

ON THE IMPORTANCE OF NOVEL PROCEDURES AND DEVICES BASED ON MEDICAL-ENGINEERING DATA

Alessandro Mauro, M. Salahudeen, Nicola Massarotti

Dipartimento di Ingegneria, Università degli Studi di Napoli “Parthenope”, Centro Direzionale,
Isola C4, 80143 Napoli, Italy, alessandro.mauro@uniparthenope.it

Mario Cesarelli

Dipartimento di Ingegneria elettrica e delle Tecnologie dell'Informazione, Università degli Studi di
Napoli Federico II, Via Claudio, 21, 80125 Napoli, Italy

Vito Romano

Department of Eye and Vision Science, Institute of Ageing and Chronic Disease, University of
Liverpool, Liverpool, UK; Instituto Universitario Fernandez-Vega, Universidad de Oviedo,
Fundacion de Investigacion on Oftalmologica, Oviedo, Spain

Mario R. Romano

Department of Biomedical Sciences, Humanitas University, Via A. Manzoni 113, Rozzano, 20089
Milan, Italy

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PROPOSAL

Research activities in medical science are nowadays often based on technical-scientific data, due to the complex physical phenomena to be studied. Different coupled physical mechanisms need to be studied in the majority of medical fields, such as biological processes, heat and mass transfer, interaction with porous media, fluid structure interaction and others.

A particular focus in this Mini-Symposium can be given to human eye, that is a small, but extremely complex, part of the body. Both surgeries and diagnostic techniques on human eyes can be optimized thanks to the improvement of knowledge, based on scientific research findings, such as in many other medical fields. The practical consequence is that post-operative complications can be reduced, with increase of life quality.

The employment of mathematical modelling in biomedical applications has proven to be a success in terms of prediction of physical quantities of interest like velocity, pressure, stress and temperature of the human tissues, such as for the design of biomedical equipment and procedures [1-5].

Patient-oriented based numerical models can be useful to further improve the present standards in the field of eye diseases. In fact, the use of a multidisciplinary technical-medical approach may provide a valuable engineering support to doctors, providing them with useful information based on specific patients' needs, with consequent reduction of post-operative complications.

As concerns the posterior section of the eye, a relevant example of surgery can be represented by vitrectomy, which is an intraocular surgical procedure involving removal of vitreous gel to release the vitreoretinal traction, in order to treat the retinal tear and epiretinal proliferation. [1, 2].

As concerns the anterior section of the eye, relevant examples of surgeries are represented by the glaucoma curing techniques or the keratoplasty procedures. Glaucoma is an eye illness that affects humans and other mammalians, leading to a stage of total blindness. It is a major concern for ophthalmologists, as it is the second cause of eye vision loss worldwide [3]. Ageing and increased

values of intraocular pressure (IOP) at the anterior chamber of the eye, generally above 21 mm Hg, are the main risk factors of glaucoma [4-6]. Therefore, curing treatments for glaucoma are targeted towards lowering IOP by means of various techniques. Among the available surgical procedures, the insertion of glaucoma drainage devices assumes a relevant role. These devices provide the increase of aqueous humour outflow, creating alternative outflow pathways, at the proximal region of conjunctiva and suprachoroidal space [4-8].

Corneal transplantation, known as keratoplasty, is a surgical procedure aiming to replace damaged cornea with healthy donor tissue. It can be used to improve sight, relieve pain and treat severe uncontrolled corneal infections [9-11].

The proponents of this Mini-Symposium believe that a combined medical-engineering approach, based on patient-specific data, is needed to improve the surgical procedures and reduce post-operative complications.

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