiology.

The purpose of this study was to quantify expression of clinically relevant biomarkers in primary trabecular meshwork cells exposed to disease-relevant insults, transforming growth factor beta 2 (TGF-β2) and mechanical strain.

Methods:

Primary human TM cells were cultured and seeded in collagen I-coated BioFlex® plates. Once confluent, cells were transferred to serum-free conditions and exposed to mechanical strain (10% static strain) in the presence of absence of recombinant TGF-β2 (5 ng/ml) for 48 h. The supernatant was collected and secreted proteins from TM cells were concentrated using centrifugal filter units (Amicon). Osteopontin (OPN) was

quantified by ELISA (Millipore Sigma) according to the manufacturer's protocol.

Total RNA was extracted from cell lysates, and cDNA was prepared. Gene expression levels of osteopontin (SPP1), matrix metalloproteinase 9 (MMP9), tumor necrosis factor alpha (TNFA), vascular endothelial growth factor A (VEGFA), TGFB1 and TGB2 were quantified by quantitative polymerase chain reaction (qPCR).

Results:

Human TM cells secreted baseline levels of OPN, which increased ~5-fold in response to recombinant TGF-β2 treatment ($n=3$, $P<0.01$). The combination of mechanical strain and TGF-β2 treatment resulted in an >350-fold increase in OPN secretion ($n=3$; $P<0.01$).

Biomarkers level determined from cells lysates were successfully quantified by qPCR. QPCR experiments confirmed increased gene expression of OPN (SPP1) following TGF-β2 exposure. While TNFA expression was below the detection threshold in naïve TM cells, exposure to TGF-β2 significantly increased TNFA expression. Mechanical strain and TGF-β2 significantly increased MMP9 expression. Neither TGF-β2 nor mechanical strain altered VEGFA expression. Mechanical strain significantly increased gene expression of both TGF-β1 and TGF-β2.

Conclusions:

TGF-β2 exposure to primary human TM cells resulted in significantly increased OPN levels, which were exacerbated by simultaneous exposure to mechanical strain. These data are consistent with previous findings in animal models. Our results suggest that mechanical strain exacerbates the fibrotic effects of recombinant TGF-β2, likely due to upregulation of TGFB1 and TGFB2 gene expression.

Keywords: TM cells, Biomarker, Glaucoma

References

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Meibomian gland contrast measurement

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Purpose: Meibography is a useful tool to assess the integrity of the Meibomian glands (MG). An evaluation of the structural and functional nature of these glands is necessary to make an early and correct diagnosis of related pathologies. In recent years, new techniques that improve the information that specialists can obtain from MG have emerged. The measurement of MG contrast can be seen as a potential biomarker of related pathologies. [1] The present study aimed to analyse the differences in contrast between meibography images taken in healthy eyes and in eyes with MG related pathologies, such as Meibomian gland dysfunction or Blepharitis.

Methods: A total of 80 meibography images of forty participants (20 control/20 pathology) were included in the study. The Oculus Keratograph 5M was used to capture images of the upper and lower eyelids of each eye. Contrast measurement was carried out on the eight central glands. Two equations for contrast computation were analysed (Michelson and Yeh), [2] and both the contrast between glands (inter-gland) and within a gland (in-gland) were computed.

Results: Statistically significant differences were found between the control and the pathology group for the inter-gland contrast, in the upper and lower eyelid for the Michelson and Yeh contrast. While for the in-gland contrast, only statistical differences were found for the lower eyelid in the contrast measured with the Michelson contrast.

Conclusions: In conclusion, it has been found that the most appropriate variable for contrast evaluation is that corresponding to the inter-glandular area, regardless of whether it is measured with the Michelson or Yeh contrast. These results show that MG contrast can be a biomarker of pathology.

Keywords: Meibography; Meibomian gland; contrast; biomarker

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Characterization of the anterior pole in a general population group without ocular pathology

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Purpose: To provide a description of the anterior pole made with swept-source optical coherence tomography (OCT Anterion, Heidelberg Engineering) in a healthy general population group. To create a database that serves as a reference of normality among Spanish population. To find correlations between descriptive parameters of the anterior pole and others such as those relating to subjective refraction.

