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Fund “Nauka” Project № 20012 Resume – Competitive-based Session 2020:
“Upgrading the infrastructure for high-tech analysis of the anterior segment of the eye, based on corneal biomechanics for innovative diagnosis of socially significant diseases in a pandemic (COVID-19)”
Project leader: Assist. prof. Evgeni Valentinov Neshkinski, MD, PhD, FEBO

In the indirect methods of examination, the hysteresis of the target tissue is of primary importance for obtaining an accurate result, as the non-contact examination is the main method of prevention and prophylaxis of COVID-19.

The aim of this project is to create an infrastructure for long-term, dynamic, non-invasive, microstructural examination and monitoring of the normal state and pathology in the anterior and posterior segment of the eye using a non-contact pneumotonopachymeter with built-in detection of biomechanical corneal response.

The set goal includes the following tasks:

1. Creating a database with normal images of the anterior segment of the eye;
2. Study of patients with socially significant eye diseases, including glaucoma;
3. Use of innovative technology for non-invasive assessment of biomechanical corneal response and pachymetry;
4. Study for the influence of UV rays on the anterior ocular surface and their influence on the corneal integrity in patients with keratoconus and crosslinking;
5. Investigation of the effect of amniotic membrane transplantation on the anterior ocular surface in the short and the long term;
6. Refinement of the diagnosis and follow-up of glaucoma patients using high-tech software collaboration between corneal pachymetry, corneal hysteresis, optical coherence tomography and computer perimetry.

Methods: All patients will be examined with a non-contact pneumotonopachymeter with a built-in module to assess the biomechanical response of the cornea in patients in normal conditions and pathology. The method provides high repeatability, allowing unique visualization and recording of changes occurring in the anterior segment of the eye when measuring intraocular pressure, opening new horizons in the diagnosis of pathological changes.

Expected results:

1. Early detection of number of eye diseases leading to severely reduced visual acuity and, consequently, poor quality of life of patients;
2. Development of scientific and clinical activities at a global level for young specialists studying in Medical University of Varna;
3. Development of scientific papers examining for the first time in Bulgaria through non-invasive methods ocular biomechanics and the behavior of the anterior segment of the eye in the presence of socially significant diseases;
4. Optimization of the work in the Clinic of Ophthalmology and the Department of Ophthalmology and Visual Sciences at MU-Varna, saving time, effort and money;
5. Improvement of treatment and diagnosis, which in turn will create an opportunity for high-tech research of the young specialists, working and associated with MU-Varna.

Results:

Performed activities

- Purchase of an innovative device for non-contact measurement of intraocular pressure with real time detection of corneal biomechanics, using a high-speed Scheimpflug camera Oculus Corvis ST.
- Introducing the members of the Department of Ophthalmology with the equipment, conducting training to use both the equipment and its software.
- Development of the first scientific projects of the project participants:
  - "Evaluation of biomechanically corrected intraocular pressure using Corvis ST and comparison of Corvis ST, non-contact tonometer, and Goldmann applanation tonometer in glaucoma patients";
  - "Relationship between corneal hardness, thickness and biomechanical parameters measured by Corvis ST, Pentacam and ORA in keratoconus";
  - "Comparative analysis of corneal biomechanical parameters in normal eyes and eyes after cross-linking and amniotic membrane transplantation";
  - "Possibilities for non-invasive assessment of corneal biomechanics in healthy individuals";
  - "Analysis of modern possibilities for prevention of infectious diseases when measuring IOP with different methods".

Perspectives and opportunities for future development of the research activity in MU - Varna, as a result of the project implementation:

The project provides a unique infrastructure in the context of the COVID-19 pandemic, providing long-term research (over 10 years), as the equipment purchased is the latest

combined technology on the market at the moment. The lack of similar equipment on a national scale allows the construction of a revolutionary infrastructure for our country, increasing the scientific potential of the Medical University – Varna. In the future, there will be an opportunity for its software update. It provides training for young scientists, doctoral and postdoctoral students, as well as for students of MU-Varna in the specialties “Medicine”, “Medical Optician” and “Optometry”.