THE LEVEL OF KNOWLEDGE, SKILLS, MANAGEMENT, AND ATTITUDE OF PHYSIOTHERAPISTS IN ROMANIA REGARDING ELECTRICAL STIMULATION

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Abstract. **Aim**: Rehabilitation programs often include electrical stimulation (ES), an essential component in the rehabilitation process. Due to the diversity of pathologies and associated symptoms, a variety of forms of electrical stimulation can be utilized. To ensure beneficial patient outcomes, it is crucial for electrical stimulation to be applied specifically for each condition, taking into account its particularities. This study aims to evaluate the level of knowledge, skills, management, and attitudes of physiotherapists in Romania regarding the use of ES. The study is part of the professional training project "Clinical Key for Electrical Stimulation in Physiotherapy and Rehabilitation" (CK4Stim), supported by the Erasmus+ program of the European Union.
Materials and Methods: A total of 30 physiotherapists from Romania participated in a cross-sectional and descriptive study. After recording the demographic data of the participants, they completed a 19-question questionnaire created by the project partners to assess their level of knowledge, skills, management, and attitude related to ES. The questionnaire was administered through the Google Forms platform, and participants were invited to complete it via email, social networks, and the Craiova branch of the Romanian College of Physiotherapists. Statistical data analysis was performed using the SPSS 21.0 program.
Results: The study highlighted that Romanian physiotherapists have varying levels of knowledge and skills in using electrical stimulation in the rehabilitation process. In general, participants rated their knowledge as moderate in applying electrical stimulation to healthy muscles, denervated muscles, and muscle contractures, with the average responses exceeding the "to some extent" threshold. The largest number, 16 (53.3%) participants, chose this level of knowledge for the question on treating denervated muscles. According to the report, the level of skills in applying electrical stimulation appears low, with approximately 50% of participants responding with an evaluation of "to some extent." The most problematic levels of knowledge about the use of electrical stimulation were recorded in sports traumatology (6.7%) and pediatric rehabilitation (36.7%), where participants selected "I don't know." Additionally, some responses regarding the preference for the type of electrical stimulation in pediatrics were left unanswered, revealing a lack of experience in managing this department.
Conclusions: The study underscores the need to improve the knowledge and skills of Romanian physiotherapists in the field of electrical stimulation to ensure more effective and accurate application of this technique in clinical practice.
Keywords: Electrical stimulation, knowledge level, skills, attitude, rehabilitation

Introduction

Physiotherapists work in a healthcare environment characterized by increasing complexity, demands for responsibility, and rapid changes. The ability to respond appropriately to these pressures is essential not only for professional development but also for professional survival (Strohschein et al., 2002). For new generations of

physiotherapists, it is crucial to provide an education that fosters a desire for continuous learning and the ability to critically evaluate their own practice and the underlying theories, reinforced with relevant attitudes and competencies (Higgs et al., 1991). Regarding clinical education, where students are involved in learning within the context of clinical practice, it represents the best area for teaching and refining such skills and attitudes. It is considered that through such a consistent and effective approach to the clinical education process, it is possible to influence the development of these attitudes and skills, thus impacting the future of the profession. According to the literature, clinical education has numerous philosophical and practical needs that require study and attention. The development of a common philosophy for clinical education, integrating both the process and the outcomes of clinical educational experience, is essential (Opacich, 1995). Another need is to cultivate a commitment to continuous reflective practice and lifelong learning among early-career professionals (Hayes et al., 1999). It is essential to have a more consistent approach in establishing mutually beneficial relationships between supervisors and students throughout the clinical education experience. There is also a clear demand from many clinicians for more adequate formal preparation and training in the role of clinical educator. A quality assurance process in clinical education is necessary to evaluate and, if needed, improve the consistency and effectiveness of the entire clinical education process (Strohschein et al., 2002).

The literature also provides information about competency-based education, which is a concept, philosophy, and methodology in educational design where a teacher's professional advancement occurs only when demonstrating the necessary competencies (Gruppen et al., 2016). Under the banner of this concept, it is considered necessary to introduce this system into the field of physiotherapy. There is a need within our profession to establish defined performance outcomes and reduce the number of situations where graduates enter unsupervised practice unprepared. Although institutional missions provide an important context for the variability in physical therapy programs, the need for a common foundational framework connecting education and practice based on performance is now evident (Thibault, 2020).

