

REVIEW

by **Prof. Dr. Nikolay Stefanov Gabrovsky, dms**
Head of Neurosurgery Department, UMHATEM "N. I. Pirogov" - Sofia,
chairman of the scientific jury

Regarding: procedure for defense of the **dissertation thesis by Assoc.Prof. Dr. Nikolay Svetoslavov Yanev, MD on the topic "Algorithm for clinical application of virtual planning, modeling and 3D printing in local, regional and microvascular reconstructions of complex maxillofacial defects"** for acquisition of the scientific degree "Doctor of Sciences", District 7. Health care and sports, Professional direction 7.1. Medicine, Scientific specialty "Neurosurgery"

The review is prepared based on the Order of the Executive Director of UMHATEM "N.I. Pirogov", No. RD-26-1325/ 30.05.2022 on the basis of Art. 32, par. 2 and 3 of the Regulations for the development of the academic staff at UMBALSM "N.I. Pirogov" EAD, Sofia, according to the decision of the Scientific Council with protocol No. ND-01-2/18.05.2022.

Associate Professor Yanev presents a dissertation work, an abstract and the other necessary documents in accordance with the Regulations for the Development of the Academic Staff at N.I. Pirogov UMHATEM - Sofia.

Biographical data of the author

Associate Professor Nikolay Svetoslavov Yanev, PhD, was born on July 5, 1976 in the city of Ruse. In 1994, he completed secondary education at 31 Secondary School for Foreign Languages and Management "Ivan Vazov" - Sofia

In 2002, he obtained a master's degree in dentistry, and in 2010, a master's degree in medicine - both degrees completed with excellent results at the Sofia Medical University. He was awarded for the excellent results by the University.

He holds a specialty in maxillofacial surgery (MFS) from the Sofia University, as well as a doctorate in medicine, for the successful defense of a dissertation on the topic: "Mechanism of targeted pain treatment - experimental models and pharmacological effects", developed at the Department of Pharmacology and Toxicology of MU – Sofia.

In the period 2012 - 2018, he worked in England, successively at University College London Hospital and Royal Derby Hospital, where he reached the highest clinical position in the British hospital system - Consultant Oral and Maxillofacial Surgeon.

Since 2013, he has a recognized specialty in Oral and Maxillofacial Surgery in Great Britain (UK GMC Specialty registration – Oral and Maxillofacial Surgery Specialist), and since 2018 a European recognized diploma in Oral and Maxillofacial Surgery from the Board of Oral and Maxillofacial Surgery at the European Board of Medical Specialties (UEMS), with the rights of Fellow of the European Board of Oral and Maxillofacial Surgery (FEBOMFS)

In the period 2016 - 2018, he divided his work commitments in half between Bulgaria and England, working here at the Specialized Hospital for Active Treatment in Maxillofacial Surgery - Sofia, and in England - at the Royal Derby Hospital.

Since 2018, he has been an associate professor at the Scientific Research Institute of the MU - Pleven, and since 2019 - an associate professor at the "N.I. Pirogov" UMBALSM - Sofia.

In 2017, he performed the first completely virtually planned complex maxillofacial resection with microvascular reconstruction in Bulgaria, stabilized with a patient-specific laser-sintered implant. In the same year, he was nominated for Doctor of the Year Award by the Bulgarian Medical Association.

In the period 09.2019–05.2022, he headed the Department of MFS of the "N.I. Pirogov" UMBALSM.

Prof. Yanev is a member of a number of prestigious international organizations and has represented Bulgaria in the European Association for Craniomaxillofacial Surgery (EACMFS) and in the International Association for Oral and Maxillofacial Surgery (IAOMS) in the period 2010 - 2016

Characterization and evaluation of the dissertation work

The dissertation work of Assoc.Prof. Dr. Nikolay Yanev consists of 246 standard pages and is illustrated with 12 tables and 147 figures. It is structured correctly. Contains: used abbreviations, introduction, literature review, aim and objectives, own research, material and methods, results and discussion, conclusion, implications, bibliography. The bibliography includes 253 literary sources, 15 in Cyrillic and the rest in Latin.

The literature review is highly informative and presents world standards in virtual planning, modeling and 3D printing in microvascular reconstructions of complex maxillofacial defects. An overview of the main microvascular reconstructive approaches is also provided. It is written in good medical language. The Bulgarian school of maxillofacial surgery is presented with its leading specialists and achievements, as well as the specialties Plastic and reconstructive surgery, Orthopedics, traumatology and hand surgery and Neurosurgery, working actively on the issues of microvascular and digitally-assisted surgery.

The aim of the dissertation is: "Creation of an algorithm for clinical application of the methods of virtual 3D planning, modeling and printing in local, regional and microvascular reconstructions of extensive bone defects in the maxillofacial region, after the implementation of the relevant surgical treatment and follow-up of the results from him". It is clearly formulated and implemented through five tasks:

- Systematization of the necessary preparatory studies and the steps in the process of virtual planning, modeling and corresponding bony maxillofacial surgical intervention.

