
PHDAY
FOO
2020

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ÍNDICE

PRÓLOGO

Por cuarto año consecutivo los doctorandos de la Facultad de Óptica y Optometría de la Universidad Complutense de Madrid cuentan con un congreso propio organizado por y para ellos, el 4º PhDAY- FOO. Se trata de un congreso gratuito abierto en la 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 15 de octubre de 2020. En esta ocasión será un Congreso On-line para evitar que la incertidumbre asociada a la pandemia Covid-19 pudiera condicionar su celebración.

A través de varias sesiones de presentaciones orales y 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 multicisciplinar 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, agradecer al Comité Organizador toda su dedicación, ilusión y profesionalidad. Sin todos ellos sería imposible que congreso logre las metas propuestas.

Beatriz Antona Peñalba
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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 4ª Edición del PhDAY FOO – Complutense. 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 tanto siendo ponentes como asistentes en esta nueva edición del PhDAY, ya que sin su colaboración todo esto no sería posible. Siendo un congreso hecho por y para los doctorandos. Gracias nuevamente y más en este año que ha sido atípico.

Agradecer también a las empresas patrocinadoras por el apoyo ofrecido para llevar a cabo las jornadas PhDAY FOO, dándonos la oportunidad a los jóvenes investigadores de poder realizar nuestro trabajo gracias a su financiación.

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

PONENCIA INVITADA

“Estoy terminando mi doctorado ¿Y ahora qué?”

Por: Dra. Laura Rico del Viejo

Durante el periodo doctoral estamos muy enfocados en llevar a cabo todas las actividades asociadas a nuestra tesis como puede ser la elaboración de artículos, divulgación científica, congresos, estancias en el extranjero, etc. Es normal que durante este periodo solo pensemos en llegar a ser doctores, pero… ¿qué ocurre después? ¿Qué salidas profesionales ofrece un doctorado? ¿Debo seguir una carrera académica o apostar por la industria? ¿Puedo realizar ambas cosas? ¿Qué competencias o habilidades son más relevantes a la hora de elegir una u otra opción? ¿Qué dificultades pueden surgir? Antes o después todos pasamos por esta etapa de dudas e incertidumbre sobre nuestro futuro, por lo que reflexionar y redefinir objetivos y metas profesionales a lo largo de la etapa doctoral es esencial para nuestro futuro como investigadores.

Laura Rico del Viejo

Doctora en Optometría y Visión e Ingeniería Biomédica con la tesis en cotutela titulada “*Evaluación de la estructura de las glándulas de meibomio mediante tecnología infrarroja*” desarrollada en la Universidad Complutense de Madrid y Wroclaw University of Technology (Polonia), realizada con el apoyo de beca europea MarieSkłodowska-Curie. Actualmente investigadora clínica en el departamento de I+D en la clínica oftalmológica IOA Madrid perteneciente al grupo Miranza.

COMITÉ CIENTÍFICO

Natalia Díaz Herrera

Licenciado en Ciencias (Físicas) por la Universidad Autónoma de Madrid en 2001, y Doctor en Físicas por la Universidad Complutense de Madrid en 2005 con una tesis titulada: "Desarrollo de sensores de fibra óptica para el control in-situ de parámetros físicos del medio acuático". Profesora Titular de Universidad de la Facultad de Óptica y Optometría de la Universidad Complutense, donde imparte las asignaturas "Óptica Oftálmica I y II" e "Historia de la Óptica" del Grado en Óptica y Optometría, y "Técnicas Experimentales en Óptica" del Máster en Tecnologías Ópticas y de la Imagen". Miembro del Grupo Complutense de Óptica Aplicada desde 2004.

Maria Garcia Montero

Doctora en Óptica, Optometría y Visión por la UCM con la tesis titulada "Caracterización clínica de la población con disfunción acomodativa sintomática: insuficiencia y exceso de acomodación". Es profesora asociada del Dpto de Optometría y Visión de la Facultad de Óptica y Optometría de la UCM desde el curso académico 2007/08. Su trayectoria de investigación y docencia se ha compaginado siempre con la actividad de carácter profesional. Los últimos 11 años ha desarrollado su trabajo profesional en la clínica oftalmológica Vissum (Madrid) dirigiendo la Unidad de terapia visual del Departamento de Optometría. Actualmente realiza su actividad profesional para el Grupo Miranza de Madrid.

Marina Mercedes Molina Santos

Licenciada en CC. Químicas y Biológicas, Doctora en Ciencias Químicas por la Universidad Autónoma de Madrid; realizó un trabajo postdoctoral en la Universidad de Princeton (EEUU). Ha dedicado la mayor parte de su investigación a la biofísica de proteínas y ácidos nucleicos en el CSIC.

Profesora del Departamento de Química Orgánica de la UCM perteneciente al Cuerpo de Catedráticos de Escuela Universitaria.

Miguel Ángel Muñoz Sanz

Doctor en Ciencias Biológicas, por la Universidad de Valencia en el año 1992 con la Tesis titulada; "*Consideraciones sobre la utilización de las Técnicas de Análisis de Mixturas en Taxonomía*". Catedrático EU de la Facultad de Óptica y Optometría en la Universidad Complutense de Madrid. Imparte docencia en las asignaturas de Anatomía Humana y Anatomía del SIstema Visual en el Grado de Óptica y Optometría y de Evolución de la Visión y del Sistema Visual en el Máster de Optometría y Visión. Investigación en Morfología Ocular y Anomalías Refractivas y en aspectos relacionados con la Evolución del Sistema Visual

Maria Jesús Pérez Carrasco

Licenciada en Farmacia y diplomada en Óptica y Optometría. Doctora en Óptica Avanzada por la Universidad Complutense de Madrid con la tesis titulada "*Efecto de un filtro amarillo sobre la función visual mesópica de sujetos emétropes y sujetos miopes operados de cirugía refractiva LASIK*". Profesora Contratado Doctor en la Facultad de Óptica y Optometría donde imparte las asignaturas: "*Visión en cirugía refractiva"* en el Máster de Optometría y Visión y "*Percepción visual"* en el Grado de Optometría y Visión. Miembro del Grupo de Investigación "Visión Aplicada". Donde trabaja en proyectos relativos a los mecanismos ópticos y neuronales implicados en los cambios de la función visual, medidos con métodos psicofísicos, en el ojo sano envejecido y con enfermedad ocular

COMITÉ ORGANIZADOR

Victoria Eugenia Lledó Mayans

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

"Nada en la vida es para ser temido, es sólo para ser comprendido. Ahora es el momento de entender más, de modo que podamos temer menos"

Marie Curie

Nadiuska Cristine Platero Alvarado

Licenciada en doctorado profesional en Optometría por la Universidad Especializada de las Américas.
Máster en Optometría y Visión por la Universidad Complutense de Madrid.
Máster en Rehabilitación visual por la Universidad de Valladolid.

"El conocimiento empieza en el asombro"

Sócrates

PROGRAMA CIENTÍFICO

4ª Edición PhDAY- FACULTAD DE ÓPTICA Y OPTOMETRÍA 2020

15 de octubre de 2020

ESTRUCTURA DEL PROGRAMA
15 de octubre de 2020

15:00 – 15:30 h Inauguración 4º PhDay-FOO
15:30 – 16:15 h Comunicaciones primera sesión- ORAL 1
16:45 – 17:30 h Comunicaciones segunda sesión - POSTER
17:30 – 17:45 h Descanso
17:45 – 18:30 h Comunicaciones tercera sesión - ORAL 2
18:30 – 18:50 h Conferencia invitada
18:50 – 19:00 h Entrega de Premios y Clausura 4º PhDay-FOO

DESGLOSE DEL PROGRAMA

15:00 – 15:30 h. *Inauguración PhDay Facultad Óptica y Optometría*

SALA 0. Inauguración

Director de la Escuela de Doctorado UCM: Dr. Fernando Gascón Inchausti

Decana de la Facultad de Óptica y Optometría. Dra. Mª Isabel Sánchez Pérez

Vicedecana de Posgrado e Investigación y Coordinadora del Programa de Doctorado. Dra. Beatriz Antona Peñalba

15:30 – 16:15 h. Comunicaciones primera sesión. Presentación ORAL 1

SALA A. Línea de investigación: Lentes de contacto. Coordina el miembro del jurado: Dra. María Jesús Pérez Carrasco

- Dynamic stabilization system in lathed soft toric contact lenses - Prototype. Elena Durán Prieto
- Visual function, ocular surface integrity and symptomatology of a new extended depth-of-focus and a conventional multifocal contact lens. *Irene Martínez Alberquilla*
- Effect of scleral contact lens on conjunctival Goblet cells in irregular cornea patients over one year. *María Serramito Blanco*

SALA B. Línea de investigación: Bioquímica y biología molecular. Coordina el miembro del jurado: Dra. Marina Mercedes Molina Santos

- Optimization of a rabbit dry eye model induced by topical instillation of benzalkonium chloride. *Carlos Carpena Torres*
- Annexin A1 on the ocular surface epithelium: modulation by hyperosmolarity and its role in inflammation. *Miguel Ángel Fernández Torres*
- Modulation of aqueous humor melatonin levels in cataracts by yellow-filter. *Victoria Eugenia Lledó Mayans*

SALA C. Línea de investigación: Óptica. Coordina el miembro del jurado: Dra. Natalia Díaz Herrera

- Looking for solutions for fluorescence images. *Ana Cayuela López*
- Virtual photonic restoration applied to cultural heritage: Application case Dali's picture "Dos figuras". *Ángela Gómez Manzanares*
- Development of imaging tools for biologicalcharacterization: retinal analysis. *Asmae Igalla El Youssfi*

16:45-17:30 h. Comunicaciones segunda sesión Presentación PÓSTER

SALA D. Línea de investigación: Óptica, optometría y visión. Coordina el miembro del jurado: Dr. Miguel Ángel Muñoz Sanz.

- Effect of orthokeratology contact lenses on rabbit eye (morphology and physiology). *Wael Almalki*
- Peripheral refraction, topographic profile and aberrations of six hydrophilic contact lenses for myopia control: Piloto study. *Júlia Bodas Romero*
- Characterization of the microbiota of dry eye in users of monthly replacement disposable soft contact lens wearers. *Raquel Calderón García*
- Evaluation of retinal ganglion cells function measured by pattern electroretinogram (pERG) after femtosecond laser assisted LASIK (FS-LASIK). *Gorka Laucirica Saez*
- In vitro study of delivery of melatoninergic tear secretagogues using contact lenses. *Francsco Javier Navarro Gil*
- Bipolar disorder treatment´s effects on the tear film. *Xabier Rodríguez Alonso*
- In vivo changes in wettability of hydrophilic contact lenses after an Aloe vera – HPMC based artificial tear drop. *Candela Rodríguez Pomar*

SALA E. Línea de investigación: Óptica, optometría y visión. Coordina el miembro del jurado: Dra. María García Montero

- Intra-examiner repeatability and agreement in the measurement of ocular heterophoria in young people. *José Luís Cebrián Lafuente*
- Low-contrast visual acuity as visual function predictor for night driving. *Marta María García Rojo*
- Pupillary reaction time in subjects treated with psychotropic drugs. *Sara Gutiérrez Jorrín*
- Influence of distance and hours of nearwork on accommodative function. *Esther Mármol Errasti*
- Optical quality in pediatric patients. *Beatriz Martín García*
- Evaluation of retinal vasculature by OCT Angiography in type II diabetes. *Nadia Mínguez Caro*
- Software for real-time distance control and visio-postural control. *Miguel Ángel Tomé de la Torre*

17:30 – 17:45 h. Descanso.