Electrotherapy is part of the European curriculum, and physiotherapists undergo standardized learning regarding the use of this technique in medical recovery. The evident assumption is that all these theoretical components in the physiotherapy curriculum prepare graduates for practice. However, the design of this curriculum is also influenced by other factors such as professional accreditation groups, regulatory bodies, as well as clinicians, students, and professors (Jensen et al., 2012). The practice of electrotherapy in the current context is varied in terms of evaluation and treatment skills. The treatment method can vary from one therapist to another, depending on their exposure to different electrotherapy concepts and recent trends (Nkusi et al., 2006). One way to assess the quality of university education is by examining the curriculum content.

Electrotherapy is taught to physiotherapy students, with basic concepts addressed in undergraduate courses and advanced topics in master's courses. The subject has evolved over time based on advancements in the field. It is essential that the curriculum content in this area is periodically evaluated and updated. This content can play a crucial role in determining the clinical competence of graduates (Nkusi et al., 2006).

This mindset underpinned the project titled "Clinical Key for Electrical Stimulation in Physiotherapy and Rehabilitation" (CK4Stim), supported by the National Agency in Turkey under the KA220-VET project – Partner collaborations in vocational education and training. By analyzing the existing literature on electrical stimulation (ES) approaches, we identified the need for a common language for physiotherapists in the use of this technique, both in Romania and across Europe. The present paper demonstrates one of the results of the project, focusing on the evaluation of the level of knowledge, skills, and attitudes regarding electrical stimulation among physiotherapists in Romania.

Methodology

This paper presents a cross-sectional and descriptive study conducted in the form of a questionnaire addressed to physiotherapists in Romania. The study was carried out with the support of the County Representation of the Romanian College of Physiotherapists, which facilitated participation through email, social media, and direct contacts. The questionnaire was developed by the faculty members of the project partners from the University of Craiova and was designed to measure the knowledge, skills, management, and attitudes of physiotherapists in the field of electrical stimulation (ES). The process of development involved the partner

universities from the project, including PAÜ University, SDÜ University, HKMÜ University, BÜ University, University of Craiova (CÜ - Romania), Šiauliai University of Applied Sciences (SUBDÜ), and Tartu Health College. The Google Forms platform was used to administer the questionnaire, and data were collected between July 15, 2022, and September 15, 2022. Participants were informed in advance about the purpose and procedure of the study, and those interested completed the online questionnaire to contribute to the research.

Participants

The study included physiotherapists working in Romania. Participants were asked for information about their workplace, area of activity, years of experience, etc. After recording all this information, participants completed the prepared questionnaire. They had the option to complete the questionnaire online or to submit a completed PDF file via email.

Questionnaire Form

The questionnaire consists of 19 questions, structured to assess the level of knowledge, skills, management, and attitude in the use of electrical stimulation (ES) in evaluation and treatment programs within the field of physiotherapy and rehabilitation. The first 7 questions focus on assessing participants' knowledge of ES, questions 8-11 explore their skill levels, questions 12-13 examine management levels, and questions 14-19 are designed to analyze their attitudes toward the use of ES. The questions about knowledge, skills, and management, with the exception of the third question, are structured in two options: A) for raising participants' awareness of their own level, and B) for assessing knowledge, skills, and management in a simple and clear manner. The questionnaire was anonymous, with no personally identifiable information being collected. The estimated time to complete the questionnaire is approximately 15 minutes.

Statistical Analysis

The statistical analysis of the study data was performed using SPSS 21.0 software. For continuous variables, the arithmetic mean ± standard deviation (X ± SD) was calculated, while for categorical variables, the values were reported as percentages (n %).