- Production of individual 3D jaw models for patients with bone resections and reconstructions and individualization of standard reconstructive implants based on them, as an initial stage of application of digital methods in surgical practice.

- Complete process of digital planning, modeling, operative simulation, production of surgical transfer guides and 3D patient-specific implants.

- Intraoperative application of the individualized standard implants according to the produced 3D jaw models, as well as the 3D printed patient-specific implants and surgical guides.

- Generalization of an algorithm for the application of the methods of virtual 3D planning, modeling and printing in local, regional and microvascular reconstructions of extensive bone defects in the maxillofacial area.

To fulfill the goal and set tasks, Prof. Yanev uses various modern methods: clinical approaches; paraclinical methods - incl. laboratory, instrumental, informational, technological and medical-engineering, as well as operational

methods in the preparation, surgical treatment and follow-up of patients with reconstructive operations of complex maxillofacial defects.

The tasks are successfully completed and their results are presented analytically and concretely. I value their conclusions as a contribution to modern medical science and clinical practice.

The protocol created for the first time in our country for computed tomography examination of patients with upcoming microvascular reconstructive operations in the head and neck area, with a donor area in a remote part of the body, is successfully applied in practice by Prof. Dr. Yanev.

Sets of surgical guides were produced to transfer the virtual plan to the real operation. When using the reconstructive guides, a very good precision of adaptation to the donor bone structures and absolute matching of the planned position and angulation of the bone graft fixation holes in the position in its position to the patient-specific implant and in its relation to the recipient bone structure were reported.

Individualized standard titanium implants according to the produced 3D jaw models are associated with the application of microvascular and regional axial reconstructions.

The algorithm created by Prof. Yanev for the application of digital-assisted methods in cases of local, regional and microvascular reconstructions of complex and extensive defects in the maxillofacial area can be introduced as a standard in this type of surgery.

From my personal impressions in connection with the performance of Prof. Yanev, I am convinced that the current scientific thesis is entirely his personal work and is a result of his long-term personal experience, shared and appreciated not only in our country, but also in Great Britain, where until 2018 he works actively as Consultant Maxillofacial Surgeon, at the Head and Neck Department, Royal Derby Hospital, UK

I accept and stand in solidarity with the contributions of the dissertation work, namely:

1. A specialized protocol has been created for computer-tomographic examination of patients who are to undergo microvascular reconstructive surgery in the head and neck area, with a donor area in a remote part of the body. It allows the generated image information to be directly exported to the

planning server and simultaneously used for the purposes of digital planning methods.

2. The first series of fully virtual planned and 3D modeled microvascular reconstructions of extensive maxillofacial defects stabilized with laser sintered patient-specific implants was performed. This clinical project is based on international technological cooperation and Bulgaria's own surgical experience.

3. The application of both individualized standard implants and patient-specific implants with the two main reconstructive methods of complex maxillofacial defects – microvascular and regional axial flaps – has been verified.

4. A series of virtually planned resection and reconstructive surgical guides were applied for the first time in clinical practice in our country for the exact transfer of the virtual plan in each of the performed real operative interventions.

5. A series of innovative hybrid multisegmental mandibular patient-specific implants were virtually designed and clinically applied in fibular microvascular reconstructions, with an implant base restoring the contour of the jaw according to the individual characteristics of the patient and a stabilizing part of the implant allowing positioning of the fibular bone section in optimal alveolar mandibular position, with a view to correct intraoral restoration and dental prosthetics.

6. Two-piece Titan-REEK mandibular and craniofacial implants were virtually designed, manufactured with combined 3D technology and clinically applied.

7. Virtual planning and clinical application of navigated dental implants in previously virtually planned microvascular fibular reconstructions stabilized with 3D printed patient-specific implants was performed.

8. An algorithm was created for the clinical application of the methods of virtual 3D planning, modeling and printing in reconstructions in the maxillofacial area, which could be used on an interdisciplinary basis by all specialists working in this complex area of the human body.

On the topic of the dissertation, 15 publications in specialized scientific publications and 6 participations in scientific forums are presented.

The dissertation fully meets all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations of UMHSTEM "N.I. Pirogov", Sofia, for its application.

In conclusion:

Based on the above, I find that the dissertation work of Associate Professor Dr Nikolay Svetoslavov Yanev on the topic: "Algorithm for clinical application of virtual planning, modeling and 3D printing in local, regional and microvascular reconstructions of complex maxillofacial defects" has the necessary qualities and meets all the criteria for awarding the educational and scientific degree "**Doctor of Science**"

June 2022 г.

Sofia

REVIEWER:

(Prof.Dr. Nikolay Gabrovsky, dms)