Methods: This is a prospective descriptive study. Individuals of all ages, with no gender restrictions will be included. No ocular nor systemic pathologic individuals will be included. No previous ocular surgery will be included. Ordinary ophthalmic examinations will be carried out. A swept-source OCT (Anterion) will be used to describe the anterior ocular pole. It will be done as a part of a routine ocular examination. Several parameters such as WTW, STS, ACD, CCT, Lens Vault, Lens Rise and Lens thickness will be measured and compared. These parameters will be also compared to others such as those describing subjective refraction.

Results: No results have been obtained.

Conclusions: No conclusions have been achieved

Keywords: anterior pole, sewpt-source, Anterion

High dynamic range hyperspectral reflectance with application to Dali´s artwork: “Two figures (1926)”.

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Purpose: The measurement of spectral reflectance of artworks by hyperspectral imaging has become very important in the field of restoration and conservation of cultural heritage (1, 2). Commercial hyperspectral imaging systems typically consist of CCD and CMOS sensors with a non-linear response (3). In the measurements made of Dalí's artwork "Two Figures (1926)", this non-linearity in the response results in hyperspectral images with underexposed or overexposed areas. To solve this problem, we have designed a system for measuring spectral reflectance by means of high dynamic range (HDR) hyperspectral imaging using commercially available devices.

Methods: The designed hyperspectral imaging system consists of a set of twelve spectral filters arranged on twelve high spatial resolution cameras. After processing the hyperspectral images obtained at different exposure times, HDR hyperspectral images are obtained. By processing these images as indicated in equation (1), it is possible to obtain the HDR spectral reflectance of Dalí's artwork "Two Figures (1926)".

$$\rho_M(x,y) = \rho_{white}\,(x,y)\,\frac{I_M(x,y) - I_{darkness}(x,y)}{I_{white}(x,y) - I_{darkness}(x,y)}, \quad (1)$$

where, ρ_M is the reflectance of the sample at each pixel x and y; I_M, I_{white} and $I_{darkness}$ are the HDR hyperspectral images of the sample to be evaluated, of a white material of the same size as the sample to be measured, and the dark image needed to calibrate the noise of the sensors. And finally, ρ_{white} is the value of the reflectance of the white material used in the calibration.

Results: Using the developed system, the HDR spectral reflectance of Dalí's artwork has been obtained in the spectral range between 470 and 690 nanometers in steps of 20 nanometers and a spatial resolution of 2510x3322 pixels (figure 1).

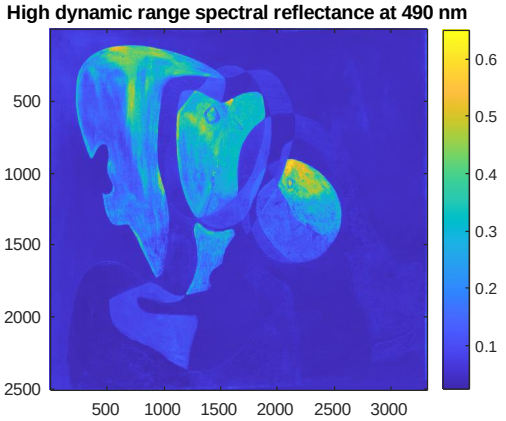

Figure 1. High dynamic range spectral reflectance of Dalí's "Two Figures (1926)" at 490 nm.

Conclusions: The design of an accessible and affordable hyperspectral HDR camera is demonstrated by measuring the spectral reflectance of different reflectance standards. Spectral reflectance measurements of Dalí's artwork "Two Figures (1926)" are also shown, demonstrating the need for an HDR system for its analysis.

Keywords: Hyperspectral image; spectral reflectance; high dynamic range

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Measures of accommodative function in secondary school Year 9 and Year 13: a 4-year longitudinal study

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Currently, many of the daily activities of children and adolescents involve near distance work including a large proportion of free time spent on mobile phones, computers, and tablets rather than on outdoor activities [1]. One of the consequences of this increase in hours in near vision tasks could be overexertion of the eye's accommodation system [2,3] and therefore a greater tendency to accommodative excess. Given the relationship between accommodative anomalies and symptoms affecting academic performance [4], accommodative function should be carefully studied in school children and adolescents.