17:45 – 18:30 h. Comunicaciones tercera sesión. Presentación ORAL 2

SALA F. Línea de investigación: Optometría y visión. Coordina el miembro del jurado: Dra. Marina Mercedes Molina Santos

- Comparative clinical evaluation of a New Isofocal intraocular lens against Monofocal intraocular lens. *Carla Charbel*
- Prevalence study of visual dysfunctions in High School students. *Juan Oliveros López*
- Descriptive study of the prevalence of visual anomalies in the school population. *Nadiuska Cristine Platero Alvarado*

SALA G. Línea de investigación: Óptica, Optometría y Visión. Coordina el miembro del jurado: Dra. Natalia Díaz Herrera

- Objective determination of the morphology of Meibomian Glands using deep learning techniques. *Elena Diz Arias.*
- Variation of meibomian glands contrasts throughout the day. *Elena Fernández Jiménez.*
- Does the blue light of the tablets cause dry eye? *Gema Martínez Florentín.*

SALA H. Línea de investigación: Optometría. Coordina el miembro del jurado: Dra. María Jesús Pérez Carrasco.

- Home-based amblyopia therapy by mean of playing videogames. *Alejandro León Álvarez*
- Visual skills in athletes with physical disabilities. *Sandra Milena Medrano Muñoz*
- The CISSve-R2 scale. A reduced versión of CISSve. *Carlos Pérez Garmendia*

18:30 – 18:50 Conferencia invitada

SALA 0. Conferencia invitada. "Estoy terminando mi doctorado ¿Y ahora qué?"

Dra. Laura Rico del Viejo

18:50- 19:00 h Entrega de Premios y Clausura

SALA 0. Entrega de Premios y Clausura

PONENCIAS ORALES

Carlos Carpena Torres

Ana Cayuela López

Carla Charbel

Elena Diz Arias

Elena Durán Prieto

Elena Fernández Jiménez

Miguel Ángel Fernández Torres

Ángela Gómez Manzanares

Asmae Igalla El Youssfi

Alejandro León Álvarez

Victoria Eugenia Lledó Mayans

Irene Martínez Alberquilla

Gema Martínez Florentín

Sandra Milena Medrano Muñoz

Juan Oliveros López

Carlos Pérez Garmendia

Nadiuska Cristine Platero Alvarado

María Serramito Blanco

Optimization of a rabbit dry eye model induced by topical instillation of benzalkonium chloride.

*Carlos Carpena Torres *[1,2], Jesús Pintor[2], María Jesús Pérez de Lara[2], Fernando Huete Toral[2], Almudena Crooke[2], Cristina Pastrana[1] and Gonzalo Carracedo[1].*
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Introduction: In 2017, the TFOS DEWS II defined the dry eye as "*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]. The discovery of new diagnostic biomarkers and treatments for dry eye requires the use of animal models [2, 3].

Aim: To optimize a rabbit dry eye model induced by topical instillation of benzalkonium chloride (BAC), reducing the days of instillation of the original model by increasing the concentration of BAC from 0.1% to 0.2%.

Methods: An experimental, prospective and randomized study was performed on 10 male New Zealand white rabbits, divided into two groups, considering both eyes: 5 rabbits as control (n = 10) and 5 rabbits with 0.2% BAC treatment (n = 10). Saline solution (control) and 0.2% BAC were instilled for 5 consecutive days, twice daily. Tear secretion with and without anesthesia, tear break-up time, tear osmolarity, corneal staining, conjunctival hyperemia, density of Goblet cells, height of mucin cloud and transcript levels of IL-6 were measured before and after the treatment.

Results: After the instillation of 0.2% BAC for 5 consecutive days, there was a significant increase in tear secretion without anesthesia ($P < 0.001$), corneal staining ($P < 0.001$), conjunctival hyperemia ($P < 0.001$) and levels of IL-6 mRNA ($P = 0.005$) compared to the control group. Conversely, there was a decrease in tear secretion with anesthesia ($P < 0.001$), tear break-up time ($P = 0.007$), tear osmolarity ($P < 0.001$), density of Goblet cells ($P < 0.001$) and height of mucin cloud ($P < 0.001$).

Conclusions: The topical instillation of 0.2% BAC for 5 consecutive days, twice daily, was a proper procedure to induce a rabbit dry eye model, reducing the number of days of instillation compared to the original model (14 days).

Keywords: dry eye; animal model; benzalkonium chloride.

References:

[1] Craig JP, Nichols KK, Akpek EK, Caffery B, Dua HS, Joo CK, et al. TFOS DEWS II Definition and Classification Report. Ocul Surf. 2017;15(3):276-83.
[2] Barabino S, Dana MR. Animal models of dry eye: a critical assessment of opportunities and limitations. Invest Ophthalmol Vis Sci. 2004;45(6):1641-6.
[3] Schrader S, Mircheff AK, Geerling G. Animal models of dry eye. Dev Ophthalmol. 2008;41:298-312.

Looking for solutions for fluorescence images.

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Introduction: Nowadays, optical fluorescence microscopy plays an essential role in order to monitor cell physiology for understanding many biological processes from organelles to single molecules. This work is chiefly focused on developing automated single-particle detection and tracking methods capable of handling large datasets to solve problems arising from low-SNR fluorescence. In this field, these tools are indispensable for analysing time-lapse images where objects are first detected and localized in all frames before being linked frame by frame to finally follow trajectories.

Aim: The development of two Java-based applications available through ImageJ or Fiji for the accurate detection and tracking of spots or roughly spherical objects (aggregates of dye molecules) in fluorescence microscopy datasets. These plugins are developed using a Java compiler, providing extensibility to ImageJ or Fiji and having even an intuitive GUI through which user will be guided to 2D or 3D visualization of analysis results.

Methods: Present fluorescence image processing tools for single-particle detection and tracking, have some limitations when imaging complex biological processes or when processing hundreds of images. To overcome these limitations, we present a flexible design in our Java-based plugins to adapt themselves to the required conditions of images. ParticleDetector_ performs single-particle detection, 2D visualization and post-processing actions (exporting data to CSV or Excel file, etc...), while TrackMate_test executes automated single-particle tracking in batch reading configuration parameters from a file. ParticleDetector_ implements a segmentation method to distinguish an interest object from its background either through automatic methods (Otsu's and Maximum Entropy) or manually (threshold range). This plugin also runs a watershed segmentation for overlapping objects after threshold so when done, gets statistical information related to each. *TrackMate_test* is based on TrackMate, an open source image analysis package developed at Institute Pasteur, France [1]. It has a focus on usability and pluggability and is distributed under Fiji, hence it interacts

with whole ImageJ ecosystem. It resolves single-particles that temporarily overlap or disappear by identifying linking, gap-closing, splitting, or merging events without making further assumptions on the biological significance of them. This batch-mode plugin allows to follow single-particles trajectories over time in low-SNR complex environments enabling an accurate linking in high dense particle situations [2].

Results: At present, we are fully involved in validating our algorithms for detection and tracking. We are testing our methods with several fluorescence microscopy movie datasets of 500 frames each acquired using a Total Internal Reflection Fluorescence (TIRF) microscope imaging molecules with Laser lines 405, 488, 561 and 638 nm. ParticleDetector_ includes as an innovation, executing a raw quantification, detection, measure, visualization or postprocessing actions of binary roughly spots using either ImageJ particle analysis/intensity threshold or importing detections generated by TrackMate allowing efficient computation of very large datasets. TrackMate_test, meanwhile, runs TrackMate in batch mode without need to place a configuration file in the parent folder of the processed files and instead, setting a configuration xml file from TrackMate, leading to a more proficient performance. Furthermore, this plugin accomplishes statistics tasks based on spots, links and tracks features or postprocessing actions in batch.

Conclusions: We have developed and is still being validated an effective Fiji method for automated single-particle detection, analysis, trajectories tracing and visualization of sub-cellular structures, providing robustness and efficiency for testing single-particle behavior. The principal aim is to attend microscopy users who deal with any adversity derived from fluorescence. Both proposed methods supply wider flexibility for the entire analysis process even for a large range of fluorescence datasets. Regarding the future distribution of these tools to scientific community, our chronology will be initiated at Centro Nacional de Biotecnología (CNB-CSIC) as a primary approach for validation of these versatile solutions but flatly, our long-term goal is to distribute them as open source and extendible platforms within the Fiji distribution of ImageJ.

Keywords: single-particle, ParticleDetector_, TrackMate_test.

References:

[1] Tinevez JY., Perry N. & Schindelin, T. et al. TrackMate: An open and extensible platform for single-particle tracking. Methods 2017; 115:80-90.

[2] Jaqaman, K., Loerke, D. et al. Robust single-particle tracking in live-cell time-lapse sequences. Nat. Methods 2008: 8:695-702.

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

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Introduction: Cataract, lens opacification, is the 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 IOL are the most commonly implanted.[2]
Given the high demand from patients for the independence of eye glasses, multifocal IOL are becoming more and more used, providing satisfactory far, intermediate and near vision. [2] Their concept 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, 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®) by the same manufacturer (PhysIOL, Belgium).

Methods: 50 cataract patients will be recruited and will received bilateral implantation. We will have one group implanted with Isopure 1.2.3, device under investigation, and a group control implanted with Micropure 1.2.3: 25 patients per group based on 1:1 randomization given by the Electronic Data Capture. They will attend a total of maximum 11 visits over a period of 12 months.
First monocular best corrected distance visual acuity (CDVA) under photopic light conditions on the first implanted eye, will be compared between both groups.
As secondary study endpoint several parameters will be 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 light conditions as well as under mesopic light conditions with a glare source. Subjective outcomes will be obtained by standardized questionnaires. Statistically significant differences will be set at a level of 0.05.

Results and conclusions: At the time of writing this abstract, we have no results and conclusions. A previous study [2] reported that EDOF IOLs provides good intermediate and near vision, but also increases photopic phenomena compared to the monofocal IOLs.

Keywords: EDOF extended depth of focus, IOL intraocular lens, CDVAcorrected distance vision.

References:

[1] Thompson J, Lakhani N. Cataracts. Prim Care - Clin Off Pract. 2015;42(3):409-23.
[2] Liu J, Dong Y, Wang Y. Efficacy and safety of extended depth of focus intraocular lenses in cataract surgery: A systematic review and meta-Analysis. BMC Ophthalmol. 2019;19(1):1-10.
[3] Akella SS, Juthani V V. Extended depth of focus intraocular lenses for presbyopia. Current Opinion in Ophthalmology. 2018.

Objective determination of the morphology of Meibomian Glands using deep learning techniques.

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Introduction: Meibomian glands (MG) are sebaceous glands, located in both eyelids, which are responsible for secreting lipids (meibum) to the tear film. Meibum is the main component of the superficial lipid layer of the tear film that stabilize the tear film and protects it against evaporation. Consequently, meibomian lipids are essential for the maintenance of ocular surface integrity and health**.** [1]
Changes in the morphology of MG are directly related to ocular alterations such as dry eye or Meibomian Gland Dysfunction (MGD). A correct observation of the structure of the MG will allow an accurate diagnosis of these anomalies so recurrent today. For this reason, this study aims to study the morphology of MG using deep learning techniques.
Deep learning is part of the family of machine learning techniques that uses only image data for the detection of diseases, it has been shown that these techniques have great utility in the field of biomedical sciences. [2]

Aim: The main objective of the study will be to teach and train the deep learning program to be able to characterize the morphology of the Meibomian glands. This will be done manually, segmenting each gland. The secondary objective will be to obtain a complete evaluation of the Meibomian glands. In such a way that, once the deep learning program has been trained, it can, in addition to making a structural contribution to the glands, characterize them according to the degree of their loss and their contrast with respect to the tarsal conjunctiva.

Methods: To train and verify this program, 3006 images corresponding to 66 subjects will be used, which have been divided into three groups, a control group without any ocular surface pathology, a contact lens users group and

a Meibomian Gland Dysfunction and Blepharitis group. This procedure will be performed in different groups of patients to have greater data variability. Matlab program will be used to process the images. A predetermined number of images will be taken from each study group, and the MG images of both eyelids will be manually segmented.

Results: It is expected to obtain a greater accuracy, in the measurement of the structures and the loss of MG, than in that of previous studies. This greater accuracy is expected since, by manually performing the segmentation of each gland, it is possible to be more exact in the measurement, eliminate possible reflections or artifices that have the images of the MG and that in previous studies made it difficult to characterize them.

