A new procedure to estimate patient-specific intraocular pressure

Elena Redaelli, Begoña Calvo, José F Rodriguez Matas, Giulia Luraghi and Jorge Grasa

Intraocular Pressure

The intraocular pressure (IOP) is defined as the pressure inside the eye that is maintained by the balance of aqueous humor production and drainage.

Elevated IOP is a significant risk factor for glaucoma, which is a leading cause of blindness worldwide.

Accurate and repeatable IOP measurements are the key to diagnose the pathology in time and to provide for effective treatment strategies.

The equilibrium occurs when the work of the air puff and the work of the IOP on the corneal anterior surface are equal.

Changing both the mechanical properties of the corneal tissue and the thickness of the eye, the equilibrium point does not change, it only depends on the IOP.

Non Contact Tonometry

Corvis ST is a commercially available Non-Contact Tonometer.

An air jet deforms the cornea during 30 ms and the deformation is recorded by a Scheimpflug camera.

Currently, the IOP measurement is based on the first applanation time.

However, the applanation time also depends on the thickness of the cornea and on the mechanical properties of the corneal tissue.

Conclusions

- The equilibrium of the anterior corneal surface is considered. The mechanical properties and the thickness of the cornea does not influence the methodology.
- The FSI simulation and the subsequent CFD permit to study the air pressure over the corneal surface, that is different from the air pressure at the Corvis ST nozzle.
- Combining numerical simulations and the segmentation of clinical images it is possible to estimate the patient-specific IOP.

References


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 956720."