Purpose: To characterize accommodative function in secondary school children in Year 9 and Year 13.

Methods: This was a prospective study. Participants were 43 subjects who were first examined in Year 9 and then again when they were in Year 13. The accommodation variables measured in each session were: accommodation amplitude (AA), accommodative response (AR), monocular and binocular accommodation flexibility (MAF and BAF), negative relative accommodation (NRA), and positive relative accommodation (PRA). Participants were classified as those with accommodation variables within the normal range (NA) and those with variables suggesting accommodative excess (AE). All statistical tests were performed using IBM SPSS software version 27. Descriptive data are provided as means and their standard deviations. The normality of data was confirmed using the Shapiro Wilk's test. To compare accommodative variables with standard values, a single-sample t-test was used. Data were compared between the right and left eye and between the first and the second test session using a Student's t-test for paired samples. To assess relationships among qualitative variables, we used the Chi-square

test or Fisher's exact test depending on the sample size. Significance was set at $p < 0.05$.

Results: Several accommodative function variables were below normative values in both Year 9 and Year 13. The number of subjects classified as having AE went from 27.9% in Year 9 to 58.1% in Year 13 according to AR ($p<0.005$) and from 23.3% to 46.5% according to MAF ($p=0.024$).

Conclusions: In both school years, values outside the norm were detected in several accommodative function measures. Also, the tendency to accommodative excess seems to be greater in higher grades. We would therefore recommend regular accommodative function assessment in secondary school children.

Keywords: near vision, accommodative excess, secondary school children

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Effect of obesity on visual function

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Purpose: The impact of overweight and obesity on almost every system of the body is widely known, with consequences for morbidity and quality of life,[1] as well as being an important risk factor for developing cardiovascular disease and other health problems.[2,3] However, correlations between obesity and retinal dysfunctions have hardly been studied. In this project, anthropometric variables such as body mass index (BMI), waist circumference (WC) and waist-to-height ratio (WHtR) will be used to evaluate adiposity[4] and relate them to the structure of the retina. The purpose of this study was to study how obesity affects visual function and ocular morphological aspects.

Methods: A cross-sectional, observational, and comparative clinical study of a group of overweight or obese people and a control group will be conducted. Both groups will be balanced in age and between men and women and only one of the eyes will be measured. The study group will be recruited with the collaboration of the Municipal Community Health Centers (CMSc) of Madrid among the subjects who attend the programs and workshops related to food and physical activity for people with weight problems. The subjects of the control group will be recruited from relatives, acquaintances, and students of the Complutense University of Madrid. The tests will be carried out in a single visit to the clinic of the Faculty of Optics and the laboratory of the Complutense Group of Applied Optics and Optometry of the Complutense University of Madrid.

Measurements will be made in the eye with the best AV with the best optical compensation, with preference, in case of equality, by the right eye. The inclusion criteria will be age between 30 and 60 years, all subjects will be required to have a visual acuity of 0.9 decimal places or better in at least one eye, a refractive error no greater than ± sphere of 3.50 diopters (D) or ± cylinder of 1.50 D and a normal ophthalmological examination. The study group must be overweight or obese. The exclusion criteria will be for systemic diseases such as diabetes.

We will examine the relationships between anthropometric measures of adiposity with thickness changes in the inner and outer layers of the retina; changes in visual function mediated by different populations of retinal cells measured at high and low lumen levels and the morphology of retinal arteries and veins (caliber and characterization of tortuosity).

Subsequently, the subjects in the study group will be invited to a second follow-up consultation after 6 or 12 months. In which a prospective intervention study will be carried out on subjects who have lost at least 10% of their body weight at the beginning of the study. To assess whether the weight change is related to changes in eye structure and visual function.

