



AVRUPA BİRLİĞİ PROJESİ KAPSAMINDA DURUM ANALİZİ: TÜRKİYE'DE ÇALIŞAN FİZYOTERAPİSTLERİN ELEKTRİK STİMÜLASYONU HAKKINDAKİ BİLGİ, BECERİ, YÖNETİM VE TUTUM DÜZEYLERİ

SITUATION ANALYSIS WITHIN THE SCOPE OF THE EUROPEAN UNION PROJECT: KNOWLEDGE, SKILL, MANAGEMENT AND ATTITUDE LEVELS OF PHYSIOTHERAPISTS WORKING IN TURKEY ABOUT ELECTRICAL STIMULATION

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Öz

Amaç: Çalışmanın amacı Erasmus+Mesleki Eğitimde İşbirliği Ortaklıkları kapsamında Türkiye Ulusal Ajansı ve Avrupa Birliği tarafından desteklenen “Fizyoterapi ve Rehabilitasyonda Elektrik Stimülasyonu İçin Klinik Anahtar (CK4Stim)” başlıklı proje kapsamında Türkiye’de çalışan fizyoterapistlerin elektrik stimülasyonu’na (ES) yönelik bilgi, beceri, yönetim ve tutum düzeylerinin belirlenmesidir.

Yöntem: Kesitsel ve tanımlayıcı çalışmaya Türkiye’de çalışan toplam 95 fizyoterapist (6.55 ±6.29 çalışma yılı) katıldı. Katılımcıların demografik özellikleri kaydedildikten sonra, proje ortakları tarafından hazırlanan 19 soruluk anketi Google Formlar üzerinden doldurması istendi. Ankete katılımları için Türkiye’de çalışan fizyoterapistlere e-posta, sosyal medya ve Türkiye Fizyoterapistler Derneği aracılığıyla çağrıda bulunuldu.

Sonuçlar: Her soru için değişkenlik göstermekle birlikte %38,90-50,50 arasında katılımcı ES hakkında orta düzeyde bilgi sahibi olduğunu ifade ederken, çok iyi düzeyde bilgi sahibi olduğunu ifade edenlerin oranı sadece %3,20-6,30 arasında değişiyordu. Bilginin beceriye dönüşümü sorgulandığında

katılımcılar, her soru için %44,20-72,60 arasında değişen oranlarda orta ve üstü beceri düzeyine sahip olduğunu bildirdi. Yönetim düzeyinin orta ve üstü seviyelerde olduğunu belirtenlerin oranı ise % 50’ye dahi ulaşmıyordu (44,20-49,40). Saptanan bilgi, beceri ve yönetim düzeyleri ise belirtilen seviyelerin çok altındaydı. Katılımcıların farklı rahatsızlıkların tedavisinde tercih ettikleri akım türleri ise çok geniş bir yelpazede çeşitlilik gösteriyordu.

Tartışma: Her soru için değişkenlik göstermekle birlikte %38,90-50,50 arasında katılımcı ES hakkında orta düzeyde bilgi sahibi olduğunu ifade ederken, çok iyi düzeyde bilgi sahibi olduğunu ifade edenlerin oranı sadece %3,20-6,30 arasında değişiyordu. Bilginin beceriye dönüşümü sorgulandığında katılımcılar, her soru için %44,20-72,60 arasında değişen oranlarda orta ve üstü beceri düzeyine sahip olduğunu bildirdi. Yönetim düzeyinin orta ve üstü seviyelerde olduğunu belirtenlerin oranı ise % 50’ye dahi ulaşmıyordu (44,20-49,40). Saptanan bilgi, beceri ve yönetim düzeyleri ise belirtilen seviyelerin çok altındaydı. Katılımcıların farklı rahatsızlıkların



tedavisinde tercih ettikleri akım türleri ise çok geniş bir yelpazede çeşitlilik gösteriyordu.

