We are an interdisciplinary group that encompasses optics, optometry, ophthalmology and pharmacy.

OPTICAL AND VISUAL QUALITY. We have a protocol developed at the Fundación Oftalmológica del Mediterráneo (FOM) for the measurement of the optical quality of intraocular lenses (IOLs), contact lenses and human eyes. We study the visual quality of patients with IOL implants or diseases of the cornea or crystalline lens.

TRANSMITTANCE, SCATTERING AND UV EFFECTS. We have the necessary equipment to measure spectral transmittance and obtain the modulation transfer function.

We also have a source of ultraviolet radiation.

VISUAL PERCEPTION. Analysis of visual mechanisms in patients with ocular disease. We use the ATD multichannel functional test developed by the Universidad de Valencia and INDO Internacional SA (Barcelona, Spain), with patents 7,641,344 B2 (USA) and 2246174 (Spain).

AUTOLOGOUS SERUM. Use of autologous serum drops in patients with dry eye.

OBJECTIVES

- Transmittance of intraocular lenses, contact lenses, porcine and human corneas and crystalline lenses.
- Light scattering of eye-explanted intraocular lenses, porcine and human corneas and crystalline lenses.
- Effects of ultraviolet light on intraocular lenses, porcine and human corneas and crystalline lenses.
- In vivo assessment of optical quality and visual quality of eyes of patients with intraocular lens implants or ocular disease.
- Determination of the concentration of growth factors (IGF, TGF-beta1, PDGF-AB, VEGF, HGF, EGF, FGF) in autologous serum eye drops enriched with growth factors.

“Analysis of visual mechanisms in patients with ocular disease...”
AREA 1. Study of the optical characteristics of intraocular and contact lenses. Correlation of these characteristics to clinical outcomes.

Study of the optical and clinical performance of newly developed intraocular lenses and contact lenses. Research is conducted following the in-house protocol and in adherence to the UNE in ISO 11979-2:1999 standard, that is, determining the back vertex power of the lens and experimentally measuring the modulation transfer function (MTF) to establish the optical quality of the IOL.

To assess the association of lens optical quality with patient visual quality, we measure the contrast sensitivity function and visual acuity in each patient to find how they correlate to the optical quality parameters of the implanted intraocular lenses. We have a Visio-nix® L79 topographer that allows the determination of the MFT in vivo, so we can compare the optical quality and performance of the IOL in vivo and in vitro.

PARTICIPATING STAFF


**AREA 2.** Analysis of light scattering in intraocular lenses, contact lenses, and porcine and human corneas and crystalline lenses.

We can analyse scattering by using a spectrophotometer to measure directly the amount of light transmitted by a specific IOL, and then performing the same measurement with an integrating sphere. The sphere allows the measurement of the total amount of light transmitted by the IOL in all directions. The difference between both measurements yields the amount of light lost to dispersion (“scattering”).

We have already published one article on the objective determination of light scattering by intraocular lenses. In that work, we used custom-made devices that allowed us to modify the measuring configuration of the spectrophotometer. However, we could only test the goodness of fit of this method with three IOLs explanted from cadaveric donors that presented no obvious deterioration due to deposits. Our aim is to continue this investigation by determining light scattering in lenses explanted due to deposit problems so that we can, on one hand, improve the method, and on the other study the performance of lenses deteriorated by different types of deposits.

At the same time, we want to develop a device capable of measuring scattering angles to attempt to determine the type of scattering (Rayleigh or Mie).

**PARTICIPATING STAFF**

**PUBLICATIONS**

**AREA 3.** Spectral transmittance of contact and intraocular lenses and human and porcine corneas and crystalline lenses. Effects of ultraviolet radiation.

Study of the spectral transmittance of different types of intraocular and contact lenses, both monofocal and multifocal. When it comes to contact lenses we usually work with soft lenses, as they constitute 98% of the contact lenses used by the population, but we will also analyse some rigid gas permeable lenses. We will complete our investigation by analysing the performance of the lenses under different types of light, that is, both in sunlight and in different types of artificial light (incandescent, fluorescent, halogen, xenon, white LED).

We analyse the effect of ultraviolet light on the spectral transmittance properties of intraocular lenses. This can be tested experimentally by using a spectrophotometer to measure directly the amount of light transmitted by a specific IOL, and then performing the same measurement with an integrating sphere. The sphere allows the measurement of the total amount of light transmitted by the IOL in all directions. The difference between both measurements yields the amount of light lost to dispersion (“scattering”).

Selecting different bands and wavelengths in the ultraviolet source, we irradiate different IOLs made of different materials and with an integrated UV filter with the purpose of studying their performance under normal and extreme radiation conditions. This method can also be used to study the performance of aged IOLs.

We have studied the effects of ultraviolet radiation in the formation of cataracts in porcine crystalline lenses, and deduced that intense and short exposure always leads to development of anterior subcapsular cataracts. In this study, we irradiated porcine crystalline lenses with UVA (315–400 nm) and UVB (300–400 nm) radiation, and analysed the effects of the duration of exposure and the intensity of the radiation.

**PARTICIPATING STAFF**

**PUBLICATIONS**
- Ocular dose of ultraviolet A and B radiation in Mediterranean latitude: Limits and protection efficacy of intraocular lenses. JM


**AREA 4.** Visual perception assessed by means of the ATD analyzer.

In this area of research we use the multichannel functional test (ATD) developed by the Universidad de Valencia and INDO Internacional SA (Barcelona, Spain) with patents 7.641,344 B2 (USA) and 2246174 (Spain).

With this device, we can assess the contrast sensitivity of visual fields of achromatic and chromatic mechanisms of the human visual system (magnocellular, parvocellular and koniocellular). This device can also be used to assess chromatic and achromatic contrast sensitivity.

Our aim is to use the results obtained from the measurement of these sensitivities in patients with different ocular disorders to establish which of them is impaired first so that it can be used for the detection and followup of the disorders. In this line, we have already published one article on the damage caused to visual fields by chloroquine treatment toxicity.

**PARTICIPATING STAFF**

**PUBLICATIONS**

**AREA 5.** Composition of eye drops rich in growth factors.

Ocular surface disorders constitute the most frequent complaint in the field of ophthalmology. There is evidence that 12% of the population and more than 35% of individuals aged more than 50 years are afflicted with dry eye syndrome.

Therapeutic approaches for the ocular surface increasingly focus on the use of treatments with multiple mechanisms of action that are less artificial and free of potential allergens, such as preservatives and other products that can be toxic to a highly vulnerable ocular surface. Treatment with autologous substances, such as blood products, would fulfill all the above requirements. Specifically, platelets clearly play a key role in the repair of damaged tissue, as they contain great reservoirs of growth factors, important cell adhesion molecules and bioactive proteins that induce chemotaxis, cell proliferation and differentiation, neovascularisation and extracellular matrix deposition.

In this research area, we aim to determine the concentration of growth factors (IGF, TGF- beta1, PDGF-AB, VEGF, HGF, EGF and FGF) in autologous serum eye drops enriched with growth factors, to study the association between plasma platelets, the platelets contained in the eye drops, the growth factors analyzed in the eye drops, and the clinical outcomes of ocular surface disease; and to determine in vitro the antimicrobial performance of autol-
gous serum enriched with growth factors.

PARTICIPATING STAFF

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PROJECT

Serum rich in growth factors for the treatment of ocular surface disease. Quantification of growth factors contained in autologous serum drops enriched with growth factors.

Call for applications: FISABIO Grants for the Promotion of Research.

Funding institution: FISABIO

RESEARCH GROUP

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