Conclusions: If good accuracy is achieved in the measurement of the various parameters of Meibomian glands by manual segmentation of the glands, this will mean an improvement in daily clinical practice, since it would simplify the work of professionals. At the same time, more information of the glands would be obtained for a more accurate diagnosis and with a greater consensus among professionals, mainly when it comes to characterizing physiology and glandular loss.

Keywords: Meibomian Glands, Deep learning, Ocular surface**.**

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Dynamic stabilization system in lathed soft toric contact lenses - Prototype.

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Introduction: Soft toric contact lenses (STCL) with prism ballast or periballast system induces prism power from 0,52 to 1,15 PD (prismatic diopters). Meanwhile accelerated stabilization design does not induce prismatic power[1] greater than 0,5 PD, vertical prism disparity could lead to binocular issues, asthenopia, visual discomfort and motion sickness decreasing stereopsis in some patients. Moreover, it has been demonstrated that customized STCL (front surface) can compensate aberrations better than standard STCL [2].
Background literature review shows the advantages and disadvantages of both, prism ballast stabilization and dynamic systems. A system based in iso-thickness (dynamic stabilization) combined with a small amount of prism is one of the most stable stabilization methods for molded STCL. However, although patent involved all manufacturing process, literature review carried out did not find in market lathed lenses with dynamic stabilization based in iso-thickness variation within the peripheral zone. It is found, thus, an opportunity for improving the mentioned system and avoid the prism effect of the prism ballast.

Aim: To implement a dynamic stabilization system in lathed STCL with the purpose of eliminating the prismatic effect induced in the optical zone. To develop a STCL design following standards to implement a medical device in the market (MDR 745/2017). Phase 1 corresponds to device background and involves literature review, device design and risk analysis; phase 2 corresponds to verification and involves manufacturing lathe programs and design modifications; phase 3 is about device validation for performance, effectiveness and safety assessment; phase 4 corresponds with transfer to production (in the case the project is feasible) for device release into the market; phase 5 and 6 are related with vigilance in the market (not included in the project). In this work only phase 1 and 2 are considered.

Methods: For phase 1(background and design), a review of existing literature has been done and Focal Points® optical design software is used.

Risk analysis is evaluated through the implementation of protocols and calculations following the standard international norms (ISO 14971:2012). Phase 2 (verification) is evaluated through contact lens manufacturing and quality control using Chiltern® to evaluate cosmetic defects, focimeter for measuring contact lens power and Nimo to evaluate aberrations.

Results: The risk analysis of Phase 1 has been compliant, not detecting new risks for the user according to regulations. In phase 2 the new design of STCL with dynamic stabilization system has been manufactured according to the theoretical design, having shown good stability, good vision and optical quality (see figure 1). Regarding cosmetic defects evaluated with Chiltern was satisfactory. The measured power contact lens was in accordance to the nominal manufacturing power according to the accepted ISO tolerance for contact lenses. (sphere ±0,25D; cylinder ±0,25D; axis ±5°) demonstrating the feasibility of the design.

Figure1: Optical zone non affected by prism effect. +3.00(-3.00*180°) contact lens power with design proposed.

Conclusions: Verification stage demonstrate that design is feasible, lathes were able to manufacture these design and prototypes could pass quality control. Satisfactory prototype is achieved in this first approach although some modifications could be carried out; however, the design needs to be improved before testing on eye and larger production to avoid non-justified rejects due to cosmetic appearance (blendings, edges) or split lenses.

Keywords: Individually crafted soft toric contact lens, aberration free, dynamic stabilization.

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Variation of meibomian glands contrasts throughout the day.

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Introduction: Meibomian Glands (MG) are responsible for synthesizing and secreting the meibum, this substance is part of the outer layer of the tear film, promoting stability and preventing its evaporation. Meibomian Gland Dysfunction (MGD) is the leading cause of evaporative dry eye worldwide [1] and is defined as a chronic and diffuse abnormality of meibomian glands.
Clinicians and researchers are now closer to creating a consensus regarding the definition, classification, and diagnosis of MGD [2], but there are still no objective diagnostic techniques that allow an automatic determination of the degree of dysfunction of these glands and their clinical evolution.
To assess the morphology of the Meibomian Glands, it is carried out subjectively, by direct illumination with a slit lamp that incorporates an infrared (IR) light source and an infrared CCD camera [3]. With this technique images called meibographies are obtained, and with them glandular parameters associated with pathology are determined. The use of this instrument is not very widespread, due to its high specificity and high cost.
In the present study a white light meibographer and low band-pass filters in the red region will be used an analysis of the morphology of the Meibomian glands will be carried out with objective techniques that will estimate the degree of alteration of the mentioned glands.
The contrasts between neighbouring glands, known as interglandular contrasts (CINTER) and within the same gland, known as intraglandular contrasts (CIN) will be determined.

Aim: Observe the variation of contrast in Meibomian Glands, throughout the day, studying its possible correlation with physiology, in normal subjects and with pathology of MG.

Methods: The selection of the sample for the investigation will be calculated with the GRANMO program. The sample will be divided into several study groups, all the participants will be previously informed about the characteristics of the study and the tests that will be carried out.

- Experimental methodology:
  - Clinical tests
  - Examination of the ocular surface
  - Optometric tests
  - Capture images of the meibomian glands with the Keratograph 5M
  - Capture meibomian gland images with the white light meibographer.

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

Result: It is expected to observe variations in contrast and morphology of MG. This variation expected to be found is due to the fact that the meibum is transported within the gland by the force of the secretory pressure and by the action of the muscles during blinking, this can vary the aspect of the glands as well as the contrast within and between them.

Conclusions: Applying this image technique, it is expected to know more about the morphology and function of the Meibomian Glands.

Keywords: Meibomian glands, meibography, meibographer, ocular surface

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Annexin A1 on the ocular surface epithelium: modulation by hyperosmolarity and its role in inflammation.

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Introduction: Osmotic stress, triggered by increased extracellular osmolarity, is a highly relevant challenge to normal cell function in a variety of tissues, including the ocular surface epithelium. In dry eye disorders, decreased tear secretion and/or excessive tear evaporation results in tear film hyperosmolarity. Although the pathogenesis of dry eye is not fully elucidated, it is recognized that elevated tear osmolarity damages the ocular surface directly or indirectly by inducing the release of inflammatory molecules that leads to cell death [1].
Annexin A1 belongs to the annexin superfamily of calcium-dependent phospholipid-binding proteins. It is a protein widely distributed in several tissues, as well as in a variety of cells of the hematopoietic system and epithelial cells [2]. Among the functions described for annexin A1, its anti-inflammatory biological role is especially relevant since it inhibits several enzymes related to the inflammatory response, such as phospholipase A2. Furthermore, it has been suggested that this protein and their peptides mimetic could promote the resolution of inflammation by modifying inflammatory cytokines production [3]. While the location and function of annexin A1 has been extensively analyzed in other organs, there is still scarce information about its presence and biological actions in the eye.

Aim: The purpose of this study was to identify the presence of annexin A1 on the ocular surface epithelium and to detect possible changes in annexin A1 protein expression and secretion as consequence of hyperosmolar conditions. Moreover, considering the well-established contribution of inflammation in dry eye, the potential anti-inflammatory activity of a peptide analog of annexin A1, which mimics its N-terminus, was evaluated.

Methods: Annexin A1 location in stratified human corneal and conjunctival epithelial cells was examined by immunofluorescence and confocal microscopy. Stratified human corneal and conjunctival epithelial cells were

exposed to hypertonic treatment with sodium chloride to mimic the tear hyperosmolarity characteristic of dry eye. Annexin A1 protein levels in conditioned media and total cells lysates were evaluated by western blot. Determination of interleukin 1β by ELISA (enzyme-linked immunosorbent assay) was performed to analyze the potential anti-inflammatory role of a peptide mimetic of annexin A1 in cells exposed to hyperosmolar challenge.

Results: Annexin A1 showed a cytosolic and membrane staining and a continuous labeling pattern was observed throughout the stratified corneal and conjunctival epithelium including areas of projections of contact between cells. In human corneal and conjunctival epithelial cells, western blot analysis revealed the presence of the complete native form of annexin A1 with a molecular weight of 37 kDa together with a weaker and lower molecular weight band (33 kDa), that corresponds to the truncated form of this protein. A significant increase in intracellular protein levels and annexin A1 secretion was detected in both cell lines after hyperosmotic exposure. Treatment with a peptide mimic of annexin A1 reduced interleukin 1β release induced by hypertonic conditions.

Conclusions: Annexin A1 was identified on the ocular surface epithelium and its expression and secretion was modified by hyperosmotic stress. Interestingly, treatment with a peptide mimetic of annexin A1 ameliorated interleukin 1β release triggered by hyperosmolarity. These findings suggest a potential role of annexin A1 in the modulation of inflammatory events associated to dry eye pathology.

Keywords: ocular surface, annexin A1, dry eye

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Virtual photonic restoration applied to cultural heritage: Application case Dali's picture "Dos figuras".

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Introduction: As time goes by, the artworks that make up a country's cultural heritage start to degrade. Lately, it has been interesting the development of new restoration techniques that are capable of solving the damages caused by humidity, temperature and electromagnetic radiation that affect or have affected artworks throughout its history. [1] Some artworks are difficult to restore by the usual method, the Dali's picture due to pigment composition and deterioration can not be restored by traditional intervention.
A system is proposed by which a restored perception of the artwork can be obtained, applied to Dalí's painting "Two Figures". As shown in Figure 1, its appearance has been altered from its creation in 1928 there are some. The research will be carried out in the doctoral thesis with title: Virtual photonic restoration applied to cultural heritage, this Phd research is granted by a project with reference: RTI2018-097633-AI00, financed by the Ministry of Science of the Spanish Government through their state RDI program called "Research Challenges 2018".

Aim: Create a system capable of solving the defects of the different artworks, providing a visualization of the artwork as if the years had not passed through it and without the need for contact and in a completely reversible way.

Methods: For a correct development of the technique, the current state of the artwork to be studied must be analyzed in depth. For it, a multispectral instrument will be developed, by which we can obtain the spectral reflectance of the artwork as a whole. In this way, together with the vision of

a restorer, we can have an objective vision of the artwork. Subsequently, an exhaustive study will be carried out of the optimal lighting conditions on which artworks can be illuminated without causing damage to it, in order to finally obtain a calibrated projection system.

Results: A visual compensation system capable of visually resolving the damage to the artwork will be projected, thus achieving a restored vision of it.

Conclusions: The development of this technique will allow obtaining a restored vision of artworks, which will be very useful both to display artworks in museums and to help restorers with restoration work.

Figure: (Left) Salvador Dali in the Figueres studio with his painting “Dos figuras” (1926) / Photography by Joan Xirau. (Right) Dali’s painting “Dos figuras” in 2019.

Keywords: Virtual, restoration, illumination.

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Development of imaging tools for biological characterization: retinal analysis.

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Introduction: Diabetic retinopathy and glaucoma are two types of eye diseases which are the main causes of vision loss worldwide that lead to total blindness. These two pathologies progress with changes in the retinal vasculature that can appear at different stages of the disease. Many studies have shown that the fundus image is a useful tool to directly visualize blood vessels non-invasively and in vivo, and that it offers a lot of information about the progress of these diseases [1].

Aim: The main objective of this work is to develop imaging tools to support the diagnosis and characterization of ocular pathologies through changes in the retinal vasculature. For this, figures of merit are developed that compare healthy retinas with other pathological ones in order to find differences between the two automatically. The tools focus on the study of the retinal vasculature through the study of its morphology and the diameter of the retinal vessels based on fundus images.

