

Evaluation report

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**Member of the Scientific Jury appointed by Order No. P-109-149/
26.03.2026 with regard of the procedure for conferral of the
PhD educational and scientific degree in doctoral program
“Healthcare Management”, professional field: 7.4. Public Health,
higher education field: 7. Health and Sports**

Professional field: 7.4. Public Health

Doctoral program: Healthcare Management

Author: Denislav Krasimirov Ivanov

PhD study form: independent

Department of HealthCare

Faculty: Sliven branch

Subject: “Application of medical dry needling for subacromial shoulder impingement syndrome”

Scientific supervisor: Assoc. Prof. Silvia Ivanova Filkova, PhD

1. General overview of the procedure and the PhD student

By Order No. **P-109-149/26.03.2026** of the Rector of the Medical University – Varna, I am appointed as external scientific jury member for public defense of a thesis for conferral of the PhD educational and scientific degree.

The PhD student Denislav Krasimirov Ivanov presents a set of materials both on paper and electronic media meeting the requirements of Art. 44, para. 3 of the Statute for the Academic Staff Development at the Medical University - Varna regarding the conferral of the PhD educational and scientific degree. In addition to the dissertation and thesis abstract, the documents contain a list of applicant’s scientific works related to the dissertation, CV of the PhD student, order for disenrollment with the right to defense and the required notarized copies of diplomas, declarations and transcripts from the decisions of the

Department councils in connection with the readiness for preliminary defense and opening of the official defense procedure.

I have no objections/comments regarding the presented documents.

2. Brief biographical data about the PhD student

Denislav Krasimirov Ivanov was born in Dobrich in 1993. In 2015, he completed the Bachelor in Sports and Physical Science (Sports Injuries) degree in Edinburgh, Scotland, He obtained the Professional Bachelor in rehabilitation degree at the Medical College at the Medical University of Varna in 2020 and the Master degree in Physical Therapy and Rehabilitation at the National Sports Academy in 2022.

The applicant began his professional career in 2014 as a sports therapist at FC "Links United", Edinburgh, Scotland. From 2020 to 2023, he worked as a rehabilitator at the Tervel Medical Center, Tervel, and from 2023 to present, is a rehabilitator at the Dobrich Physio Center Medical Center - Dobrich. For the period 2021-2023 has specialized in Dry Needling and Acupuncture and Moxa at the Bulgarian Association of Physiotherapists Specializing in Acupuncture.

3. Relevance of the problem and appropriateness of the thesis' goals and objectives. The evaluated PhD thesis is of **high medico-social importance**, as it combines **a holistic and humane approach** aimed at restoration of musculoskeletal balance, reduction of pain and optimization of biomechanical functions through medical needling. The latter is a minimally invasive therapeutic technique focused at deactivation of myofascial trigger points, modulation of pain mechanisms, and improvement of local tissue function. Due to its ability to affect both peripheral and central pain mechanisms, medical dry needling is considered a promising complementary modality in the treatment of subacromial shoulder impingement syndrome.

The major focus of the dissertation is the evaluation of the therapeutic effect from the application of medical dry needling as a method complementing

the traditional physiotherapy protocol in patients with subacromial impingement syndrome.

4. Knowledge of the problem. The PhD student has in-depth knowledge of the topic. The theoretical reasoning and conclusions made by Denislav Krasimirov Ivanov are based on detailed analysis presented on 218 pages, and 202 literary sources (4 in Cyrillic; 198 in Latin). The structure of the dissertation comprises four chapters: chapter one – literature overview; chapter two – original studies – methodology; chapter 3 – results and discussion; chapter four: original algorithm; the thesis also contains conclusions, contributions, references and appendices. The data and results from conducted studies are illustrated by 48 tables, 20 figures and 6 appendices. The presented publications are related to the topic.

Chapter one of the thesis describes the problem's theoretical and methodological backgrounds and makes a detailed theoretical analysis of the scientific problem state at the time of the work. The main emphasis is placed on problem's medical-social significance and prevalence. The subacromial impingement syndrome (SAIS) is a leading pathology, responsible for 44% to 65% of all shoulder pain cases. The disease mainly affects active people, leading to significant disability and high healthcare costs. Women are more prone to developing SAIS and to more severe rotator cuff tears, while their recovery is slower. SAIS develops as a result of subacromial space narrowing and resulting compression of the rotator cuff tendons and the subacromial bursa. The three SAIS clinical stages are described - from oedema and microhaemorrhages to fibrosis and structural ruptures or osteophytes. The advantages of dynamic ultrasound and MRI are discussed. The special Neer, Hawkins–Kennedy, Jobe, and Lift-Off tests are analyzed, indicating that their combination increases the diagnostic accuracy up to 90%.

The review analyzes the application of integral treatment - medications, surgery (arthroscopy) and physiotherapy. The medical dry needling method is

outlined as a minimally invasive and safe method for treating myofascial trigger points, and is considered an effective complementary method accelerating muscle strength and function restoration. The chapter ends with conclusions justifying the need for development of new integral protocols, including dry needling, for faster and more lasting recovery of patients with subacromial impingement syndrome.