Results

In our study, the survey was completed by a total of 30 physiotherapists working in Romania. The average work experience of the participants was 3.8 ± 2.8 years. The clinical characteristics of the participants are detailed in Table 1. Regarding the workplace, 5 participants (16.7%) work in the public sector, 23 (76.6%) in the private sector, and 2 (6.7%) in the academic field. Regarding their area of specialization, 19 (63.3%) specialize in general rehabilitation, 4 (13.3%) in pediatric rehabilitation, 3 (10%) in neurological rehabilitation, 1 (3.3%) in orthopedic rehabilitation, and 2 (6.7%) each in orthosis-prosthesis rehabilitation and the academic field. Table 2 presents the participants' responses regarding their level of knowledge about electrical stimulation. Concerning the stimulation of healthy muscles, 16 (53.3%) of participants indicated a moderate level of knowledge, while 11 (36.7%) reported a low level, and only 3 (10%) mentioned a good level. For stimulating muscle contractions, 5 (16.7%) indicated a good level, 16 (53.3%) a moderate level, and 9 (30%) a low level. Regarding the stimulation of nerves and muscles, 1 (3.3%) stated they had good knowledge, 17 (56.7%) a moderate level, and 12 (40%) mentioned they had little knowledge. Regarding the use of electrical stimulation in upper motor neuron injuries, 17 (56.7%) reported a moderate level of knowledge, 12 (40%) mentioned they had little information, and 2 (6.7%) had no knowledge in this field. For detecting and rehabilitating nerve degeneration with electrical stimulation, 11 (36.7%) indicated a moderate level of knowledge, 14 (46.7%) mentioned they had little knowledge, 4 (13.3%) had no knowledge, and 1 (3.3%) did not know about this topic. Regarding the parameters necessary to treat a denervated muscle with electrical stimulation, 12 (40%) indicated a moderate level, 16 (53.3%) mentioned they had little information, and 2 (6.7%) had no knowledge in this area. Regarding preferences for stimulation agents for polarization and depolarization of cells, the majority of participants, 19 (63.3%), preferred SENM, followed by SEM with 16 (53.3%), CR with 11 (36.7%), and TENS and CDD with 10 (33.3%) each. In the context of using electrical stimulation, it was observed that 76.7% of participants preferred the use of active muscle stimulation, 36.7% for cell healing, 83.3% for muscle contraction stimulation, and 50% for pain management. Regarding the preferred order of nerve stimulation after injuries, 40% of participants preferred the order CG-CR-SGPIF-CF. In treating spasticity, 10 (33.3%) preferred the use of SGPII. Regarding the treatment of denervated muscles, 63.3% preferred SENM, while 33.3% opted for TENS.

Table 1. Clinical Characteristics of Participants

	(Mean±SD)					
Working time (years)	3.8±2.8					
	Public (n %)	Private (n %)	Academic (n %)			
The workplace	5(16.7%)	23(76.6%)	2(6.7%)			
Work area	General rehabilitation (n %)	Pediatric rehabilitation (n %)	Neurological rehabilitation (n %)	Orthopedic rehabilitation (n %)	Orthotic-prosthetic rehabilitation (n %)	Academic field (n %)
	19(63.3%)	4(13.3%)	3(10%)	1(3.3%)	1(3.3%)	2(6.7%)

Table 2. Participants Knowledge Levels of Electrical Stimulation

Question 1A. Knowledge of the physiotherapists about electrical stimulation of healthy muscles. (Self-assessment)										
Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
0	0	11(36.7%)	16(53.3%)	3(10%)	0					
Question 1B. Physiotherapist's preferences for electrical stimulation in action potential generation, cell polarization and depolarization										
FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other (s) n (%)
0 (0)	19(63.3%)	1(3.3%)	10(33,3%)	7(23.3%)	16(53.3%)	6(20%)	11(36.7%)	7(23.3%)	10(33.3%)	0(0)
Question 2A. Physiotherapists' knowledge of electrical stimulation for muscle contraction (Self-assessment)										
Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
0	0	9(30%)	16(53.3%)	5(16.7)	0					
Question 2B. Physiotherapists' preferences for electrical stimulation parameters for muscle contraction										
Answer choices					n (%)					
Active					23(76.7%)					
Passive					16(53.3%)					
Large superficial motor units are first engaged, next smaller motor units					9(30%)					
Stimulated motor units continue to fire until the stimulus is removed, and this causes rapid fatigue					2(6.7%)					
Action potential moves away from the nerve cell body					0					
Action potential is generated in two direction, away from the cell body and back toward the cell body					10(33.3%)					
Other(s)					0					
Question 3. Physiotherapists' preferences for the use of electrical stimulation										
Answer choices					n (%)					
To strengthen muscles					25(83.3%)					
To promote healing of the cells					11(36.7%)					
For pain management					15(50%)					
To increase circulation					10(33.3%)					
To improve range of motion					4(13.3%)					
To stimulate contraction					25(83.3%)					
Other(s)					0 (0)					
Question 4A. Physiotherapists' knowledge of electrical stimulation treatment of denervated muscles (Self-Assessment)										
Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
0	0	12(40%)	17(56.7)	1(3.3%)	0					
Question 4B. Physiotherapists' preferences for electrical stimulation of denervated muscles										
LFC n (%)	MFC n (%)	HFC n (%)	LVC n (%)	HVC n (%)	AC n (%)	MGC n (%)	Others n (%)			
12(40%)	8(26.7%)	2(6.7%)	1(3.3%)	6(20%)	8(26.7%)	11(36.7%)	0 (0)			
Question 5A. Physiotherapists' knowledge of the use of electrical stimulation in upper motor neuron injuries (Self-Assessment)										
Do not know (n	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n					