Methods: In the present study we are going to analyse how the aforementioned pathologies affect the retinal vasculature by measuring the fractal dimension (DF) of the retinal vessels. DF is a global measure of the branching pattern of complex geometric structures, such as vascular networks. In our study, we analysed the DF of image banks of healthy and pathological retinas classified into diabetic retinopathy and glaucoma. Previously, the retinas vessels are segmented from the fundus image through morphological image processing segmentation. In turn, the diameter of the blood vessels is measured in order to establish a correlation between their diameter and their fractal dimension. The calculation process uses programs for this purpose (FracLAc of ImageJ, Aria, [2], [3]) and all the results are integrated through its own interface in MATLAB. The figures of merit developed are the probability distribution of the Fractal Dimension and the probability distribution of diameters of the retina vessels. Differences are established with these distributions in pathological retinas and the altered image areas are marked, giving numerical values for their categorization.

Results: The previous methods allow us to calculate the probability distribution function of the fractal dimension and the vessel diameters of a retina. Healthy retinas show a similar behavior so an average value for them can be calculated together with a standard deviation. Pathological retinas show relevant deviations from this distribution (areas above or below the standard deviation), which allows studying the area where this deviation occurs. For diabetic retinopathy, the fractality distributions appear displaced to the right, with respect to healthy retinas (areas of greater fractal dimension, see figure 1). In the case of glaucoma, the average fractal dimension is more abundant than in healthy retinas.

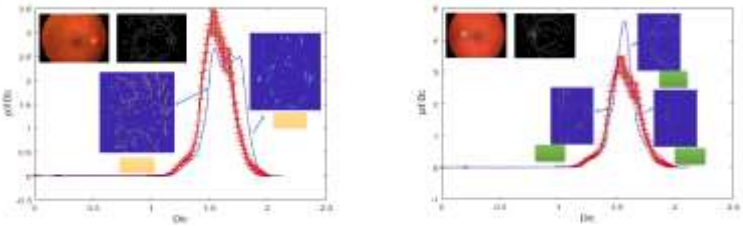

Figure 1: Left image, example of distribution of the fractal dimension for diabetic retinopathy (blue) versus the mean and deviation of healthy retinas (red) for vascular segmentation (B) of a retina (A). In C) and D) the retina area affected by the difference. Right image, the same for a glaucoma case.

Conclusions: The probability distributions of the fractal dimension and the diameters of the vessels are different for healthy and pathological retinas. In the case of the fractal dimension for eyes with diabetic retinopathy, the results show an increase in the mean fractal dimension (tortuosity). In the case of glaucoma there is a lower density of low and high fractal dimension vessels, increasing the number of vessels in the mean value**.**

Keywords: Fractal Dimension, diabetic retinopathy, glaucoma.

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Home-based amblyopia therapy by mean of playing videogames.

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Introduction: Amblyopia is the reduction of the visual function (mainly visual acuity) of one or both eyes no matter if the subject is corrected by mean of any optical or surgery method. It is developed during childhood and results in the interruption of normal cortical visual pathway development [1]. It is usually treated as a monocular deficit by mean of patching the "fellow (dominant eye)", but this solution could increase the binocular problems, because it does not allow the cooperation between both eye [2]. From last ten years, some researches have showed that using some videogames by mean of a dichoptic methodology improve the visual acuity and stereopsis in amblyopic subjects [3] but those works have been performed in adults and in the office and it could be a problem if the patient has to go frequently to the therapy in the office, and it could lead the subject do not complete the treatment or he/she abandons it.

Aim: The purpose is determinate if a home-based binocular therapy (Oculus go) produce changes in the monocular and binocular visual function in refractive amblyopic children (7-12 years old).

Methods: Sixteen refractive amblyopic children (7-12 years old) who had worn an optical correction at least 8 weeks and with no evidence for amblyopia visual therapy in the last 6 months were included. The monocular visual function *(Snellen visual acuity, Vernier visual acuity and Contrast Sensitivity Function – the last two test were designed in the Psykinematix software running in a MacBook Pro 13)*, and binocular visual function *(Stereopsis – Howard Dolman test, Interocular Ratio Difference – test designed in Matlab version 8.4)* were evaluated previous to start and after to complete the therapy. Subjects had to play along 2 hours (six days a week) a first-shooter video game (Dead and Buried, Death Horizon, Gunjack) installed in an Oculus go (virtual reality googles) plus a Bangerter Filter fitted on the dominant eye, until to complete 30 hours of playing the videogame. The therapy was followed up through daily video-calls (Skype) by the

researcher or an optometry student (playing as an auxiliary of the research). The results were grouped by dominant (DE) and non-dominant eye). The statistical analysis included median, interquartile rank and the Wilcoxon sum rank test to evaluated the difference between both eyes or the changes in the visual function after the therapy.

Results: Sixteen children with refractive amblyopia (15 anisometropic, 1 isometropic) and an age range between 7 to 12 years old were included (mean 9 years, SD±2years). Snellen Visual acuity (SVA) showed significant differences among dominant (DE) and non-dominant eye (NDE) pre (0.33 logMAR, p=0.001) and post therapy (0.20 logMAR, p=0.001); additionally, a significant improve was seen for NDE eye (0.1 logMAR, p=0.001) after the visual therapy. Vernier Visual Acuity (VVA) showed similar findings to SVA between both eyes previous (0.027 arcmin, p=0.001) and after the therapy (0.026, p<0.001), however, comparing pre vs post therapy, neither DE nor NDE eye showed significant changes (DE: <0.001minarc, p=0.201; NDE: 0.001, p=0.093). On the other hand, the Contrast Sensitivity Function showed (again) significant differences between both eyes (DE vs NDE, p<0.05) in all spatial frequencies (1.5, 3.0, 6.0 and 12.0 cycles per degree – C/º), but no significant change was observed after to complete the therapy in any frequency (p>0.05). Finally, the binocular visual function showed that stereopsis improved after the treatment (33 arcsec, p=0.004), but that change was not found for interocular ratio difference (IORD, p>0.05) at any spatial frequency (0.5, 1.5, 2.5 and 5.0 C/º).

Conclusions: Ambiguous results were observed in the monocular and binocular visual function after to complete a home-based therapy methodology, indicating that this method could be used as a complementary therapy in the treatment of the refractive amblyopic children.

Keywords: Amblyopia, binocular therapy, videogames.

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Modulation of aqueous humor melatonin levels in cataracts by yellow-filter.

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Introduction: Melatonin is a neurohormone mainly secreted by the pineal gland, but it also produced by various structures of the eye such as ciliary body, retina and lens [1]. It has been recently demonstrated that it is possible to induce the ocular synthesis of melatonin by reducing the blue component of white light by means of filters [2]. In the lens, melatonin is considered as an antioxidant and free radical scavenger [3]. As oxidative stress is a key event in cataract formation, changes in melatonin levels could be relevant in the progression of this pathology.

Aim: The purpose of this work is the evaluation of melatonin concentration in the aqueous humor of senile- and diabetic- cataract patients as well as in a diabetic cataract animal model as compared to control subjects. Additionally, the effect of a yellow-filter on aqueous humor melatonin concentration in the pathological animal model and the molecular mechanisms responsible for this effect was analyzed.

Methods: Aqueous humor melatonin levels from patients and experimental diabetic rabbits were determined with a commercially available ELISA (Enzyme-linked immunosorbent assay) kit. Human lens epithelial cells (HLE B-3) were also used for *in vitro* experiments. HLE B-3 cells were exposed for 2 hours to darkness, white-light (a known inductor of reactive oxygen species production in lens) and white-light in presence of yellow filter. After cell lysis and protein determination, western blot was performed to examine protein expression of the melatonin biosynthetic enzymes: hydroxyindole-O-methyltransferase (HIOMT) and unphosphorylated and phosphorylated forms of arylalkylamine N-acetyltransferase (AANAT).
Results: The concentration of melatonin in human aqueous humor was significantly different between control subjects and cataract patients. Patients with senile-cataracts showed a 40% of reduction in aqueous humor

melatonin levels as compared to control subjects ($p < 0.05$). The decrease in melatonin concentration was even greater (around 60% of reduction) in patients with diabetic cataract ($p < 0.01$). Consistent with diabetic-cataract patients data, significantly lower levels of melatonin were observed in aqueous humor of experimental diabetic cataract-induced animals (5.817 ± 3.05 ng/mL) as compared to those of control rabbits (12.94 ± 9.17 ng/mL) ($p < 0.05$). In contrast, aqueous humor melatonin levels of experimental diabetic cataract-induced animals exposed to yellow filter resembled control values (14.04 ± 10.21 ng/mL) indicating that yellow filter preserved melatonin levels. White light exposure in HLE B-3 cells resulted in a decrease in HIOMT, AANAT and pAANAT protein levels [% reduction: HIOMT (31%), AANAT (22%), pAANAT (25%)] compared with HLE B-3 cells under darkness conditions ($p < 0.05$). Yellow filter prevented light-induced protein reduction of melatonin biosynthetic enzymes, since no statistical significance was found between HLE B-3 cells in darkness and HLE B-3 cells exposed to light in the presence of yellow filter.

Conclusions: Yellow filter precluded melatonin secretion reduction observed in cataracts. Aqueous humor melatonin levels recovery could be mediated by the induction of melatonin biosynthetic enzymes protein expression. Considering the key role of oxidative stress in cataract pathology and the antioxidant properties of melatonin, yellow filter use might contribute to delay cataract progress.

Keywords: Melatonin, Cataract, Yellow filter.

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Visual function, ocular surface integrity and symptomatology of a new extended depth-of-focus and a conventional multifocal contact lens.

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Introduction: The increasing longevity is affecting over a billion people suffering from presbyopia [1]. Nowadays, simultaneous-image contact lenses (CLs) are the most prescribed multifocal CLs. However, these designs are often associated with dysphotopsias such as halos and glare perception, decreased contrast sensitivity (CS) and ghosting, and are more susceptible to pupil variations and illumination levels, which might have an adverse effect on quality of vision [2]. New designs for presbyopia are being developed varying high order spherical aberrations terms to induce an extended depth-of-focus (EDOF), which seem to be less susceptible to ocular aberrations, pupil variations and CL decentration [3].

Aim: To evaluate visual function, ocular surface integrity and dry eye symptoms with an EDOF CL design and a conventional multifocal design after 15 days of wear.

Methods: A crossover blind randomised clinical trial was conducted on 30 presbyopes who wore EDOF and a conventional multifocal CL for 15 days. Defocus curves, depth-of-focus range, CS under photopic and mesopic conditions (with and without glare) and subjective perception of halos and glare were evaluated. Ocular surface was evaluated through non-invasive Keratograph tear breakup time (NIKBUT), averaged tear breakup time (NIKBUT-avg), tear meniscus height (TMH), bulbar and limbal redness, and conjunctival and corneal staining. Dry eye symptoms were registered with the OSDI questionnaire.

Results: No statistically significant differences were found for defocus curves or depth-of-focus range between the two CLs ($p>0.05$ both). Subjective perception of halos and glare was not significantly different

between CLs. Small statistically, but not clinically significant differences were observed for CS under mesopic conditions for low spatial frequencies (p=0.008). None of the CL produced significant changes on NIKBUT, NIKBUT-avg, TMH or redness. 76.7% and 73.3% of participants maintained the bulbar staining grading for EDOF and the conventional CL, respectively, and 86.7% and 83.3% maintained the corneal staining grading for EDOF and the conventional CL, respectively. No changes were observed in the symptomatology measured with OSDI questionnaire (p>0.05).

Conclusions: Both CL for presbyopia offer good visual quality, preserve the ocular surface integrity and provide the patient with similar symptomatology levels after 15 days of wear.

Keywords: Extended depth-of-focus, multifocal contact lens, presbyopia.

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Does the blue light of the tablets cause dry eye?