The statistical analysis will be performed using the Statgraphics Centurion software package. The significance shall be set at a p-value of less than 0,05. The normality of the data shall be checked by the Shapiro-Wilk test. First, all variables will be compared between the two subject groups using a student's t-test or a Wilcoxon rank test. Second, the Spearman correlation coefficient will be calculated to explore the association between anthropometric measurements and structural and visual function variables. Third, through step-by-step multiple linear regression, we will determine the independent factors that are most strongly correlated with the dependent variables. In addition, a covariance analysis will be performed to compare the regressions of the two groups.

Results: No results have yet been drawn.

Conclusions: No conclusions have yet been drawn.

Keywords: obesity, visual function, cardiovascular disease

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Analysis of the CISSve scores pre and post visual therapy in patients clinically diagnosed with Convergence Insufficiency

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Purpose:

CISS-v15 (Convergence Insufficiency symptom survey) [1,2] is the most accepted survey to detect and measure close vision problems and CISSve is Spanish version of this scale, culturally adapted by our team [3]

This research tests the hypothesis of effectiveness of visual therapy applied to a clinically diagnosed population for reducing the symptoms associated with convergence insufficiency

Methods: Statistical analysis of the data captured from the CISSve surveys administrated onsite to a 9-30 year old group of diagnosed patients (n=24, M=17.29, SD=6.74 yr) who underwent vision therapy (pre and post therapy)

Statistical comparison (pre and post therapy), attending to the symptom categories identified on a previous research [3] (visual function, visual fatigue, lack of concentration)

Results:

- **CISSve scores:**
  - Before therapy (n=24, M=20.04, SD=9.92)
  - After therapy (n=24, M=8.13, SD=4.98)
  - Student-t score: 5.37 (p<0.01,n=24)
- **Visual function scores:**
  - Before therapy (n=24, M=4.54, SD=3.10)
  - After therapy (n=24, M=0,79, SD=1.56)
  - Student-t score: 5.40 (p<0.01,n=24)

- **Visual fatigue scores**:
  - Before therapy (n=24, M=8.58, SD=4.99)
  - After therapy (n=24, M=2,46, SD=2.08)
  - Student-t score: 5.66 (p<0.01,n=24)
- **Lack of Concentration scores:**
  - Before therapy (n=24, M=6.92, SD=5.73)
  - After therapy (n=24, M=4.87, SD=4.42)
  - Student-t score: 1.41 (p=0.16,n=24)

Conclusions:

- Treatment through visual therapy demonstrated high effectiveness in reducing the symptoms associated with convergence insufficiency

- Symptoms related to the visual function were reduced significantly as the ones related to visual fatigue post a visual therapy treatment while it wasn't observed any significant difference for the symptoms related to lack of concentration

Keywords: CISSve, Visual Therapy, Binocular vision symptoms

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Objective Refraction in a new Isofocal intraocular lens.

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Purpose: Automated refraction (AR) after intraocular lens (IOL) implantation is a proper starting point to estimate subjective refraction and to verify if this is within the range calculated previously. While it has been noted that in monofocal lenses there is a good correlation between AR and manifest refraction[1], the same may not occur with multifocal refractive IOLs or with diffractive optic, where the results obtained for the sphere by autorefraction tend to yield more negative values[2].

The main objective is to evaluate and compare the subjective (manifest refraction) and objective refractions, obtained by autorefraction and aberrometry under different lighting conditions with the Isofocal intraocular lens compared to a monofocal control lens, the Micropure lens (Physiol, Liége, Belgium) with the same platform and material.

This is a prospective, comparative, randomized study on patients undergoing cataract surgery and bilateral Isofocal IOL or monofocal IOL implantation.

Methods: Patients were examined 3 months after surgery, as this is when refraction is considered reliable. Manifest refraction (MR) was always performed under the same lighting conditions for all the patients using the ETDRS acuity chart and a trial frame. For objective refraction two instruments were used. The first one was the autorefractor KR8800 that determines both objective refraction and corneal keratometry. The second device was the aberrometer OPD-Scan III (Nidek Inc., Tokyo, Japan.). It combines a wavefront aberrometer, an autorefractor, an autokeratometer and a pupillometer.