	%)					%)					
	0	1(3.3%)	12(40%)	17(56.7%)	0	0					
Question 5B. Physiotherapists' preferences for electrical stimulation in reducing post-stroke spasticity											
	FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other (s) n (%)
	3(10%)	11(36.7%)	10(33.3%)	9(30%)	5(16.7%)	2(6.7%)	4(13.3%)	8(26.7%)	9(30%)	5(16.7%)	0(0)
Question 6A. Physiotherapists' knowledge of the use of electrical stimulation to detect nerve degeneration in physiotherapy and rehabilitation (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	1(3.3%)	4(13.3%)	14(46.7%)	11(36.7%)	0	0					
Question 6B. Physiotherapists' preferences for currents used after nerve injury											
	FC-RC-GC-HVPGS (n %)	GC-RC-HVPGS - FC (n %)	GC-FC-HVPGS - RC (n %)	HVPGS - RC-GC-FC (n %)	FC-GC-RC-HVPGS (n %)						
	6(20%)	12(40%)	6(20%)	1(3.3%)	5(16.7%)						
Question 7A. Physiotherapists' knowledge of the parameters required to treat denervated muscles with electrical stimulation (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	0	2(6.7%)	16(53.3%)	12(40%)	0	0					
Question 7B. Physiotherapists' preferences for electrical stimulation in the treatment of denervated muscles											
	FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other (s) n (%)
	1(3.3%)	19(63.3%)	7(23.3%)	10(33.3%)	7(23.3%)	8(26.7%)	8(26.7%)	1(3.3%)	7(23.3%)	9(30%)	0 (0)

FC : Faradic current, HVPGS: High Voltage Pulsed Galvanic Stimulation, NMES: Neuromuscular Electrical Stimulation, TENS: Transcutaneous Electrical Nerve Stimulation, IC : Interferential Current, EMS: Electrical Muscle Stimulation, FES: Functional Electrical Stimulation, RC : Russian Current, GC : Galvanic Current, DDC: Diadynamic Current, LFC: Low Frequency Current, MFC : Medium Frequency Current, HFC : High Frequency Current, LVC : Low Voltage Current, HVC : High Voltage Current, AC : Alternating Current, MGC : Modulated/Modified Galvanic Current

Regarding the level of competence of the participants in electrical stimulation, 3 (10%) considered themselves to have a good level, 11 (36.7%) a medium level, 15 (50%) a low level, and 1 (3.3%) reported having no competency. Regarding the use of FES, only one participant (3.3%) reported a good level, 8 (26.7%) indicated a medium level, 13 (43.3%) a low level, and the remaining 8 (26.7%) reported having no skills or knowledge. For FC applications, 7 (23.3%) considered themselves to have a medium level, 8 (26.7%) a low level, 10 (33.3%) no skills, and 5 (16.7%) lacked knowledge on the subject. In terms of IC, 2 (6.7%) reported a good level, 13 (43.3%) a medium level, and the remaining 15 (50%) were categorized as having low skills or no knowledge. Among the participants, 63.3% (19) prefer bipolar application for motor stimulation, followed by monopolar with 16.7% (5).