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Introduction: Electronic device visual syndrome (SVDE) includes a series of both ocular and extra-ocular symptoms in those who routinely use these kind of devices for long periods of time [1,2].
These eye symptoms include dry eye, irritated eyes, eyestrain, blurred vision, red eyes, irritated eyes, excessive tear discharge, double vision, headache, glare and sensitivity to light, contact lens discomfort, slow change of focus, changes in color perception [3]. Among these electronic devices are computers, mobiles and tablets, which emit blue light at wavelengths between 400nm and 490nm from their light-emitting diodes (LEDs), this emitted radiation is close to the peak of suppression sensitivity of melatonin and in turn produce electromagnetic fields, aspects that interfere with circadian cycles. Exposure to electromagnetic fields at night affect the quality of sleep and the rate of melatonin secretion.

Aim: To evaluate the influence of the use of electronic devices before sleeping on the dry eye associated with this habit.

Methods: In this work, the survey started a year ago has been expanded the present year. The aim is finding eye habits and symptoms that may arise due to the excessive use of new technologies.
The use of an App is introduced to control the parameters of use of electronic devices. This App allows to obtain data objectively without the user intervening, so we can know the time of use and lighting during the reading on the device, among other parameters. The application and benefits of its use, on the research we carry out, will be described.

Results:
In the expanded survey 257 participants were obtained:

- 77.5% are women
- 67.4% are between 20 and 25 years old

- 88.2% read before sleeping on an electronic device
- 10.6% notice grit feeling, 35.3% sensitivity to light, 10.2% blurred vision and 18.1% dry eye after this reading

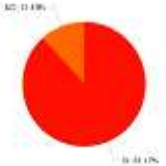

Figure 1: Users who read before bed.

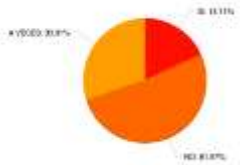

Figure 2: Users who refer dry eye.

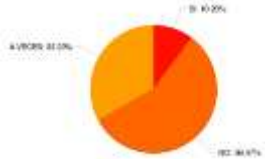

Figure 3: Users who report blurred vision.

Conclusions: At this point of the investigation we continue to make progress in objectively evaluating the use of electronic devices and evaluating the symptoms presented by users.

Keywords: Electronic device, Melatonin, Dry eye

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Visual skills in athletes with physical disabilities.

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Introduction: Sensory interrelations, perceptual, communicative and cognitive elements are linked to decision making and to the motor execution response in sports. This of course requires to get the mechanical aspects and the perception of external stimuli that involve visual function [1,2], which is an advantage to ease athletes with a more precise orientation, achieving better results in the performance on the playing field. Thus, the aspects of visual function are key to the development of visual skills of speed and precision [3,]as well as superior perceptual skills, which have been found more developed in athletes compared to the general population. However, there is a lack of evidence in this sense aimed at athletes with a physical disability condition despite the fact that Paralympic sport has gained great strenght in recent years and from WHO figures that estimates that 15% of the world population are people with a disability condition and whose number seems to be increasing. Colombia is the second country with the highest prevalence of people with a physical disability condition in Latinoamerica with a 6.3%, therefore, it requires to count with rehabilitation strategies, development of autonomy and social inclusion, being sport one of the more powerful tools to achieve it.
Sport adapted due to physical causes requires a classification according to the type of disability to achieve competitiveness with equity. Thus, as the brain needs to adapt through neuroplasticity and vision plays a fundamental role as it is the sense that is responsible for receiving most of the information from outside [2], however, in physical disability, there is no evidence or enough knowledge to address the evaluation and training of visual skills in these type of persons.

Aim: To determine the state of visual function and visual skills focused on sport in athletes with a physical disability condition.

Methods: Quasi-experimental mixed study. A population of 20 Rugby players older than 18 years was included, who are the totality of available players in Bogotá from the Cundinamarca and Colombian team. Players with visual diseases, cognitive development alterations and seizures were excluded. The project was endorsed by the University of La Salle Ethics Committee and the Helsinky regulations for intervention with human beings were complied. The evaluation was carried out in 3 moments: 1: optometric evaluation and contact lenses and sports glasses fitting when needed. 2. Assessment of visual efficacy with reference ranges according to Scheiman. 3. Assesment of sports vision adapted to physical disability, developed as part of the work. This is the first phase and the 2nd phase will be visual training.

Results: When observing the frequencies of the different aspects of visual function and evaluated abilities, 37.5 % of binocular and accommodative dysfunctions are found, followed by 31.25 % of accommodative dysfunctions. The visual abilities of visual perception in general are found below the average. The dynamic visual acuity was found with an average speed of 23.3 which expected level is 32 in rotator revolutions in its original creation. Contrast sensitivity was found with values within the normal ranges for the age and evidences greater sensitivity in the dominant eye curve. In the visomotor ability, an average of 17.92 errors of the athletes are found when carrying out the test and a speed of 0.47 secs, while in the reaction speed on the reactive mode, 3.33 errors were found with an average time of 0.53 secs.

Conclusions: The visual abilities in athletes that are below the normal ranges are binocular vision and visual perception considered vital for a good performance in dynamic team sports.

Keywords: visual skills, disabilities, athletes.

References:

[1] Alvis,K, Pulzara, Auditory discrimination, visual scanning, space and body schemes development in tennis players and non-athletes subjects. Rev. Fac. Med. 2013; 61; 4: 395-403.
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Visual skills in athletes with physical disabilities.

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Introduction: Sensory interrelations, perceptual, communicative and cognitive elements are linked to decision making and to the motor execution response in sports. This of course requires to get the mechanical aspects and the perception of external stimuli that involve visual function [1,2], which is an advantage to ease athletes with a more precise orientation, achieving better results in the performance on the playing field. Thus, the aspects of visual function are key to the development of visual skills of speed and precision [3,]as well as superior perceptual skills, which have been found more developed in athletes compared to the general population. However, there is a lack of evidence in this sense aimed at athletes with a physical disability condition despite the fact that Paralympic sport has gained great strenght in recent years and from WHO figures that estimates that 15% of the world population are people with a disability condition and whose number seems to be increasing. Colombia is the second country with the highest prevalence of people with a physical disability condition in Latinoamerica with a 6.3%, therefore, it requires to count with rehabilitation strategies, development of autonomy and social inclusion, being sport one of the more powerful tools to achieve it.
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[2] Graham B. Erickson, Optimizing Visual Performance for Sport. Advances in Ophthalmology and Optometry. 2018: 3; 1-19
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Prevalence study of visual dysfunctions in High School students.

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Introduction: Over the last few decades, visual habits have been changing in line with the development of new technologies. Near vision work, increased use of computers, smartphones and tablets even in the classroom and less time spent outdoors can be related to some visual dysfunctions, such as myopia; as well as non-strabismic anomalies [1].

Aim: To determine the prevalence of visual impairment in a population of high school students, as well as to identify possible risk factors.

Methods: A cross-sectional descriptive epidemiological study was conducted. Subjects in the 2nd year of secondary education (E.S.O.) from two schools in the Community of Madrid were evaluated, excluding those with pathologies or surgery affecting the refractive state or any type of psychological deficiency or disorder.
Visual acuity was measured monocularly with ETDRS in far and near vision; objective refraction with auto-refractometer and retinoscopy, color vision with Ishihara test, stereopsis with random dot and Wirt's circle tests; lensometry; cover test, near point of convergence; and fusion vergence. In addition, the CISS questionnaire was carried out. A score greater than or equal to 16 was considered as symptomatic [2].
Spherical equivalent (SE) of retinoscopy results was calculated except in subjects with an astigmatism equal or higher than 1.50D. Myopia was defined as a SE ≤-0.50D and, a visual acuity ≥ 0.1 LogMAR; hyperopia as a spherical power ≥ +0.75D; astigmatism was fixed as a cylinder power ≥ 1.00D; and emmetropia as a spherical power between -0.50 and +0.75D. Anisometropia was defined as a difference in SE equal or higher than 1.00D. Convergence Insufficiency (CI) was defined by exophoria at near at least 4Δ greater than at far, positive fusional vergence < 15Δ base out blur or break and near point of convergence (NPC) of ≥ 6 cm break.

Results: 109 subjects, mean age 13.63 ± 0.48 years, were evaluated. Right eyes were selected for analysis. Mean visual acuity was -0.01 ± 0.13 LogMAR in far vision and -0.02 ± 0.09 LogMAR in near vision. Mean stereopsis was 77.65 ± 36.99 arc seconds with random dot test (global stereo) and 43.37 ± 27.99 arc seconds with Wirt circles test (local stereo).
Refractive results showed a prevalence of 17.43% of myopia; a 15.60% of hyperopia; a 66.05% of emmetropia and a 0.92% with only astigmatism.
16,9% had an astigmatism equal or higher than 1.00D. CI was found in 4.59% of participants. In addition, prevalence of NPC of ≥ 6 cm break was 33.94%; an exophoria at near at least 4Δ greater than at far was 18.35%; and positive fusional vergence < 15Δ base out blur or break was 24.77%. Anisometropia prevalence was 12.84%. Strabismus prevalence was 0.92%.1 subject (0.92%) was protan strong.
Mean punctuation in CISS test was 12.25 ± 8.58; however, 29.36% were symptomatic and 50% of IC subjects were symptomatic.

Conclusions: CI and refractive results are in concordance with other authors. CISS symptomatology results are considerable considering subjects' age, being necessary to identify risk factors of this symptomatology.

Keywords: Refractive error, convergence insufficiency**,** near work

References:

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The CISSve-R2 scale. A reduced versión of CISSve.

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Introduction: CISS-v15 (Convergence Insufficiency symptom survey) [1,2] is the most accepted survey to detect and measure close vision problems.
Recently, our team has been working on the adaptation to Spanish of CISS-v15 [3] and its validation, in order to provide a reliable tool to measure these symptoms to Spanish speaker professionals. As an outcome, CISSve (Spanish version of CISS).
The current work implements a reduced version of CISSve.

Aim: The target of this work is the creation of a new instrument, the CISSve-R2 scale, a reduced version of CISSve that will allow quick "screenings" on a general population. Age range (9-30).
Taking advantage on the deep study performed with the CISSve survey and its psychometric properties, this investigation aims the creation of a reduced version of that scale that can support the classification of patients that requires further checks on an optical cabinet.

Methods: Analysis of psychometric properties of the Spanish version of CISS through Rasch analysis supported by the software Winsteps.
Item reduction technics applied to CISSve with the support of questionnaire design guidelines and statistical analysis methods to get the items reduced to a minimum number with a maximum reliability
Cross validation through prediction models based on "machine learning" tools.

Results: The CISSve-R2 scale, a reduced version of CISSve, available for professionals.
The CISSve-R2 performance analysis confirms a similar reliability of CISSve-R2 vs CISSve.

Conclusions: The CISSve-R2 scale, can help professionals for quick assessments and classifications of potential IC problems in patients on the age range (9-30), minimizing the administration time and extending the range of populations that can be assessed with quick “screenings”.

Keywords: IC, Scale, CISSve.

References:

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Descriptive study of the prevalence of visual anomalies in the school population.

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Introduction: Vision is an important sense with multiple functions, including those related to close-up activities. These functions may be unbalanced or malfunction, leading to a range of symptoms such as headaches, blurred vision, eye fatigue, double vision and drowsiness. School-aged children frequently perform daily activities at close distances (reading, studying, writing) so that visual functions such as: ability to focus, ability to converge, eye movements, eye refraction (myopia, hyperopia, astigmatism) and visual acuity must be optimal and function properly. However, if these visual functions function incorrectly, they can be expressed in symptoms that affect their school performance such as low reading speed, loss of the reading line, words moving on the page, decreased concentration or decreased comprehension in close-up activities [2].

Aim: To determine the prevalence of visual anomalies in the school population between 5 and 12 years old and to relate visual anomalies to symptoms.

Methods: A descriptive and comparative cross-sectional study was performed. 397 primary school volunteers matriculated in schools of the Community of Madrid (subsidized, private and public) from first and sixth year of primary school. Measures of visual acuity, retinoscopy, autorefraction, stero acuity, near point of convergence, eye movements such as versions and saccades, cover test, vergence amplitude, vergence flexibility, accommodation amplitude (Donders method and modified negative lens test) accommodation flexibility, color test, Berry VMI test, DEM test, personal history questionnaires and CISS were performed once only to identify visual abnormalities in this population. Convergence insufficiency (CI) was defined by exophoria at near at least 4Δ greater than at far, positive fusional vergence < 15Δ base out blur or break and near point of convergence (NPC) of ≥ 6 cm break. Right eyes were selected for analysis.