Chapter two presents the general and special methodology of the dissertation. The formulated goal and tasks fully correspond to the topic chosen by the PhD student. **The goal** is to evaluate the therapeutic effect from the application of **medical dry needling** as a complement to a traditional physiotherapy protocol in SAIS patients.

Eight specific tasks are formulated, including theoretical analysis of the problem, development of an experimental protocol, performance of a randomized controlled trial and evaluating the short-term (8 weeks) and long-term (6 months) results.

Three main working hypotheses are formulated:

- The combined treatments led to more substantial muscle strength increase.
- Dry needling ensures a greater and more lasting reduction of pain.
- Patients from the experimental group will demonstrate better functional results evaluated through SPADI and UCLA systems.

The experimental design is a randomized controlled clinical trial with a cohort of 80 patients (40 in the experimental and 40 in the control group) aged between 25 and 65 years, conducted at the Dobrich Physio Center Medical Center - Dobrich.

The *experimental group* was treated with the traditional physiotherapeutical protocol and medical dry needling, whereas the *control group* underwent the traditional physiotherapeutical protocol.

The study results are presented at four time points: before the start of the procedures, the end of the 3rd week, after the 8th week and after the 6th month. For more objective assessment of the condition, special diagnostic tests for ROM measurement were selected: the hand-behind-back test and goniometry according to the SFTR method of Moor, manual muscle testing, measurement with a digital dynamometer, visual analogue scale, SPADI index and UCLA scale.

The control group underwent a 3-week protocol (30 min daily) including Kaltenborn mobilization of the joint, active resistance exercises, post-isometric relaxation and Achedaway fascial treatment. The *experimental group* received the same physiotherapy protocol, complemented with three medical dry needling procedures (once a week).

The study was approved by the Ethical Committee of the Medical University – Varna.

The statistical processing of results included normality of distribution tests, multivariate analysis of variance (MANOVA), t-test for independent samples, Cochran's Q and Friedman's tests.

Chapter three of the dissertation includes the results and discussion. This is the largest part of the work. It presents and analyzes the empirical data from the prospective randomized controlled study. Eighty patients equally distributed into experimental and control groups were analyzed.

The groups were comparable in terms of age (average 46–47 years), gender and affected limb (100% the right dominant), which guarantees the validity of the comparisons. The pain response dynamics was analyzed using the Cochran's Q test for four specific tests: Hawkins–Kennedy and Neer:

- The experimental group demonstrated significantly faster and lasting analgesia as early as after the 3rd week;
- The experimental group demonstrated more rapid restoration of the function of m. supraspinatus

- More rapid restoration of the function of m. supraspinatus in patients treated with the combined protocol was proved.

The experimental group achieved almost complete internal rotation recovery (Th8 level) in 92.5% of patients at the end of follow-up. MANOVA evidenced significantly greater increase in range of motion, especially in external rotation (by 30° versus 14° in the control group). Manual muscle testing in the experimental group attained almost maximum values (4.75–5.00 points) in all movements, while the control group had a residual weakness in abduction and rotation. Dynamometry demonstrated that the complementary dry needling led to a 25–40% increase in muscle strength. The differences were statistically significant ($p < 0.001$) in favour of the experimental group throughout the period. VAS in the experimental group showed a sustained decrease in pain below score 2 at the end of treatment, while in a temporary effect and a slight regression were observed by the 6th month in control subjects. The experimental group showed a reduction in the index by over 60 points (from 76 to 12 points in the 3rd week), which is an indicator of excellent recovery. The experimental group reached an average of 32 points (“good to excellent”), while the control group varied around 28 points (the border of “satisfactory”)

Chapter two presents conclusions on the superiority of the combined protocol, underlying that medical dry needling is the key element providing faster pain relief, better muscle activation, and long-term stability of results.

The conclusions from chapter three on the long-term effect (evaluated at month 6 – T4) showed a categorical advantage of the combined approach (medical dry needling + physiotherapy) over the standard treatment. The results indicate that the improvements achieved in the experimental group (EG) were not only more significant, but also extremely stable over time.

The main conclusions on the long-terms effects of the therapy include:

- Durable pain relieving effect (VAS). Patients treated with dry needling maintained low levels of pain (under 2 points by VAS) during all movements;
- In subjects from the control group, regression of results was often observed. Six months after the therapy, the pain returned to about 3–4 points, demonstrating a weaker long-term effect of the standard physiotherapy;
- The EG maintained a range of motion close to the maximum physiological one, especially during abduction and rotation;
- Instrumental measurements (dynamometry) confirmed that there was not decline in the muscle strength in the EG after the end of the active treatment. The achieved balance between rotator cuff muscles and scapula stabilizers was long-lasting;
- On the 6th month, strength parameters in the EG were significantly greater vs the control group, while in the latter the improvement was only partial and below the norm.
- According to the UCLA scale, the EG attained an average score of 32, corresponding to the boundary of excellent functional recovery. The progress in these subjects continued even after the end of physiotherapy, indicating a real tissue remodelling.