Anahtar kelimeler: Beceri, Bilgi, Elektrik stimülasyonu, Fizyoterapist, Tutum

Abstract

Purpose: The study aims to determine the knowledge, skills, management and attitude levels of physiotherapists working in Turkey towards electrical stimulation (ES) within the scope of the project titled “Clinical Key for Electrical Stimulation in Physiotherapy and Rehabilitation (CK4Stim)” supported by Turkish National Agency and European Union within the scope of Erasmus+ Vocational Education Cooperation Partnerships.

Methods: A total of 95 physiotherapists (6.55 ± 6.29 working months) working in Turkey participated in the cross-sectional and descriptive study. After the demographic characteristics of the participants were recorded, the participants were asked to fill out the 19-question survey prepared by the project partners via Google Forms. Physiotherapists working in Turkey were invited to participate in survey via e-mail, social media and Turkish Physiotherapists Association.

Results: While it varied for each question, 38.90-50.50% of participants stated that they had moderate knowledge about ES, rate of those who stated that they had very good knowledge varied between 3.20-6.30%. When transformation of knowledge into skill was questioned, the participants reported that they had moderate and above skill levels at rates varying between 44.20-72.60% for each question. The rate of those who stated that their management level was moderate and above did not even reach 50% (44.20-49.40). The determined knowledge, skill and management levels were far below the stated levels. The types of current preferred by participants in treatment of different disorders varied in a very wide range.

Conclusion: It was noted that physiotherapists working in Türkiye have a medium level of knowledge and skills on ES, a low level of awareness, and do not have sufficient knowledge and skills as they stated. It was concluded that awareness of effective and safe ES approaches should be increased their implementation should be encouraged, and management and attitudes in the field of ES should be improved among physiotherapists, based on knowledge and clinical experiences.

Key Words: Skills, Knowledge, Electrical stimulation, Physiotherapist, Attitude.

Introduction

Physiotherapists are responsible for providing symptom

control and reducing movement limitations in order to increase the quality of life of individuals with their knowledge, skills, and professional attitudes they exhibit (1). Therefore, it is essential that the level of professional knowledge they acquire is increased throughout life and transformed into a skill and that they can effectively solve the problems they encounter (2). All individuals acquire rapid and solution-oriented sensory, cognitive and behavioral management and attitudes towards people, objects and events by blending the knowledge and skills they have at the most advanced stages of learning (3). Knowledge and skills are affected by different factors. While professional attitudes, which are one of the end products of knowledge and skills, are affected by many factors such as experiences, personal thoughts and the environment, and enable the emergence of behaviors specific to the individual (4-6). Behaviors are specific to the individual. However, the behaviors exhibited are important for the formation of the professional attitudes formed by colleagues (4,7). During treatment, physiotherapists are expected to determine the most appropriate treatment strategy by exhibiting appropriate attitudes and behaviors in addition to their knowledge and skills (8,9). This not only increases professional awareness and fulfills responsibilities, but also increases the physiotherapist's professional success and enables them to work more efficiently and with positive emotions (8,10).

Physiotherapists graduate in accordance with the classical curriculum, which is organized for the content of the basic field of physiotherapy and rehabilitation (11). However, the modern curriculum concept, which has been emphasized in recent years, focuses on whether the educational program achieves the goals and objectives after graduation or whether the goals are sustainable, in addition to the basic content. Therefore, faculty members can make some changes in the curriculum content (12) or organize some trainings for the identified deficiencies.

Electrical stimulation (ES) is one of the basic approaches that has been used for many years and has a deep-rooted role in physiotherapy and rehabilitation practice (13). The ES has been widely used for many years in physiotherapy and rehabilitation disciplines for different purposes such as neuromodulation, strengthening, pain and somatosensory management (11,13,14). Before



optimizing and developing the use of ES in clinical practice, it is necessary to improve our knowledge of the physiological properties, effects and parameters (methodology) of ES application (15). In ES, pulses are characterized by current, polarity, width, intensity, frequency, amplitude (volt or ampere), duration (pulse width), shape (rectangular, triangular, sinusoidal), transcutaneous or invasive application and stimulation site (nerve, muscle). The methodology and applications related to these parameters mainly focus on physical treatment and assessment goals (16). While the use of ES approaches for evaluation allows the discovery of the patient's neural and muscular characteristics, the purpose of using ES approaches in physiotherapy and rehabilitation sessions is to optimize the function with ES and achieve improved functional and health-related results (17).