Results: 149 subjects from the first year of primary school, mean age 6.43 ± 0.40 years, were evaluated. 75.83% male and 24.16 female. Mean visual acuity was 0.07 ± 0.07 LogMAR in far vision and 0.11 ± 0.08 LogMAR in near vision. Mean stereopsis was 104.10 ± 150.45 arc seconds. 1 subject (0.67%) was protan strong. Refractive results showed a prevalence of 3.35% of myopia; a 49.66% of hyperopia; a 45.63% of emmetropia and a 1.34% with only astigmatism.
CI was found in 1.99% of the participants. In addition, exophoria at near at least 4Δ greater than at far was 11.41%; positive fusional vergence < 15Δ base out blur or break was 16.78%; and NPC ≥ 6 cm was 22.51%.
They participated 189 subjects from the sixth year of primary school, mean age 11.55 ± 0.44 years, 76.19% male and 23.81 female. 16.40% wore glasses. Mean visual acuity was -0.00 ± 0.01 LogMAR in far vision and 0.00 ± 0.10 LogMAR in near vision. Mean stereopsis was 51.12 ± 75.41 arc seconds with Random dot test (global stereopsis) and 51.12 ± 60.58 arc seconds with Wirt circles test (local stereopsis). Refractive results showed a prevalence of 10.58% of myopia; a 26.45% of hyperopia; a 58.73% of emmetropia and a 4.23% with only astigmatism.
CI was found in 5.26% of participant. In addition, exophoria at near at least 4Δ greater than at far was 16.32%; and positive fusional vergence < 15Δ base out blur or break was 24.73%; and NPC ≥ 6 cm was 40%.
Conclusions: A prevalence of CI and refractive errors was detected in the subjects of sixth grade according to the literature, with an increase in myopia and IC prevalence with age.

Keywords: visual abnormalities, insufficiency of convergence, academic performance.

References:

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Effect of scleral contact lens on conjunctival Goblet cells in irregular cornea patients over one year.

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Introduction: Scleral contact lenses are an important tool in visual rehabilitation of patients with an irregular corneal surface from conditions such as keratoconus, intraestromal corneal rings and post-refractive surgery [1]. These lenses are rigid gas permeable with a large diameter designed to rest on the conjunctiva and vault over the entire corneal surface. As scleral lens do interact directly which conjunctiva, it could result in a mechanical impact in the bulbar conjunctiva that can hypothetically modify some conjunctival properties. Several studies demonstrate that contact lens wear may alter the Goblet cell density and function [2]. Conjunctival Goblet cells are secretory epithelial cells responsible for the production of the mucinous component of the tear film. A reduced mucin production will trigger some dryness eye symptoms [3].

Aim: To evaluate the differences between Goblet cell density (GCD) and mucin cloud amplitude (MCA) after one year of scleral lens wear in irregular cornea patients.

Methods: A total of sixty-four subjects (39,39 ±10,48 years old) wearing scleral contact lens for one year participated voluntarily in the study. Subjects were divided into three groups: 31 keratoconus, 18 intraestromal corneal rings and 15 post-refractive surgery. Superior conjunctival impression cytologies were performed and therefore analyzed with scanning laser confocal microscopy to evaluate GCD and MCA. All subjects filled-out the ocular surface disease index (OSDI) questionnaire. All measurements were performed before scleral lens fitting and one year after wearing to assess the evolution of the changes throughout this time.
Results: Regarding the goblet cell analysis, significant differences were found in GCD in total patients group (p=0,031) comparing the baseline visit

to the one year visit, GCD increased 8,36 ± 23,35 cells/ mm^2 (Figure A). There were no statistically significant differences between groups. In MCA, there was a significant increase after wearing scleral lens in total patients group (p= 0,002) and post-refractive surgery (p=0,014) (Figure B). The mean OSDI score decreased 44,42% after one year wearing scleral lens (p=0,000) in total patients group.

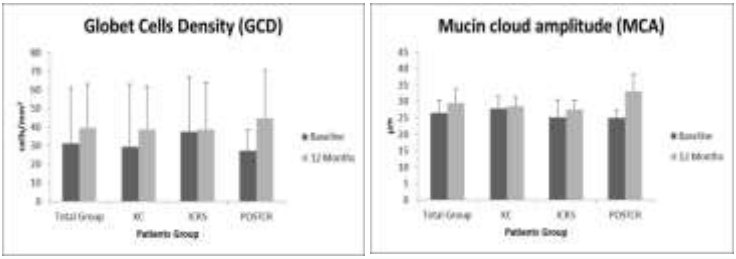

Figure 1: Differences of Globet cells density (A) and mucin cloud amplitude (B) in different groups before and after scleral contact lens wearing for twelve months, value<0.05; baseline vs 12 months student test for related samples.

Conclusions: Goblet cell density and mucin cloud amplitude increase after one year of scleral lens wearing in irregular cornea patients. Scleral contact lens improves the dry eye symptoms.

Keywords: Scleral contact lens, irregular cornea, conjunctival cytology.

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PONENCIAS EN PÓSTER

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Effect of orthokeratology contact lenses on rabbit eye (morphology and physiology).

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Introduction: Myopia is a refractive defect that affects 22% of the world population. By 2050, it is estimated that this number will reach 50% due to changes in lifestyle habits, Currently, treatments are known to slow the growth of the eye, and therefore myopia, such as the use of orthokeratology contact lenses. This study aims to investigate physiological events to develop and optimize new treatments that allow more effective to myopia control and thus reduce its negative impact on the eye health of people, society, and the economy.

Aim: To investigate the physiological events in the growth of the eye in order to develop and optimize new treatments that allow more effective control of the progression of myopia and thus reduce its negative impact on eye health.

Methods: Rabbits will be used to study the effect of orthokeratology contact lenses. A prospective study (3-month) will be carried out in the effect of orthokeratology contact lenses on morphology and physiology to understanding the mechanisms involved in eye growth. The rabbits will be divided into two groups: first group without a contact lens and the second with a contact lens. The measurements of the statistical variables will be made before (baseline), during, and after the treatments (after 1, 15, 30, and 90 days).

Results: Under process

Keywords: Orthokeratology, rabbit, myopia control.

Peripheral refraction, topographic profile and aberrations of six hydrophilic contact lenses for myopia control: Piloto study.

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Introduction: According to the World Health Organization (WHO), by 2050, half the population will be myopic [1]. That is due to new ways of slowing the progression of myopia are being researched, looking for more comfortable and effective options for the patient, such as soft contact lenses [2].

Aim: This pilot study attempts to observe the changes in corneal topography, peripheral refraction and aberrations created by specific hydrophilic lenses for myopia control.

Methods: A pilot study was realized with 7 patients (4 women and 3 men) with ametropia of between 0.00 and +1.00 whose average age was 27.43 ± 4.08. A total of 6 hydrophilic contact lenses of different design, with peripheral defocus, which were specific for myopia control, were tested in the same patient and for one eye only, in one visit. The topographic profile of each contact lens (Scheimpflug camera topographer), higher order aberrations (spherical aberration and coma), and peripheral refraction (measured with an open field auto-refractometer) were evaluated.

Results: Two main patterns were observed, three of them showed a bifocal design with a far center, and the other three lenses a more progressive multifocal design. Statistically significant differences were found in the power profiles of the topography ($p < 0.05$), but these are not related to peripheral refraction, where no differences between the 6 lenses were observed ($p > 0.05$). No statistically significant differences were found in the 6 lenses in the peripheral refraction profile, although in all of them a change in peripheral blur from hyperopic to myopic is observed, being more marked in the temporal side, and observing statistically significant differences ($p < 0.05$)

from 10º in the temporal hemisphere. Finally, statistically significant differences ($p < 0.05$) were found in total aberrations, with an increase in spherical aberration, vertical and horizontal coma.

Conclusions: All contact lenses have a similar peripheral defocus, with myopic peripheral defocus being more pronounced in the temporal hemisphere, despite their design. In addition, it has been shown an increase in coma aberration, indicating an off-centeredness of the lenses, so to assess the effectiveness in controlling myopia, the influence of this off-centeredness on each contact lens designs should be taken into consideration.

Keywords: myopia control, soft contact lenses, peripheral refraction

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Characterization of the microbiota of dry eye in users of monthly replacement disposable soft contact lens wearers

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Introduction: Dry eye syndrome is a disease of multifactorial origin that affects a large part of the world population. This disorder is characterized by causing foreign body sensation, dry eyes, photophobia, or excessive tearing [1]. Dry eye usually occurs with an increase in tear osmolarity, which can lead to instability of the tear film and alteration and inflammation of the eye surface. Age, sex, dysfunction of the meibomian glands (GM) and / or the use of contact lenses (LC) are some of the risk factors for suffering from it.
Numerous microorganisms cohabit on the ocular surface, forming the ocular microbiota. Some of these microorganisms are pathogenic, invading the conjunctiva or cornea and causing infections, but many others interact with our immune system to protect us against eye disease [2]. The use of LC is related to possible imbalances of the ocular microbiota that could alter the immunity of the ocular surface and be involved in the pathogenesis of dry eye syndrome [3].
Currently there are treatments able to brake the signs and symptoms of the disease, but there are not possibilities of heal the disorder. In consequence of that, new methods of treatments have been studied based on micro-biology [1].

Aim: To analyze the microorganisms that exist in dry eyes subjects and who are carriers of monthly soft contact lens and compare these results to a control group of individual contact lens wearers without ocular surface pathology. To study if there is a correlation between the microbiota of individuals with pathology and normal individuals.

Methods: The selection of the sample for the investigation will be calculated with the GRANMO program. The sample will be divided into two study

groups: The group of subjects with dry eye, LC carriers monthly replacement disposable soft and the control group.
Firstly, various clinical-optometric tests will be carried out to evaluate the state of the ocular surface. Including: symptomatic tests, assessment lacrimal meniscus height, time of tear film rupture, tear lipid pattern, morphology of the eyelids, in addition to corneal and conjunctival dye and assessment of the GM morphology. Subsequently, the microbial load in each group of individuals will be determined. It will be necessary collect samples from the skin located under the eyelids, the free edge of the eyelid, the superficial and deep conjunctiva and the LC from each subject. Finally, microorganisms will be sown and isolated under aerobic and anaerobic conditions in different culture media.

Result: It is expected to observe variations in the ocular microbiota between the two study groups and it is also expected that there is some microbiological finding that allows us to distinguish the individual who wears LC with dry eye from the one who does not have it, so that the determination of the microbiota of an individual, who has not yet been diagnosed with dry eye, makes us suspect that he may become one and that he could potentially have problems with his/her LC.

Conclusions: The conclusions will be determined based on the results obtained in the study.

Keywords: dry eyes, ocular microbiote, contact lens.

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Intra-examiner repeatability and agreement in the measurement of ocular heterophoria in young people.

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Introduction: There are previous studies of repeatability of the ocular deviation but not in such a large sample of young people and with the 4 tests used in this investigation in both distance and near vision [1], [2], [3]. As the methodology of the tests used is notoriously different, the hypothesis was that they are not expected to be interchangeable and present different repeatability.

Aim: The purpose of this study has been assessed and characterized in terms of repeatability, the evaluation of heterophoria with different clinical tests in a sample of young people (18 to 25 years old).

Methods: Heterophoria in distant vision (6 meters) and in near vision (40 cm) with trial glasses, was quantified in two sessions (1 week apart) in 110 subjects (men = 20, women = 90) between the ages of 18-25 (mean = 19.24 years; SD = 1.57 years old). The range of ametropia was from -0.25 to -11.00 D for myopia, from +0.25 to +6.00 D for hyperopia, up to -4.00 D for astigmatism. The four tests used were cover test, Von Graefe, Maddox rod and modified Thorington. The repeatability of the tests and the agreement between them was estimated using Bland y Altman method, where the mean difference and the 95% limits of agreement were determined to calculate the repeatability coefficient (CDR) and the coefficient of agreement (CDC).