The analysis proves that dry needling is a key factor in the long-term prevention of recurrences, by eliminating the myofascial causes of pain and muscle inhibition, which are not directly addressed by standard physiotherapy.

Chapter three proves that while standard physiotherapy leads to temporary and partial success, the inclusion of medical dry needling ensured sustainable kinematic adaptation and lasting functional shoulder joint health.

Chapter Four. The original therapeutic algorithm, developed in the dissertation, is a structured, phase-oriented biomechanically based model for SAIS treatment. It integrates clinical assessment, standard physiotherapy and

targeted medical dry needling application. The algorithm is built on four fundamental principles:

- Biomechanical - aimed at reducing the compression in the subacromial space by scapulohumeral rhythm optimization and humeral head centering.
- Pathokinesiological - focused on the correction of muscle imbalance and pathological motor stereotypes.
- Neurophysiological - uses MSI to directly affect trigger points, reduce pain and normalize muscle activation
- The principle of phases and progression: the therapy is divided into successive phases with clearly defined goals

Therapeutic decisions are adjusted dynamically according to the progress of the individual patient. The algorithm progresses through four main phases of intervention:

- Initial phase - application of dry needling into myofascial trigger points (MTrPs) of the rotator cuff for analgesia and reduction of muscle hypertonus;
- Early activation - low-load active exercises for normalization of motor control;
- Stabilization - isometric exercises and elastic resistance for restoration of scapular stability;
- Functional integration - multi joint exercises for full restoration of functional capacity.

The algorithm offers specific solutions for each identified deficit: in case of pain - medical dry needling to reduce sensitization; in case of limited range of motion - Kaltenborn mobilizations and post-isometric relaxation (PIR); in case of muscle imbalance - isometric exercises to increase stability; in case of disturbed rhythm - functional exercises to normalize the scapulohumeral rhythm.

This algorithm is established as an upgrade model providing faster pain reduction and more lasting long-term stability of results compared to standard physiotherapy.

Based on the conducted prospective randomized controlled trial (RCT) presented in the dissertation, *several groups of conclusions* regarding the effectiveness of the medical dry needling method in the treatment of subacromial impingement syndrome (SAIS) are drawn according to study's time points:

- Homogeneity at baseline: Before the start of the treatment (T1), both groups had an identical clinical profile – pronounced pain, muscle weakness, limited range of motion and similar functional scale results.
- Recovery dynamics: The experimental group (dry needling + physiotherapy) demonstrated a significantly faster, more pronounced and clinically relevant therapeutic effect as early as the end of the third week (T2) compared to the control group (physiotherapy only).
- Statistical significance: The strength of the effect ($\eta^2 > 0.5$) in all analyses conducted confirms that the improvement in EG is not only statistically significant, but also clinically relevant.

On the basis of data, the PhD thesis confirmed the three main hypotheses:

- The combined treatments led to more substantial muscle strength increase.
- Dry needling ensured a greater and more lasting analgesia (reduction of pain).
- Patients treated with dry needling demonstrated better functional results and more complete recovery.

Medical dry needling is a highly effective complementary technique that accelerates neuromuscular adaptation, reduces muscle inhibition, and ensures

sustainable functional shoulder joint health. The work recommends its integration into modern rehabilitation practice.

The contributions of the dissertation of Denislav Ivanov are grouped in two main categories:

Scientific (theoretical) contributions:

- A new perspective on the pathokinesiology of subacromial impingement syndrome is offered;
- The role of medical dry needling as a neurophysiologically and biomechanically determined complementary technique is scientifically justified;
- A modern scientific methodology for the clinical and medico-social significance of SAIS is systematized, and a structured framework for an integrated therapeutic approach is proposed.

Research and applied (practical) contributions

- An original therapeutic algorithm combining medical dry needling with traditional physiotherapy is developed and clinically tested.
- A standardized evaluation system combining clinical tests, instrumental measurements and validated indices which increase the diagnostic accuracy is introduced,
 - Through a prospective randomized study, the statistically and clinically relevant significant superiority of combined dry needling therapy over standard physiotherapy for SAIS is proven for the first time at a national scale
 - A long-term effect is proven, which confirms the practical applicability and effectiveness of the developed model for full functional recovery

The PhD thesis abstract corresponds to the material from the dissertation. No plagiarism has been detected.

CONCLUSION. The dissertation entitled: “**Application of medical dry needling for subacromial shoulder impingement syndrome**” with author **Denislav Krasimirov Ivanov** is written in good literary language and is dedicated to a serious medical and social problem, reflecting a correctly conducted detailed scientific study. The dissertation meets the requirements of the Statute on the terms and procedures for conferral of the PhD educational and scientific degree at the Medical University – Varna.

Based on the presented evaluation report, I give my positive evaluation and propose to the honorable Scientific jury members to confer the PhD educational and scientific degree to the PhD student **Denislav Krasimirov Ivanov**, PhD programme "Healthcare Management"; professional field 7.4. Public Health; higher education field: 7. Health and Sports.

17 April 2026

Undersigned:

Заличено на основание чл. 5, §1, б. „В“ от Регламент (ЕС) 2016/679
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/Prof. Ruska Paskaleva, PhD/