Statement

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Member of the Scientific Jury, appointed by the Rector of the Sofia University, order №. РД 38-575/27.07.2022.

For the Dissertation work of Sebastian Marx, M.Sc. Optometry entitled:
"In vitro and in vivo Contact Lens Dewetting Investigations
Using Placido Ring based Videokeratoscopy"

For acquiring the scientific degree "Doctor"

General characteristics of the topic

The topic of the dissertation work deals with the application of Placido ring based videokeratoscopy for the evaluation of the pre-contact lens surface.

Invented long ago by António Plácido da Costa the concentric ring pattern, nowadays allows us to view the reflected rings over time, which enables us to assess surface changes. This is of particular importance for the pre-contact lens surface as this surface impacts vision and comfort in wearing contact lenses. The wide application of contact lenses in our modern society makes the topic of the dissertation work very up to date, modern and with great practical implementation.

Brief biographical and professional data about the author of the dissertation

Sebastian Marx is born in 1978, Hale, Germany. He graduated in 2000 from the OSZ Havelland School of Ophthralmic Optics in Rathenow. After a study of optometry at the University of Applied Sciences Jena he started to work at the JENVIS Research Institute. He is coordinating research projects and is responsible for the clinical area. Parallel to his work, he is part time educator at the University of Applied Sciences Jena in the field of vision research and member of the German committee of standardization. Since 2006 he is a fellow of the International Association of Contact lens educators. In 2010 he was awarded together with his research team with the Peter-Abel-Award of the VDCO for the development of new tear film assessment methods and again in 2019 for investigating the impact of contact lens wears on MGD with the CLASS study group. He is currently PhD student at Faculty of Physics of the Sofia University.

The dissertation examines the surface of contact lenses by applying videokeratoscopy with the Placido disc. Modern applications of Placido's disc allow reflection rings to be viewed and their change over time, allowing the researcher to observe and assess surface changes as they occur. The ability of the lens surface to maintain a moist state or to rewet upon blinking is affected not only by air but also by the mechanical interactions of the eyelid as well as by possible accumulated deposits such as protein or lipids.

In addition to the current topic, Sebastian Max also offers his own modified development of an experimental keratograph K5M. Taking into account both the ocular surface and visual acuity, which is an additional plus of the dissertation work.

The dissertation work of Sebastian Marx consists of 135 pages, 67 figures, 15 tables and 270 references. It begins with a proper structure followed by an in-depth study of the topic in the literature review.

The structure of the tear film, the importance of the blink reflex, the influence of contact lenses on the stability of the tear film and its evaporation are discussed in detail in the dissertation. Sebastian Max also examines in detail the different types of contact lenses, according to the material used, as well as their different humidity and degree of drying. Various in vivo and in vitro methods for measuring the humidity of contact lenses are also shown - interferometry, tear film scan, etc. The method of keratoscopy with the Placido disk for measuring contact lens surface humidity is discussed in great detail. In the literature review, the modern searches are very precisely brought out - especially the way to evaluate the humidity of the lenses over time in order to improve the comfort, the quality of vision and the duration of wearing the contact lenses.

The main goal of the dissertation work is to make an accurate assessment of how long a (complete) thin, moist film can be kept on the polymer surface of contact lenses. This was accomplished by means of the Placido disk-based videokeratoscopy method.

In the first in vivo study, the author, using his own scheme, estimated the time to the first change in Placido's rings. To evaluate the process of rupture of the tear film, a five-segment grid was combined on pictures that were extracted from videos, in the interblink period for the moments 5, 10, 15, 20, and 25 seconds after the blink. The reflected Placido structure was evaluated on an experimental grading scale ranging from zero (completely wetted surface) to 3 (highly deformed Placido rings, more than 33% of the evaluated area). We must emphasize that this is an original idea, which contributes to the authenticity of the dissertation work and shows both the extensive knowledge of the author and his creativity.

The second in vivo study used a more time-efficient, software-based analysis. It is important to emphasize that the modifications to the Keratograph 5M's as well as the software changes are also the work of the author and an important contribution to the dissertation work. Thus it is possible to determine the time of drying of different segments of the network for analysis. The decrease in surface humidity with time represents the rate of drying, which can also be a target of analysis and is related to the comfort and duration of contact lens wear.

The third in vivo study is the first published study using a technique allowing simultaneous measurement of tear film break over time and visual acuity quality. For the first time in an experimental study, these two quantities can be evaluated simultaneously. To do this, Sebastian Max adds a hardware modification that includes a high-resolution micro screen and an adjustable optical system to change the distance to the object. Data show that a peripherally torn tear film on the contact lens also affects visual performance. It also enables the three-dimensional calculation of the area in mm^2 of the individual

drying segments, which gives an accurate quantitative analysis of the changes and is the contribution of the dissertation work.

In the last study presented, compares the drying behavior of different types of soft contact lenses after being placed in different solutions .The drying was measured by keratoscopy.

The data were processed and analyzed with the statistical software package - IBM SPSS for Windows, v.19.0.

The contributions are 5 in number, of which 3 are of a cognitive nature and 2 of a scientific-applied nature. The scientific publications included in the dissertation are 5 in number, including 1 in a renowned international journal. The dissertation student has 2 reports and 1 poster from international conferences that fully meet the minimum national requirements. The scientific publications included in the dissertation work do not repeat those from previous procedures. There is no proven plagiarism in the presented dissertation work and Author's abstract.

Characteristics and assessment of the candidate's teaching activity

Sebastian Max is a lecturer at the University of Science and Applied Arts in Jena and since 2006 he has been part of the faculty of the International Contact Lens Association.

Content analysis of the scientific and scientific-applied achievements of the candidate contained in the materials for participation in the competition

The contributions of the dissertation are related to the introduction of:

- A new application of Placida's disc, to assess the wetness of contact lenses.
- Implementation of a new modified software system for assessing contact lens humidity.
- Creation of own modified version of Keratograph M5.
- The clinical use of videokeratoscopy in in vivo conditions.

Critical notes and recommendations

The dissertation work is well developed furthermore the results are detailed and critically discussed. The Autoreferat is well-formed according to the requirements. The bibliography is detailed, including a sufficient number of sources.

Conclusion

After having reviewed the presented dissertation work, abstract and other materials, and based on the analysis of scientific significance and the number of scientific-applied contributions contained in them, I confirm that the scientific achievements meet the requirements of the RSARB and The Regulations for its application and the relevant Regulations of the SU "St. Kliment Ohridski" for acquiring the educational and scientific degree "Doctor". The dissertation work is up-to-date, innovative and with a very large personal involvement of the author in the development of his own version of a modified Keratograph 5M'.

I give a positive assessment of the dissertation paper by Sebastian Marks on "In vitro and in vivo contact lens wetting studies using Placido ring-based videokeratoscopy." and based on the above, I recommend to the esteemed scientific jury to award him the educational and scientific degree "Doctor" in the professional direction 4.1 Physical Sciences, DP Biophysics, of the Faculty of Physics, University of St. Kliment Ohridski".

11/15/2022

Statement by:

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(academic position, scientific degree, name, surname)