Regarding IC, 2 (6.7%) reported a good level, 13 (43.3%) an average level, and the remaining 15 (50%) fall into the category of those with low skills or no knowledge. Among the participants, 63.3% (19) prefer bipolar application for motor stimulation, followed by monopolar with 16.7% (5). The majority, 83.3% (25), use FES for loss of muscle functionality, followed by use for atrophy at 56.7% (17). However, only 16.7% (5) can correctly use the labile technique for the correct choice and positioning of electrodes and only 13.3% (4) can correctly apply the base and dose for DDC, this information being stored in Table 3.

Evaluating Table 4, it is observed that only 4 (13.3%) of the participants reported a good level of knowledge regarding the use of electrical stimulation (ES) in sports trauma. A medium level was reported by 9 (30%) of the participants. In sports rehabilitation, 53.3% (16) prefer the use of IC, followed by TENS and EMS with 43.3% (13) and DDC with 36.7% (11). Regarding the stimulation of healthy muscles, 7 (23.3%) of the participants reported an average level of

knowledge, while 11 (36.7%) stated that they had no knowledge in this area. In the pediatric field, TENS was the most popular current, being selected by 40% (12) of the participants, followed by NMES with 23.3% (7) and EMS with 16.7% (5).

Table 5 reflects the level of attitude of the participants. A percentage of 36.7% (11) of them prefer the use of electrical muscle stimulation (EMS) for urinary incontinence problems, followed by TENS, preferred by 26.7% (8) of the participants. As the general condition of the patients improved, only 6.7% (2) of the physiotherapists always changed the type of current used, while the others either did not change it at all (13.3%) or did so rarely (43.3%). To prevent movement restrictions and provide orthotic support, most participants prefer NMES (53.3%), followed by EMS with 23.3% (7) and FES with 16.7% (5). Regarding the increase in muscle strength, the most used agent is NMES, used by 60% (18) of the participants, followed by EMS, preferred by 56.7% (17) of the participants. After nerve degeneration, 43.3% (13) of participants preferred a frequency of 50-70 Hz to stimulate fast-twitch muscle fibers. On the other hand, only 20% (6) of the participants correctly chose the current syncopal rhythm to obtain the local muscle contraction in DDC (diadynamic).

Table 3. Participants' Skill Levels in Using Electrical Stimulation

Question 8A. Physiotherapists' skill level in applying electrical stimulation (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	0	1(3.3%)	15(50%)	11(36.7%)	3(10%)	0					
Question 8B. Physiotherapists' preferences for electrode placement in motor stimulation											
	Monopolar	Bipolar	Quadripolar	Under water							
	5(16.7%)	19(63.3%)	4(13.3%)	2 (6.73%)							
Question 9A. Physiotherapists' skill level in using FES applications (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	4(13.3%)	4(13.3%)	13(43.3%)	8(26.7%)	1(3.3%)	0					
Question 9B. Physiotherapists' preferences for FES indications											
Answer choices							n (%)				
Loss of functionality							11(36.7%)				
Loss of muscle functionality							25(83.3%)				
Paralysis							8(26.7%)				
Loss of sensation							8(26.7%)				
Atrophy							17(56.7%)				
Weight loss							2(6.7%)				
Question 10A. Skill level of physiotherapists in applying Faradic Current for muscle re-education (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	5(16.7%)	10(33.3%)	8(26.7%)	7(23.3%)	0	0					
Question 10B. Electrode type and application location preferred by physical therapists for labile technique											
Answer choices							n (%)				
Pen electrode - 45-degree angle to the skin							9(30%)				
Pen electrode - 90-degree angle to the skin							5(16.7%)				
Filet electrode - full contact to the skin							15(50%)				
Filet electrode to the motor point of muscle							1(3.3%)				
Filet electrode - under water							0				
Question 11A. The skill level of physiotherapists in the application of interference current (Self-assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	4(13.3%)	5(16.7%)	6(20%)	13(43.3%	2(6.7%)	0(0%)					

				)							
Question 11B. Physiotherapists' preferences for application and duration before diadynamic current											
Answer choices							n (%)				
After 2 minutes of Basis, 3 minutes of Dosis application							4(13.3%)				
After 5 minutes of Basis, 10 minutes of Dosis application							12(40%)				
After 10 minutes of Basis, 20 minutes of Dosis application							7(23.3%)				
After 5 minutes of Dosis, 10 minutes of Basis application							6(20%)				
After 10 minutes Dosis, 20 minutes of Basis application							1(3.3%)				