For each eye included in the study, six result sets were collected: MR (manifest refraction), AR (autorefraction measured with the autorefractor), WF-P (Zernike-coefficients-based objective refraction, photopic pupil size), WF-M (Zernike-coefficients-based objective refraction, mesopic pupil size), OPD-C (autorefraction measured with the aberrometer in the central pupil/photopic conditions), and OPD-M (autorefraction measured with the aberrometer under mesopic conditions).

and the refraction values obtained in clinical spherocylindrical notation were converted into vectorial notation for statistical analysis. All values will be analyzed with SPSS version 25 program and a significance level p-value <0.05 was considered.

Results: 22 subjects per group were included in the study according to sample size calculation. The mean sphere for manifest refraction was 0,03±0,32 for the Isopure group and 0,24±0,22 for the monofocal group (p=0,013). Friedman analysis was used to look for differences across the 6 assessment methods used for each of the refraction vector components. For the Isopure group, Friedman analysis showed statistically significant differences for sphere and SE values (p=0,000). For the sphere, differences were found with WF-P (p=0,035), WF-M (p=0,018) and OPD-M (p=0,000), which yielded the biggest difference with manifest refraction (0,68±0,61D). Differences in spherical equivalent were found only with OPD-M (p=0,004). In the Micropure lens group, the Friedman analysis showed differences for all values studied. (p<0.05).

Correlation coefficients showed that autorefraction is the objective method with the strongest correlation values for all components of refraction for both types of lenses.

Conclusions: Based on the results obtained in this study, we can conclude that the modification of the anterior and posterior surfaces of the Isopure lens with high order terms to enhance the depth of focus does not have a negative impact on the refraction obtained by AR.

Keywords: Isofocal, subjective refraction, objective refraction

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Dynamics of contrast sensitivity recovery after photoreceptor bleaching.

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Purpose: In clinical practice, contrast sensitivity (CS) is not routinely performed. Because it involves low light conditions and dark adaptation (DA) after bleaching of the photoreceptors following exposure to a light stimulus. However, DA allows us to understand cellular function in the outer retina and to determine the presence of disease. The manner of DA may be a key indicator of retinal health. In this study, will be identify the parameters of mesopic CS recovery after bleaching of photopigments capable of detecting deficits in function due to aging in healthy subjects.

Methods: An observational, cross-sectional study will be conducted in healthy subjects. The starting point will be computer-based experimental method to measure the recovery of CS after bleaching as a function of time in the dark designed by our research team (PR75/18-21577: Rapid method to measure the dynamics of DA). For the stimulus design and psychophysical method will be used mathematical software Matlab (The MathWorks Inc.) and a CRS Toolbox for Matlab.

We want to develop the technique and describe the psychometric characteristics of the CS retrieval test. To achieve this purpose, the following tasks will be carried out: first, a psychophysical method for CS retrieval, modeling and parameter extraction, in addition to the development of an efficient method to produce the optimal blanking and the study of the optimal stimulus characteristics. This will be followed by a repeatability study. And finally, a study in which the method will be applied with subjects; divided into two group: young and old, care should be taken to keep the sample equalized between sexes and ages.

Participants will be volunteers recruited from both the Complutense University of Madrid (UCM) and other fields; family members, friends. Patients will be

given informed consent following the principles of the Declaration of Helsinki. The research has been approved by the ethics committee of the Hospital Clínico San Carlos.

Inclusion criteria will be: age over 20 years, no ocular pathologies. A refractive error of less than ± 4.00 D sphere and ± 1.00 D cylinder, with a maximum spherical equivalent of ± 4.00 D. Exclusion criteria will be: pupillary diameter less than 4 mm under mesopic conditions, visual acuity > 0.1 logMAR, ocular surgery, medication that may affect visual function, failure to sign informed consent. Tests will be performed on the better eye, with preference given to the OD. Statistical analysis will be performed using the statistical program Statgraphics XIX.