ES applications are included in all physiotherapy and rehabilitation education curricula for the purpose of teaching basic knowledge and skills (18). However, the knowledge, skills, management and attitudes of physiotherapists may differ under the influence of various factors (4-6). Although ES applications are used so frequently in physiotherapy and rehabilitation programs, very different practices, preferences and frequencies of use have been reported (14). Our literature review pointed to the limited evidence in the literature regarding ES approaches. However, we reached the conclusion that a common language is needed for ES approaches in physiotherapy and rehabilitation education and practices in Turkey, Europe and even the entire world. For this purpose, it was primarily aimed to determine the knowledge, skills, management and attitude levels of physiotherapists regarding ES approaches and practices. Secondary aim was to report the identified deficiencies, to establish an open access education platform for deficiencies, to increase awareness about ES approaches and to carry out a project to create a common language. "Clinical Key for Electrical Stimulation in Physiotherapy and Rehabilitation (CK4Stim)" is an Erasmus+ Collaborative Partnerships in Vocational Education and Training (KA220-VET) project supported by the Turkish National Agency and the European Union. The project is based on the ES approach and has been implemented in partnership with eight institutions from Turkey and the

European Union (Romania, Lithuania and Estonia). In this study, it was aimed to determine the knowledge, skills and attitude levels of physiotherapists working in Turkey towards ES and to conduct a situation analysis with the aim of guiding the open access education platform to be established within the scope of the project.

Material and Methods

This study is a cross-sectional and descriptive survey. The study was conducted by the academicians working at Pamukkale University (PAU), the project manager, and the project partners Süleyman Demirel University (SDU), Hatay Mustafa Kemal University (HMKU), Başkent University (BU), Burdur Mehmet Akif Ersoy University (MAKU), University of Craiova [University of Craiova (UCV), Romania], Šiauliai State University of Applied Sciences [SVK, Lithuania], and Tartu Health Care College [THC, Estonia]. A call was made to physiotherapists working in Turkey via the Turkish Physiotherapists Association, e-mail, and social media to participate in the survey. The survey was uploaded to Google Forms and the survey link was made available to physiotherapists. The survey was delivered to the physiotherapists who requested it by e-mail or by hand. Before starting to fill out the survey, the volunteers were informed about the study and the participants who approved the study answered the survey questions.

Participants

The study included volunteer physiotherapists working in Turkey. Physiotherapists who were not actively working or had never practiced their profession were excluded from the study. Following the questioning of participants regarding their professional status such as their workplace, field of work and years of work, the participants filled out the prepared survey. The survey was administered online, by filling in the form on paper and receiving feedback via e-mail, or face-to-face.

Survey Form

The survey included 19 items questioning the knowledge level, skill, management and attitude dimensions of ES approaches to assessment and treatment programs in physiotherapy and rehabilitation. The first 7 questions of the survey were designed with the consensus of the project



partners and the literature to determine the knowledge level of the participants on ES, questions 8-11 to determine the skill level, questions 12-13 to determine the management level and questions 14-19 to determine the attitude level. Section A of the survey, which included questions on the knowledge, skill and management level of physiotherapists, included questions aimed at “determining the awareness of the participants for the levels they have” and section B included questions aimed at “determining their current knowledge, skill and management levels”. The survey was anonymous and no personally identifiable information was collected. The time required to complete the survey was approximately 15 minutes. The survey was created with the opinions and suggestions provided by partners from 4 countries. Its final form was given with the approval of all partners.

Statistical Analysis

Statistical data analysis of the study was performed using SPSS 21.0 program. Arithmetic mean $\pm$ standard deviation ($X\pm SD$) was given for continuous variables and n (%) was given for categorical variables.