Table 4. Participants' Management Levels in the Use of Electrical Stimulation

Question 12A. Physiotherapists' knowledge of electrical stimulation in sports trauma (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	2(6.7%)	1(3.3%)	14(46.7%)	9(30%)	4(13.3%)	0					
Question 12B. Physiotherapists' preferences for electrical stimulation in sports trauma											
	FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other (s) n (%)
	1(3.3%)	8(26.7%)	4(13.3%)	13(43.4%)	16(53.3%)	13(43.3%)	7(23.3%)	2(6.7%)	4(13.3%)	11(36.7%)	0(0)
Question 13A. Physiotherapists' knowledge of electrical stimulation of healthy muscles (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	11(36.7%)	3(10%)	9(30%)	7(23.3%)	0	0					
Question 13B. Physiotherapists' preferences for electrical stimulation in pediatrics											
	FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other (s) n (%)
	1(3.3%)	7(23.3%)	0(0)	12(40%)	4(13.3%)	5(16.7%)	3(10%)	0(0)	3(10%)	1(3.3%)	0 (0)

FC : Faradic current, HVPGS: High Voltage Pulsed Galvanic Stimulation, NMES: Neuromuscular Electrical Stimulation, TENS: Transcutaneous Electrical Nerve Stimulation, IC : Interferential Current, EMS: Electrical Muscle Stimulation, FES: Functional Electrical Stimulation, RC : Russian Current, GC : Galvanic Current, DDC: Diadynamic Current, LFC: Low Frequency Current, MFC : Medium Frequency Current, HFC : High Frequency Current, LVC : Low Voltage Current, HVC : High Voltage Current, AC : Alternating Current, MGC : Modulated/Modified Galvanic Current

Table 5. Attitudes of Participants towards Electrical Stimulation

Question 14. Physiotherapists' preferences for electrical stimulation in urinary problems											
	FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other (s) n (%)
	2(6.7%)	5(16.7%)	3(10%)	8(26.7%)	6(20%)	11(36.7%)	5(16.7%)	4(13.3%)	1(3.3%)	1(3.3%)	0 (0)
Question 15. Physiotherapists' preferences for type of current change as health improves (Self-Assessment)											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	5(16.7%)	4(13.3%)	14(46.7%)	5(16.7%)	2(6.7%)	0					
Question 16A. Physiotherapists' preferences for electrical stimulation to prevent motion limitation and provide orthotic support (Self-Assessment)*											
	Do not know (n %)	Not at all (n %)	Somewhat (n %)	Moderately (n %)	Good (n %)	Very good (n %)					
	3(10%)	2(6.7%)	13(43.3%)	9(30%)	3(10%)	0					
Question 16B. Physiotherapists' preferences for electrical stimulation to provide orthotic support											
	FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other (s) n (%)
	0 (0)	16(53.3%)	3(10%)	4(13.3%)	2(6.7%)	7(23.3%)	5(16.7%)	3(10%)	4(13.3%)	4(13.3%)	0 (0)
Question 17. Physiotherapists' preferences for electrical stimulation to increase muscle strength											
	FC n (%)	NMES n	HVPGS n	TENS	IC n	EMS n (%)	FES	RC n	GC n	DDC n	Other

		(%)	(%)	n (%)	(%)		n (%)	(%)	(%)	(%)	(s) n (%)
	0 (0)	18(60%)	3(10%)	5(16.7%)	7(23.3%)	17(56.7%)	4(13.3%)	3(10%)	1(3.3%)	6(20%)	0 (0)
Question 18. Physiotherapists' preferences for frequency to stimulate fast-twitch muscle fibers after nerve degeneration											
	10-30 Hz	30-50 Hz	50-70 Hz	70-90 Hz	90-110 Hz						
	2(6.7%)	6(20%)	13(43.3%)	6(20%)	3(10%)						
Question 19. Physiotherapists' preferences for the diadynamic current modality to achieve local muscle contraction											
	Fixed diphasic (n %)	Single phase fixed (n %)	Short period (n %)	Long period (n %)	Syncopated rhythm (n %)						
	10(33.3%)	8(26.7%)	4(13.3%)	2(6.7%)	6(20%)						