Results: No results have yet been drawn.
Conclusions: No conclusions have yet been drawn.
Keywords: psychophysical method, dark adaptation, contrast sensitivity.

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Changes induced in the tear film after cataract surgery

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Purpose: Dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles [1]. Despite the wide variety of articles and publications on dry eye, there are few studies on the changes that occur in the tear film after cataract surgery [2].

Methods: A pilot study will be conducted to calculate the sample size. The sample will be composed of individuals of both sexes undergoing cataract surgery. The patients will be selected from the Ophthalmology Department of the Rey Juan Carlos Hospital in Móstoles. One member of the group will be present in the Ophthalmology consultation, in the cataract section. This researcher will offer patients who come for consultation the possibility of participating in this study, giving all the details and procedures that will be carried out, and making special emphasis on the painless and non-contact nature of the tests to be performed. Tear film characteristics will be analyzed with the Keratograph 5M® (Oculus, Germany) [3]. The tear film volume will be evaluated through the tear meniscus height. Tear film stability will be assessed by noninvasive tear film breakup time (NIKBUT). Tear film quality will be assessed through lipid layer interference patterns. The degree of ocular redness and meibomian gland dysfunction will be assessed. Dry eye-related quality of life will be measured with the OSDI (Ocular Surface and Disease Index®) questionnaire. There will be an enabled space (provided by the Hospital), where the necessary equipment will be available to carry out the study. All patients who wish to participate in the study will be given access to this room where the measurements will be taken in a period of no more than 10 minutes.

Results: No results are available. The measurement period is scheduled to begin in November 2022.

Conclusions: Not determined.

Keywords: Dry eye, cataract surgery, Keratograph 5M

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Biometric and biochemical changes after light deprivation in an animal model

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Purpose: The increasing incidence of myopia has become a public health problem in recent decades [1]. Pharmacological and optical treatments are available to reduce the myopia progression [2]. The aim in this research project is to determine the biometric and biochemical changes are involved in progressing myopia when is produced with light deprivation.

Methods: The proposed methodology has been designed to achieve this goal. We want to determine the differences at the molecular level and biometric changes between a myopic eye and a non-myopic eye and to create a deprivation method to induce myopia in an animal model. 2-3 weeks old pigmented rabbits will be used in controlled environmental conditions of 25°C temperature and 12-hour light/dark cycles, with daytime illumination of approximately 300 lux. Several pilot studies will be performed to determine the minimum sample and the correct deprivation method to follow. The left eye of the pigmented rabbit will be deprived, leaving the right eye free, the patch for defocusing or light deprivation must allow blinking and cannot come into contact with the cornea. In addition, during the deprivation period, the rabbit should be checked daily.
After a 6-week deprivation period, biometric changes will be evaluated by performing corneal topography, optical biometry, refraction by retinoscopy, biomicroscopy and electroretinography to assess retinal neuronal function.
The effect of melatoninergic receptor agonists and antagonists on axial growth will be evaluated in an animal model, under normal conditions and after deprivation. We will also evaluate the effect of dopaminergic receptor agonists on axial growth under normal conditions and after deprivation. Thickness changes in the sclera will be studied. We will proceed to the extraction of ocular structures separating sclera, choroid and retina, aqueous humor by sclerocorneal limbus injection and tear through microcapillary, and we will proceed to perform different experimental laboratory techniques.

Statistical analysis will be performed with the latest available version of the SPSS Statistics software. A p-value lower than 0.05 will be considered statistically significant.

Results: In the first studies to be performed, it is expected to obtain a good deprivation method that allow us to obtain pigmented rabbits with monocular myopia after 6 weeks under light deprivation. We expect to find significant differences between the deprived eye and the control eye of each rabbit in the biometric tests after 45 days. It is also intended to investigate the biochemical cascade and the biochemical changes that occur in the eye during axial growth. Differences in different hormones and molecules are expected to be registered between treated and controls.

Conclusions: The study of the changes that may occur in the eye during axial growth would serve in the future to know, with more accuracy, the biochemical action mechanism by which current optical and pharmacological treatments are able to partially control the progression of axial growth and therefore, myopia.