Results

A total of 95 physiotherapists working in Turkey participated in the survey. 24 (25.3%) of the participants were working in public institutions, 45 (47.4%) in private institutions, and 26 (27.4%) in academic institutions. According to the field, 15 of the participants were working in orthopedic rehabilitation, 7 in neurological rehabilitation, 7 in pediatric rehabilitation, 3 in cardiopulmonary rehabilitation, and 63 in general physiotherapy and rehabilitation. The participants had an average of 6.55 ± 6.29 years of professional experience. The professional characteristics of the participants are presented in Table 1.

Table 2 shows the responses of the participants regarding their level of knowledge about ES approaches. For healthy muscles, 21 (22.1%) of the participants had good, 4 (4.2%) very good, 48 (50.5%) moderate (Q.1A), 25 (26.3%) good, 6 (6.3%) very good, 44 (46.3%) moderate (Q.2A), for denervated muscle had 16(16.8%) good, 5 (5.3%) very good, 44 (46.3%) moderate (Q.4A), for upper motor neuron lesions had 12(12.6%) good, 4 (4.2%) very good, 39 (41.1%) moderate (Q.5A), for nerve degeneration detection and rehabilitation with ES had 12 (12.6%) good, 3 (3.2%) very good, 37 (38.9%) moderate (Q.6A), and for treating a denervated muscle with ES had 13(13.7%) good,

Table 1. Professional characteristics of the participants

		Mean $\pm$ SD			
Experience duration (years)		6.55 $\pm$ 6.29			
Working institutes		Government n%	Private n%	Academic n%	
		24 (25.3)	45 (47.4)	26 (27.4)	
Experienced Area	Orthopedical Reh. n (%)	Neurological Reh. n (%)	Pediatric Reh. n (%)	Cardio. Reh. n (%)	General Reh. n (%)
	15 (15.78)	7 (7.36)	7 (7.36)	3 (3.15)	63 (66.31)

Cardio: Cardiopulmonary, **Reh:** Rehabilitation

In order to determine their real knowledge levels, the participants were asked to mark the agent they preferred among the agents on the determined problems and topics. When the answers given to the prepared questions were

examined, it was seen that 35.50-48.40% of the participants preferred NMES, EMS, FES or RA to both polarize and depolarize the cell (Q.1B). It was observed that 50 (54.9%) of the participants preferred active muscle



contraction in ES approaches (Q.2B), 74 (77.9%) used ES to strengthen the muscles and 72 (75.8%) used ES for pain management (Q.3B). While HVPGS had the highest preference percentage with 23.6% (21 participants) for contraction of denervated muscles (Q.4B), 53.9% (48) of the participants preferred NMES and 42.7% (38) preferred FES to reduce spasticity (Q.5B). When the physiotherapists were asked which current order they

preferred after nerve lesion, it was determined that the largest percentage was GC-FC-HVPGC-RC with 53 participants (58.2%) (Q.6B). In the treatment of denervated muscles (Q.7B), it was observed that 55 (59.1%) of the participants preferred GA and 38 (40.9%) FA (Table 2).