Results: Regarding the CDR, we highlight that in all the techniques studied, this coefficient was lower when the tests were used in distance vision, compared to near vision. The CDR were ± 1.58 Δ to ± 4.07 Δ in distance vision and 3.31 Δ to 5.56 Δ in near vision. Cover test showed the best intra-examiner repeatability in distance (CDR = ± 1.58 Δ) and near vision (CDR = ± 3.31 Δ). Regarding the agreement between pairs of tests, cover test and

modified Thorington showed the best agreement, with the lowest coefficient of agreement both in distance (± 2.99 ∆) and in near vision (± 3.87 ∆).

Conclusions: Remarkable differences have been found in the degree of repeatability of the different clinical tests to measure ocular deviation, being always better when the test is used in distance vision than in near vision. Cover test was the most reproducible test in distance and near vision. The most repeatable objective test in distance and near vision was modified Thorington test. The low degree of agreement between the tests studied means that they are not interchangeable.

Key words: Repeatability, heterophoria, agreement.

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Low-contrast visual acuity as visual function predictor for night driving.

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Introduction: Under mesopic illumination or bad weather conditions such as rain or fog, visual information is reduced, contour discrimination gets worse and there is a substantial loss of color perception, with a general decrease of the visual perception [1,2]. The higher risk of accident in night driving could be decreased by a proper estimation of the parameters of the visual function.
In this respect, the evaluation of VA in night driving conditions must be a priority in the normalization and regularization of the exploration of drivers. Therefore, it is crucial to examine the visual function of the drivers thoroughly. Photopic visual acuity alone is not a good predictor of night driving ability [3]. Mesopic visual acuity seem relevant for night driving. Due to the small number of studies evaluating predictors for night driving ability, further research is needed.

Aim: The main purpose of the present work is to study the correlation between mesopic visual acuity (MVA) and photopic visual acuity (PVA) in drivers. As a consequence of the previous study, we develop a predictor of the visual function between different illumination conditions of driving.

Methods: The study has been carried out in 56 people, aged between 20 and 71 years, all of them in possession of the Spanish driving license. The former is evaluated with the 100% contrast optotype chart, while the latter is evaluated with optotype charts with variable contrasts and filters of different densities.

Results: We observed larger values of VA in the younger group (below 50 years old) under all conditions of illumination and contrast ($p<0.05$). Interestingly, the results indicated that the average value of the PVA with 20% contrast and 80% filter is very close to the MVA with 100% contrast.

Conclusions: Visual acuity significantly diminishes under night driving conditions, being this effect especially severe in people above 50 years old. Using optotype charts with 20% contrast and a filter of 80% in photopic conditions serves a cheap and easy simulator of mesopic conditions. Given the high correlation between both methods, the photopic measurements with contrast and filter could be used as a predictor of the MVA.

Keywords: Mesopic visual acuity, photopic visual acuity, night driving.

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Pupillary reaction time in subjects treated with psychotropic drugs.

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Introduction: Psychiatric or mental illnesses are those illnesses that occur due to a dysregulation of the brain and its functions, producing a series of biological, psychological and social symptoms. These disorders are treated with different types of psychotropic drugs that have different effects on the central nervous system.
During the last decades, numerous studies have been carried out in which the pupillary reflex is used as a possible indicator of pathologies or alterations, both at the ocular and general level, due to its involvement in the nervous system. Among all the investigations, those in which the photomotor reflex is used to determine possible psychiatric disorders, such as schizophrenia [1], bipolar disorder [2] or depression [3], should be highlighted.
The photomotor reflex is the reflex arc responsible for the contraction of the pupil of the eye in response to an increase in the amount of light. This reflex is mediated by the vegetative nervous system, whose function is to ensure that the optimal amount of light enters the eye for adequate vision, avoiding glare.

Aim: To know the differences between patients treated with psychotropic drugs and people without treatment in the times of pupillary reaction to a repeated white light stimulus using dynamic photopic pupillometry to know if the treatment dose is adequate.

Methods: The sample consisted of 68 volunteers divided into two groups. 37 of them (14 men and 23 women), diagnosed with a psychiatric disorder and undergoing treatment with psychotropic drugs, formed the study group, with an average age of 46±10 years old. The remaining 31 subjects (13 men and 18 women) formed the control group, with an average age of 52±17 years old. Pupil latency, contraction and redilatation time was evaluated monocularly under five white light stimuli using the Keratograph 5M (Oculus Opikgeräte GmbH, Wetzlar, Germany).

Results: Statistically significant differences (p-value<0.05) were found between both groups for the three variables analyzed and for each of the five light stimuli. In the case of the latency time, that is, the time it takes for the pupil to react once the stimulus has been activated, this time is statistically longer for the group of subjects treated with psychotropic drugs. Regarding the time of pupillary contraction and dilation after stimulation, it was in both cases greater for the control group.

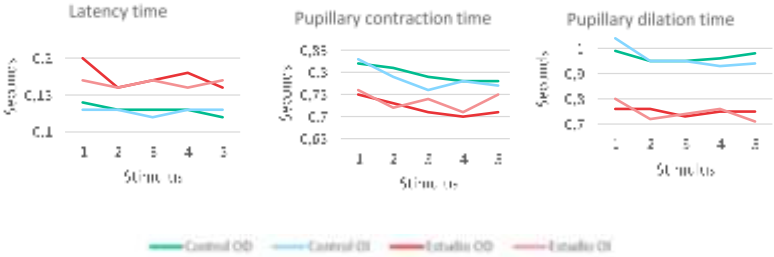

Figure 1: Comparative graphs between the control group and the study group (right and left eye) for each of the three variables: latency time, pupillary contraction time and pupillary dilation time.

Conclusions: The time it takes for pupils to react is longer for subjects diagnosed and treated for some psychiatric disorders. However, once it has reacted, the time it takes to contract and expand again is shorter.

Keywords: Pupillary light reflex, psychotropic drugs, psychiatry.

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Evaluation of retinal ganglion cells function measured by pattern electroretinogram (pERG) after femtosecond laser assisted LASIK (FS-LASIK).

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Introduction: Patients undergoing femtosecond laser assisted LASIK (FS-LASIK) experiment a transient increase of IOP during the procedure [1]. There is evidence that this phenomenon does not cause loss in retinal nerve fiber layer thickness [2]. However, it is not known what happens to the electrical function of the retinal ganglion cells.

Aim: To analyze the effect of FS-LASIK on the electric response of retinal ganglion cells using pattern electroretinogram (pERG).

Methods: This was an observational, prospective cohort study, that included myopic patients that have consecutively undergone FS-LASIK (IntraLase®J&J) for less than 6 diopters of myopia and less than 2 diopters of astigmatism correction. We excluded patients with diabetes, retinal or neuroophthalmological pathologies; also, those with an excessive blinking or tearing, or patients with 1 day postoperative uncorrected visual acuity less than 0.9 (Snellen). Diopsys NOVA® (Diopsys Inc., NJ) pERG records, using high and low contrast patterns, were obtained 24hours and 1 month after FS-LASIK was performed. We analyzed the Magnitude(μV), Magnitude D(μV), ratio Magnitude D/Magnitude, and signal-to-noise ratio(dB). Wilcoxon test for nonparametric paired data was employed.

Results: We analyzed pERG data from 24 eyes from 24 different patients, that underwent FS-LASIK. 41% were men. Mean age was 35.79±9.86 years. Mean preop myopic refraction was -2.69±7.6D and -0.38±0.40D of astigmatism. Mean surgery time was 56.88±7.6 seconds. No statistically significant differences were obtained for any of the studied parameters when comparing 24h with 1 month post FS-LASIK, with the exception of

Magnitude at low contrast, that increased from 1.21±0.2 μV to 1.39±0.29 μV, at 24h and 1 month post-op, respectively (p=0.03).

Conclusions: FS-LASIK seems to induce a mild and transitory defect in retinal ganglion cell function. We have only detected a mild decrease in the Magnitude value for low contrast stimuli when pERG was performed at 24 hours postoperatively, then it recovers 1 month after the surgery.

Keywords: pattern electroretinogram, FS-LASIK, retinal ganglion cell.

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Influence of distance and hours of nearwork on accommodative function.

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Introduction: New technologies have produced a change in the visual habits of children and adolescents. In earlier times, the close-up tasks young people performed were mostly related to school tasks, while leisure was largely linked to outdoor activities. Currently, mobiles, computers, tablets, etc…occupy a large part of leisure time [1]. This change in habits could have adverse effects on the visual system in those cases in which it is not prepared to face so much time working in near vision. Abnormalities in the binocular, accommodative system or both could lead to asthenopic symptoms and learning problems [2]. Since future prospects seem to maintain the trend towards an increase in the use of electronic devices and near vision, it is necessary to study the impact of different near vision working conditions on the accommodative system, as a fundamental part of visual function. Within the different working conditions are the distances used for near vision activities (reading, writing and using electronic devices) and the number of hours dedicated to these activities.

Aim: The aim of this study was to examine possible differences in the accommodative parameters depending on the hours and the working distances used in near vision.

Methods: The study was made on 73 subjects aged between 13 and 14 years. The patients completed a questionnaire that included questions about their visual symptoms, based on the CISS questionnaire, and questions about the number of hours per week dedicated, during their free time, to perform tasks closely. In order to evaluate the accommodative function, the following measurements were taken: Accommodation Amplitude (AA), Accommodative Response (AR), Monocular (MAF) and Binocular (BAF) Accommodative Facility, Relative Negative Accommodation (RNA) and Relative Positive Accommodation (RPA).
After finishing the optometric tests, a measurement of the working distance was made in different close-up tasks: reading, writing and mobile.

Data analysis was performed with the SPSS statistical program. The results were considered statistically significant when the P value was less than 0.05.

Results: Of the 73 children evaluated, 37% of them presented normal values in all the tests of accommodative function, 2.7% presented Accommodative Insuficiency suspect due to low AA values, 53.4% presented Excess Accommodation suspect because they failed positive lenses in MAF and 6.8% of cases presented Accomodative Infacility suspect, since low values were obtained in MAF, with both positive and negative lenses.
Regarding the variable "working distance", there were no statistically significant differences ($p > 0.05$) between the groups with subjects with normal accommodative abilities or those who presented an accommodative anomaly suspect.For the variable “number of hours in nearwork vision”, it was found that the subjects who presented Accommodative Infacility dedicated an average of 6.39 hours per week more (outside the school) to tasks in nearwork, and difference was statistically significant ($p = 0.03$).

Conclusions: A high prevalence (62.9%) of accommodative anomaly suspect was found in a group of schoolchildren from a “non-clinical” population aged between 13 and 14 years, with Accommodative Excess being the most prevalent (53.4%).
The variable "number of working hours" seems to have a greater influence on the anomalies of the accommodative function than the variable "working distance”.

Keywords: Accommodative anomaly, accomodative symptomatology, nearwork

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Optical quality in pediatric patients.

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Introduction: The tear film is the first optical structure that influences the optical light path in the eye and plays an important role in its optical quality. In order to obtain a clear image, the tear film has to be smooth and stable [1].
The High Definition Analyzer (HD Analyzer™) (Visiometrics S.L.,Terrassa, Spain) is an instrument that determine objectively and non-invasively the optical quality of the human eye. It uses a double-pass system to measure the scattering of light in the eye and obtains the objective scatter index (OSI). The OSI can be recorded in 0,5-second intervals in a period and it assess the variation in ocular scattering produced by changes in the tear film [2].
Optical quality has been assessed in adult population but there is a brief research in children.

Aim: To evaluate intraocular light scattering by the eye as a measure of optical quality in a healthy pediatric population**.**
To measure the influence of tear film changes in optical quality in children.