FC : Faradic current, HVPGS: High Voltage Pulsed Galvanic Stimulation, NMES: Neuromuscular Electrical Stimulation, TENS: Transcutaneous Electrical Nerve Stimulation, IC : Interferential Current, EMS: Electrical Muscle Stimulation, FES: Functional Electrical Stimulation, RC : Russian Current, GC : Galvanic Current, DDC: Diadynamic Current, LFC: Low Frequency Current, MFC : Medium Frequency Current, HFC : High Frequency Current, LVC : Low Voltage Current, HVC : High Voltage Current, AC : Alternating Current, MGC : Modulated/Modified Galvanic Current

Discussions

Partner universities have extensive experience in the field of electrotherapy, offering training courses and workshops for undergraduate, master's, and doctoral students in physiotherapy, as well as for practitioners. However, the transfer of knowledge from academia to professionals has not fully succeeded in meeting the real training needs of physiotherapists regarding the application of electrical stimulation (ES). It is also well known that there are regional variations in professional training and knowledge transfer among European universities.

The specialized literature highlights numerous applications of ES for various purposes (Levine et al., 2014). To achieve the most effective rehabilitation outcomes, it is essential that ES be tailored to the condition being treated, periodically adjusted, and, in some cases, applied simultaneously with multiple ES agents (Blazevich et al., 2021). The random application of ES, without considering its timing and purpose, will not produce therapeutic effects. Therefore, the use of ES must be well-defined and oriented toward the specific condition being treated (Rushton, 2002).

The therapeutic effects of ES are well-founded and proven, making this procedure commonly applied to individuals undergoing rehabilitation treatment

Patients may spend a significant amount of time in the clinic for the application of electrical stimulation (ES) due to its proven therapeutic benefits (Zayed et al., 2020). The popularity of this method is mainly attributed to its physiological effects on recovery, and the applications of ES continue to vary depending on the evaluation methods and therapeutic skills involved. For this reason, it becomes essential to examine the preferences of physiotherapists and periodically review training programs to enhance the clinical competencies of practitioners.

In this context, it becomes crucial to continuously update the educational curriculum and to reflect on the latest international trends in healthcare..However, the diversity of ES applications, both new and traditional, can create challenges for physiotherapists in selecting the optimal treatment methods. (Bussel, 2015) . As new electrostimulation techniques are integrated into rehabilitation processes, older methods are becoming less frequently used. (Maffiuletti et al., 2023). Following international research and adaptation to local needs, curriculum authors have attempted to include new ES techniques while preserving traditional elements. This approach may lead to the expansion of study programs, resulting in physiotherapists being well-versed in less commonly used methods but less familiar with techniques frequently employed in practice.

Various studies assessing physiotherapists' general knowledge, skills, attitudes, and behaviors indicate that without applying knowledge in practical work to acquire skills, optimal rehabilitative treatment for individuals is not achievable. (Auchstaetter et al., 2016; Brown et al., 2023)

According to knowledge level analysis results, when ES is used for stimulating healthy muscles, 36.7% of participants reported insufficient knowledge, 30% rated their knowledge as "low," and 23.3% as "moderate." The most preferred current for stimulating healthy muscles was Neuromuscular Electrical Stimulation (NMES), followed by Interferential Current (IC) and

Transcutaneous Electrical Nerve Stimulation (TENS).

For Functional Electrical Stimulation (FES) applications, 43.3% of participants rated their knowledge as "low," and 26.7% as "moderate." When evaluating physiotherapists' preferences for FES indications, 83.3% mentioned its use for muscle functionality loss, followed by atrophy (56.7%) and paralysis (26.7%).

In applications involving interferential current, 43.3% of physiotherapists rated their knowledge as "moderate," while only 6.7% reported a "good" level of knowledge. Most therapists preferred a protocol of 5 minutes Basis application followed by 10 minutes Dosis application.

In sports traumatology, 46.7% of physiotherapists rated their knowledge level as "low," 30% as "moderate," and 13.3% as "good." In this context, the most preferred current was IC (53.3%), followed by TENS (43.4%) and FES (23.3%).