Keywords: Myopia, Light deprivation, Axial growth.

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Establishing an experimental model for the study of myopia progression

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Purpose: High concern exists nowadays regarding high myopia prevalence among children which can lead to vision loss as well as other pathologies such myopic maculopathy, glaucoma, or cataracts if it is higher than 6 diopters (D) [1]. Optical and pharmaceutical myopia progression treatments have been proved to be effective, but no evidence exists about the biochemical pathway these treatments activate [2]. In our research, we performed a pilot study to implement a myopia deprivation animal model so that a mechanistic study of the signaling pathways of axial growth can be performed.

Methods: Two male newborn New Zealand white rabbits were used in the study. All animals were raised under controlled conditions of temperature (20- 24ºC) and humidity (40-60%) on a 12h light/dark cycle. Water and food were freely available. Animal care and treatment protocols followed ARVO Statement for the Use of Animals in Ophthalmic and Vision Research and experimental protocols were approved by the Ethics Committee of the Complutense University of Madrid. After a week of environmental adaptation, deprivation myopia was induced with handmade facemasks that were attached carefully over the head of the rabbits. The masks leave the ears, nose, mouth, and right eye exposed, while the right eye was covered. Animals were checked every day for the facemasks to be in place and biometric measurements were performed every week at the same hour approximately. Axial length (ALX), anterior chamber depth (ACD) and lens thickness (LT) were obtained by 4Sight Accutome Ultrasound Biometer (Accutome, Inc. Malvern, PA, USA). Refraction was measured with a hand-held retinoscope. Corneal topographies were performed by Medmont E300 corneal topographer (Medmont Int., Nunawading, Australia). Seventeen days after the eyes were occluded one of the animals died, so a second phase of the same experiment was arranged. This time, deprivation myopia was attempted by suturing the right eyelids of four male newborn pigmented rabbits. To perform the sutures animals were sedated by 50mg/mg ketamine + 10mg/kg kylazime intramuscular injections, topical 25mg/g lidocaine + 25mg/g pilocarpine cream

was applied over eyelids and one drop of 1mg/mL tetracaine hydrochloride + 4mg/mL oxybuprcaine hydrochloride was instilled. Surface was cleaned with saline solution and povidone iodine was genteelly applied over the sutures. Biometrical measurements were performed at baseline and 60 days after deprivation started. On this occasion, intraocular pressure (IOP) and cycloplegic refraction after cyclopentolate hydrochloride instillation was also measured at endline. Weigh gain was recorded every 48h for animal health control reasons. Statistical analysis was performed with SPSS Statistics software. Wilcoxon test for related samples was used to analyze baseline and endline differences on the second experiment. $P<0.05$ was considered as statistically significant.

Results: The surviving facemask-occluded rabbit showed a 0.17 decrease in sphere equivalent refraction and a 3.12 mm increase in ALX for the control eye after 22 days. On the deprived eye, refraction at endline was +11.25 D, much higher than the +2.00 D measured at baseline and ALX only increased by 1.70 mm. Two days after the facemask was removed refraction decreased to +3.25 D. Right eye corneal topographies confirmed a highly depressed cornea and flatter keratometric readings than the contraleral eye. Regarding the four pigmented rabbits deprived on the second experiment, myopic refraction values were obtained after 60 days of light deprivation with an average of -2.31±0.97 diopters difference between eyes or -2.38±0.96 if measured under cycloplegic conditions but none of these differences was statistically significant ($p>0.05$). Almost no differences were obtained in ALX, ACD, LT or IOP values between eyes at endline ($p>0.05$).

Conclusions: The first experiment we performed had numerous drawbacks, the main one was the facemask, which made excessive pressure over the cornea, so a deformation was created. This corneal flattening was noticeable on the corneal topography, k-readings, ALX and refraction. On the second experiment, myopic refraction on the deprived eyes was obtained but no differences could be measured on ALX and none of the changes was statistically significant. This founding means that improvements on the light deprivation method must be done to obtain more reliable results.

Keywords: Myopia animal model, axial growth, refraction.

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