Methods: Healthy children without ocular pathologies or allergies and non-contact lens users were recruited for the study. Only an eye was examined.
The protocol included measures about the ocular surface condition. Optical quality was recorded two times, first in a single measure and after, every 0,5 seconds over 8 seconds without blinking. Also, a questionnaire to assess dry eye disease symptoms was complete by the children and measures of tear volume, tear non-invasive break-up time and corneal staining were taken, among others.

Results: 69 eyes of 69 healthy children between 7 and 17 years were measured**.** The main OSI was 0,57± 0,41.
The main OSI change rate increased after a period without blinking in 32,92%.

Conclusions: The objective scatter index measured in children is low and similar to reported values in adults.
Light scattering in children eyes increases significantly in a period without blinking.

Keywords: Optical quality, tear film, pediatric.

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Evaluation of retinal vasculature by OCT Angiography in type II diabetes.

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Introduction: Diabetic retinopathy (DR) is the leading cause of blindness in developed countries. [1]
Flourescein angiography has been the gold standard diagnostic tool for evaluating retinal vasculature. However, it is invasive and needs dye injection. [2]
Optical coherence tomography angiography (OCTA) is a new non-invasive diagnostic imaging tool that evaluates retinal and choroidal circulations and analyze them quantitatively. [3]

Aim: To evalute retinal microvasculature using OCTA in diabetic patients without DR, with mild DR and healthy controls.

Methods: Comparative cross-sectional study including 3 groups: diabetic patients without DR, with mild DR and healthy controls. We calculated a sample size of 60 subjects for each group.
All patients are undergoing OCTA (Carl Zeiss Cirrus 5000) and colour and red-free fundus photographs (Visucam 524, Carl Zeiss). OCTA macular scan protocol of 3x3mm and 6x6mm and optic nerve scan protocol of 4.5x4.5mm are being used. We are analyzing foveolar avascular zone, vessel density and perfusion density in all patients.

Results: 35 diabetic patients without DR, 108 with mild DR and 103 healthy controls has been recruited so far.

Conclusions: Study pending of data analysis.

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

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In vitro study of delivery of melatoninergic tear secretagogues using contact lenses.

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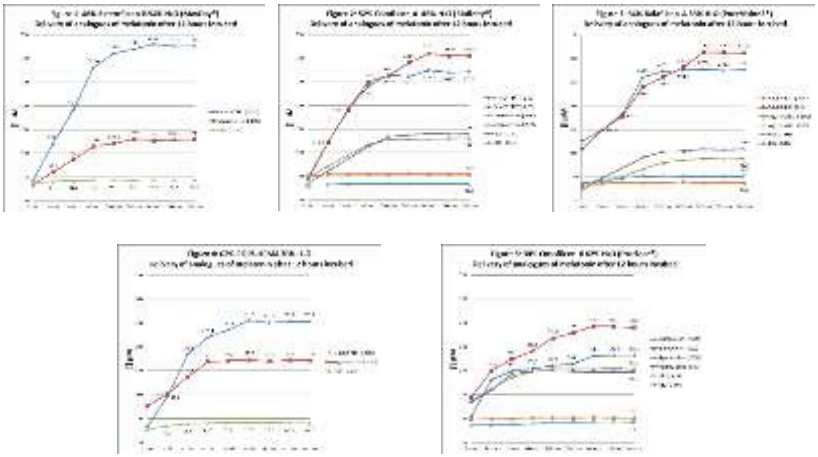
Introduction: It has been widely demonstrated that contact lenses (LC) are an effective means for the controlled and sustained release of drugs for topical use in the eye [1], proposing themselves as a means of treating different ocular pathologies and particularly in dry eye [2]. Melatonin analogs have recently been described to increase tear secretion, and have been proposed as a therapeutic alternative in the treatment of dry eye disease [3].

Aim: To assess the LC delivery capacity of different materials and power, of the melatonin analogs Agomelatine, IIK7 and 5-MCA-NAT, in a saline medium (in vitro) and analyze the differences found.

Methods: Different materials were used for the LC study Stemfilcon-A (MyDay®) (Figure 1), Comfilcon-A (Biofinity®) (Figure 2), Balafilcon-A (PureVision2®) (Figure 3), POLY-HEMA38 (figure 4), and Omafilcon-B (Proclear®) (figure 5), , with power (0,00/-0,25 y -2,00), and n=1 in all cases. Dilutions of Agomelatine, IIK7 and 5-MCA-NAT were prepared in saline solution at [1mM] containing 1% of DMSO. The lenses were incubated for 12 hours in individual wells, with a volume of 1 ml of each of the dilutions of the melatonin analogs. After incubation, the lenses were removed and placed in individual wells with a volume of 1ml of saline solution. The released concentration was measured by spectrophotometry (Power Wave XS2 - Biotek), from a 200 µl sample extracted from the post-incubation wells, deposited on a quartz plate, which was later returned to the well, at 5, 15, 30, 60, 120, 180, 240 y 360 min. in all cases. Absorption peaks studied were λ = 275 nm for Agomelatine, λ = 220 nm for IIK7 and λ = 230 nm for 5-MCA-NAT.

Results:



Conclusions: The study shows that the hydrophilic contact lenses have the capacity to release the tear secretagogues 5MCA-NAT and Agomelatine but not IIK7, corresponding to the highest concentration released to the materials Estemfilcon-B (MayDay®) y Comfilcon-A (Biofinity®). It is also observed that the materials with silicone content have a higher affinity and better release for 5-MCA-NAT. Materials without silicone content have a higher affinity for Agomelatine.

Keywords: Contact lenses, Drug delivery, Melatonin analogs.

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Bipolar disorder treatment´s effects on the tear film.

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Introduction: Bipolar disorders of types I and II affect approximately 2% of the world population, and subliminal forms of the disorder affect another 2%. Even with treatment, approximately 37% of patients relapse into depression or mania over 1 year, and 60% after 2 years, making this a complex and chronic treatment disease [1], [2], [3].
Despite a substantial expansion of research on bipolar disorder and possible treatments over the past 2 decades, real progress has been few. The development of effective treatments for bipolar disorder is hampered by poor knowledge of the basic mechanisms of the disease and the consequent absence of validated pharmacological targets, and unconvincing animal or human experimental drug models.
This situation as a whole has led to a limitation of research on aspects of these treatments such as side effects regarding the visual system and more specifically on tear film.

Aim: To know the state of the ocular surface of people treated with psychotropic drugs and to compare them with control individuals of the same age range without psychiatric treatment in order to improve visual health of patients.

Methods: The sample consisted of 42 subjects who volunteered between the ages of 21 and 69 years (mean and standard deviation: 45.93 and 11.32 years) with no apparent eye disease and a control group of 36 subjects. between 21 and 75 years (mean and standard deviation: 51.83 and 17.98 years).
Tear break up time and tear film composition measurements were evaluated with the Keratograph 5M (Oculus Opikgeräte GmbH, Wetzlar, Germany).

Results: When comparing the means of the first tear rupture time (BUT1) there are no significant differences between the study group and the control group for either of the two eyes. However, the control group of women is

close to presenting significant differences compared to the study group in average tear break up time (BUT2).
Regarding the lipid composition of the tear, there are significant differences between the control group and the study group in both the right and left eyes, with p-values of 0.0015 and 0.0016, respectively.

Conclusions: The tear time measure valued with BUT1 and BUT2 did not present statistically significant differences between control group and study group.
The composition of the tear assessed by interferometry clearly shows a worse tear composition in the group of subjects under treatment.

Keywords: bipolar disorder, tear film, pharmacology.

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In vivo changes in wettability of hydrophilic contact lenses after an Aloe vera – HPMC based artificial tear drop.

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Introduction: The abandonment of the use of contact lenses happens for different reasons. Discomfort is the main reason and is usually associated with ocular dryness symptoms.[1] On the other hand, the contact lenses wettability also plays an important role. Poor wettability of contact lenses affects the interaction between the tear film and the lens material causing discomfort.[2]

Aim: The objective of this study was to analyze the influence of an artificial tear based on Aloe vera - Hydroxrypropylmethylcellulose on the wettability of the surface of hydrophilic contact lenses.

Methods: 30 eyes of 15 healthy subjects (25.25 ± 3.02) were evaluated before and after instillation of the moisturizing solution. Each subject put on a hydrophilic contact lens (ocufilcon D) in one eye and another silicone hydrogel contact lens (somofilcon A) in the other, chosen at randomly. After 15 minutes of wear, the wettability of the contact lens surface In vivo was analyzed with the corneal topographer (Medmont E300) through the measurement of the Tear film Surface Quality coefficients (TFSQ mean) (TFSQ area). The study solutions were a saline solution (control) and a solution based on Aloe vera and Hydroxypropylmethylcellulose. Measurements of the TFSQ mean and TFSQ area parameters were made at 1, 3, 5, 10, 20 and 30 minutes after instillation. Furthermore, subjective comfort was assessed with the VAS (Visual Analogue Scale) test.

Results: No statistically significant differences were observed regarding the baseline values of the TFSQ mean and the TFSQ area up to minute 3 for the hydrogel contact lens (ocufilcon D) ($p = 0.002$) and minute 5 for the silicone hydrogel lens (somofilcon A) ($p = 0.028$). In the case of the ocufilcon D material, there was a slight increase in the TFSQ values, interpreted as a dehumidification in the initial times. However, for somofilcon A material, a significant decrease occurred at 5 minutes in the TFSQ area values.
On the other hand, after instillation of the moisturizing solution with Aloe vera and Hydroxypropylmethylcellulose, both the mean TFSQ and the TFSQ area decreased significantly, keeping the surface of the contact lens more moisturized during the initial 3 minutes for the hydrogel material (ocufilcon A) ($p <0.001$) and during the first minute for the hydrogel-silicone lens (somofilcon A) ($p <0.001$). However, in the latter case, the wetting parameters were kept below the initial values during the 30 minutes of wearing.
Conclusions: The moisturizing solution based on Aloe vera and Hydroxypropylmethylcellulose is effective in moisturizing contact lenses.
Among the materials studied, better wettability results were obtained with the hydrogel-silicone contact lens material.

Keywords: hydrophilic contact lenses, wettability, discomfort.

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Software for real-time distance control and visio-postural control.

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Introduction: Currently in the world in which we live we have an increasing overexposure to digital screens, especially children and increasingly from younger ages, having consequences on visual health. It is important to be able to control certain parameters when we are in front of a screen since in many occasions the effort made when we spend too much time in front of a screen, especially the smallest ones, and at a distance that is not the correct one can make them more likely to generating myopia [1], as well as lighting, being of utmost importance to alleviate certain visual symptoms [2].
With this application we intend to control and correct these parameters, while being able to detect certain pathologies that make the head position not adequate, normally to maintain binocularity and / or optimize visual acuity [3].

Aim: The fundamental objective is to develop an application that can monitor our eyes and thus be able to measure the working distance of the subject, that detects an abnormal position of the head and that only works in adequate lighting conditions to perform these tasks. In this way we can avoid possible visual complications in the future, achieving optimal visual performance. Based on this main objective, partial objectives are proposed:

- Understand and apply the different techniques and algorithms used in digital image processing.
- Integrate the software in any device that has a CCD receiver implemented, that is, in almost all the digital devices that we use on a daily basis, such as computers, tablets, mobile phones.
- Carry out a study on a sample of subjects with some binocular or accommodative dysfunction (accommodative and convergence

excess) to complete the thesis and check the efficiency of the proposed method.

Methods: The application will be installed on one or several different devices (computers or tablets) with a CCD receiver, and the subjects will be shown a text that they will have to read with a specific duration. Through the monitoring of their eyes we can draw the conclusions of the study.

Results: The results of the study are yet to be determined.

Conclusions: The functionality of the application has been tested, warning in real time of both the inadequate reading distance and the incorrect position of the head, making it work only when the ambient lighting we believe is adequate. The study's conclusions are yet to be determined.

Key words: mathematical simulation software, distance control, Visio-postural control.

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