Regarding preferences for the use of electrical stimulation in pediatrics, 40% of participants indicated the use of TENS, and 23.3% indicated NMES. Only 10% of participants rated their knowledge as "moderate" or higher.

For preventing movement limitations and providing orthotic support, 43.3% of participants reported applying this technique "rarely," while 10% applied it "always.", 53.3% from the participants preferred NMES, while 13.3% used FES.

Concerning muscle strength enhancement, 60% of physiotherapists cited NMES as their preferred method, and 56.7% used Muscular Electrical Stimulation (MES). At the same time, 20% opted for application of diadynamic current.

Clear differences in participants' preferences highlighted the need to develop a standardized protocol. For stimulating fast-twitch muscle fibers after nerve degeneration, 43.3% of participants preferred a frequency of 50–70 Hz, while 20% chose 30–50 Hz. Regarding diadynamic current, 33.3% of physiotherapists indicated a preference for the fixed biphasic mode, while 26.7% opted for the fixed monophasic mode.

The diversity of electrostimulation (ES) applications in medical clinics and the rehabilitation market provides a favorable framework for developing effective strategies in managing pre-professional educational programs for physiotherapists. This diversity necessitates a rigorous approach involving the collection of relevant data and the implementation of transparent processes to evaluate essential competencies. Thus, careful assessment of theoretical knowledge, practical skills, management capabilities, and professional attitudes of future physiotherapists is essential.

These evaluations and strategies are crucial to ensuring that graduates are well-prepared not only in the correct use of ES but also in adapting it to various clinical scenarios. Additionally, the data obtained can be used to create clear and coherent guidelines for educators, employers, and professional organizations, thereby facilitating high standards of continuous training and enhancing competencies among physiotherapy graduates.

These processes contribute to producing better-prepared professionals capable of efficiently integrating electrostimulation into their clinical practices, thereby supporting both improved patient outcomes and the ongoing development of the physiotherapy field.

Conclusions

It is essential to adapt and periodically update the core curriculum to keep pace with international trends in healthcare education. ES is applied in the work of physiotherapists to reduce pain, improve muscle strength, promote the regeneration of damaged nerves, and enhance neurosensory-motor connections.

Following international research and the specific needs of the community, those responsible for curriculum planning have sought to integrate new applications of electrical stimulation into existing programs while also maintaining older applications. This approach has inevitably led to an expansion of the curriculum content. The majority of participants (41.1%) reported a "moderate" level of knowledge in using electrical stimulation to produce muscle contractions. Additionally, all participants, except for 15.4%, had basic knowledge in this field. These clear discrepancies in participants' preferences highlight the necessity of developing a standardized application protocol.

Research on the knowledge, skills, attitudes, and general behavior of physiotherapists indicates that success in the rehabilitation process cannot be achieved without effectively transforming knowledge into practical skills. The most problematic level of knowledge regarding the use of electrical stimulation was rated as "I don't know," with 9.5% recorded in sports trauma and 8.4% in pediatric rehabilitation. Moreover, the lack of responses regarding the preference for the type of electrical stimulation used in pediatrics revealed a lack of experience in managing this area of practice. Our results show how low the levels of knowledge, skills, management, and attitudes among physiotherapists are, emphasizing

the need to guide training programs based on identified practical deficiencies and error rates related to different types of currents.

Our study has certain limitations. The first limitation is the difficulty our colleagues faced in sufficiently adapting to the technological concepts of the research, which prevented the grouping of participants based on years of professional experience. As a result, we could not analyze how levels of knowledge, skills, management, and attitudes vary in relation to increasing field experience. The second limitation is that most participants work in the general rehabilitation sector, and the number of those working in specialized fields is insufficient, limiting perspectives on specific applications. Nevertheless, our greatest advantage was creating an infrastructure through this project and involving experienced ES educators from Turkey, Romania, Lithuania, and Estonia in drafting the questionnaire.

Our conclusions show that physiotherapists in Romania generally perceive themselves as having a medium level of knowledge and skills in the field of electrical stimulation (ES). However, the reality suggests a low awareness of their competencies, highlighting a deficit in knowledge and skills in this field. Additionally, the results indicate the need for improving management behaviors and attitudes related to the use of ES. We believe these findings can serve as a valuable guide for the development of projects and collaborations in future professional training.

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