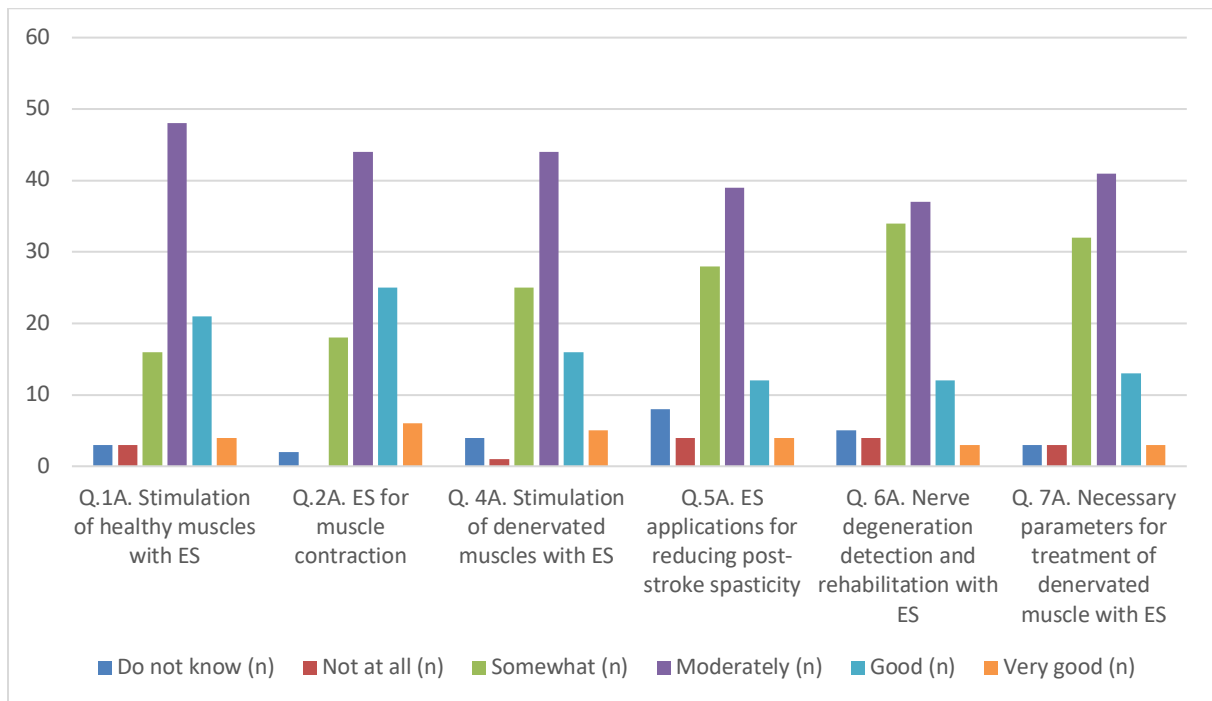


Figure 1. Participants' self-assessment of their knowledge levels regarding electrical stimulation on different topics

Table 2. Participants' knowledge levels about electrical stimulation

Q.1A. Level of 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 (%)
3 (3.2)		3 (3.2)		16 (16.8)		48 (50.5)		21 (22.1)		4 (4.2)
Q.1B. Type of electrical stimulation preference to generate action potential of the physiotherapists										
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)	45 (48.4)	25 (26.9)	18 (19.4)	18 (19.4)	33 (35.5)	33 (35.5)	35 (37.9)	20 (21.5)	12 (12.9)	0 (0)
Q.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 (%)



2 (2.1)	0 (0)	18 (18.9)	44 (46.3)	25 (26.3)	6 (6.3)					
Q.2B. Parameter preference to achieve muscle contraction of the physiotherapists.										
Options	n (%)									
Active	50 (54.9)									
Passive	9 (9.9)									
Large superficial motor units are first engaged, next smaller motor units	43 (47.3)									
Stimulated motor units continue to fire until the stimulus is removed, and this causes rapid fatigue	5 (5.5)									
Action potential moves away from the nerve cell body	14 (15.4)									
Action potential is generated in two direction, away from the cell body and back toward the cell body	33 (36.3)									
Other(s)	0 (0)									
Q.3. Preference to apply electrical stimulation of the physiotherapists										
Options	n (%)									
To strengthen muscles	74 (77.9)									
To promote healing of the cells	38 (40)									
For pain management	72 (75.8)									
To increase circulation	59 (62.1)									
To improve range of motion	24 (25.3)									
To stimulate contraction	69 (72.6)									
Other(s)	0 (0)									
Q.4A. Type of electrical stimulation preference to contract denervated muscle of the physiotherapists (self assessment)										
Do not know	Not at all	Somewhat	Moderately	Good	Very good					
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)					
4 (4.2)	1 (1.1)	25(26.3)	44 (46.3)	16(16.8)	5 (5.3)					
Q.4B. Type of electrical stimulation preference to contract denervated muscle of the physiotherapists										
LFC n (%)	MFC n (%)	HFC n (%)	LVC n (%)	HVC n (%)	AC n (%)	MGC n (%)	Diğer n (%)			
15 (16.9)	10 (11.2)	19 (21.3)	8 (9)	21 (23.6)	0 (0)	2 (2.2)	0 (0)			
Q.5A. Level of knowledge of the physiotherapists about the use of electrical stimulation in upper motor neuron lesions (self assessment)										
Do not know	Not at all	Somewhat	Moderately	Good	Very good					
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)					
8 (8.4)	4 (4.2)	28 (29.5)	39 (41.1)	12(12.6)	4 (4.2)					
Q.5B. Type of electrical stimulation preference to reduce post-stroke spasticity of the physiotherapists										
FC	NMES	HVPGS	TENS	IC	EMS	FES	RC	GC	DDC	Other(s)
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
20 (22.5)	48 (53.9)	20 (22.5)	28 (31.5)	11 (12.4)	15 (16.9)	38 (42.7)	10(12.4)	11 (12.4)	10(12.4)	0(0)
Q.6A. Level of knowledge of the physiotherapists about the detection of nerve degeneration with electrical stimulation and its use in physiotherapy and rehabilitation (self assessment)										
Do not know	Not at all	Somewhat	Moderately	Good	Very good					
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)					
5 (5.3)	4 (4.2)	34(35.8)	37 (38.9)	12 (12.6)	3 (3.2)					
Q.6B. Current preference of the physiotherapists after nerve lesion										
FC-RC-GC-HVPGS	GC-RC-HVPGS-FC	GC-FC-HVPGS-RC	HVPGS-RC-GC-FC	FC-GC-RC-HVPGS						
n (%)	n (%)	RC	n (%)	n (%)						



n (%)										
8 (8.8)	11 (12.1)	53 (58.2)	7 (7.7)	12 (13.2)						
Q.7A. Level of knowledge of the physiotherapists about the necessary parameters to treat a denervated muscle with electrical stimulation (self assessment)										
Do not know	Not at all	Somewhat	Moderately	Good	Very good					
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)					
3 (3.2)	3 (3.2)	32(33.7)	41 (43.2)	13(13.7)	3 (3.2)					
Q.7B. Type of electrical stimulation preference of the physiotherapists to treat the denervated muscles										
FC	NMES	HVPGS	TENS	IC	EMS	FES	RC	GC	DDC	Other(s)
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
38 (40.9)	26 (28)	26 (28)	11 (11.8)	7 (7.5)	21 (22.6)	18 (19.4)	18 (19.4)	55 (59.1)	4 (1.1)	0 (0)

FC: Faradic Current; NMES: Neuromuscular Electrical Stimulation; HVPGS: High Voltage Pulsed Galvanic 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: Alternative Current; MGC: Modified Galvanic Current

In terms of skill levels related to ES, 25(26.3%) of the participants stated that they had good, 4 (4.2%) very good skills, 40 (42.1%) had moderate skills (Q.8A), only 10(10.5%) had good, 2(2.1%) very good skills in terms of FES use, 30 (31.6%) had moderate skills (Q.9A), only 13 9(9.5%) had good, 4 (4.2%) very good skills, 29 (30.5%) had moderate skills (Q.10A), and only 8(8.4%) had good, 7 (7.4%) very good skills, 26 (27.4%) had moderate skills (Q.11A) in terms of EA (Figure 2). While 78.0% of the participants used bipolar application for motor stimulation

(Q.8B), FES was used by the majority of the participants (65.6-83.3%) for paralysis, loss of functionality or to restore muscle function (Q.9B). However, it was noted that only 51 (62.2%) of the participants selected the correct electrode and positioning option for the labile technique, while only 46 (56.8%) selected the correct basis and dosage application option for DDA (S11B) (Table 3).

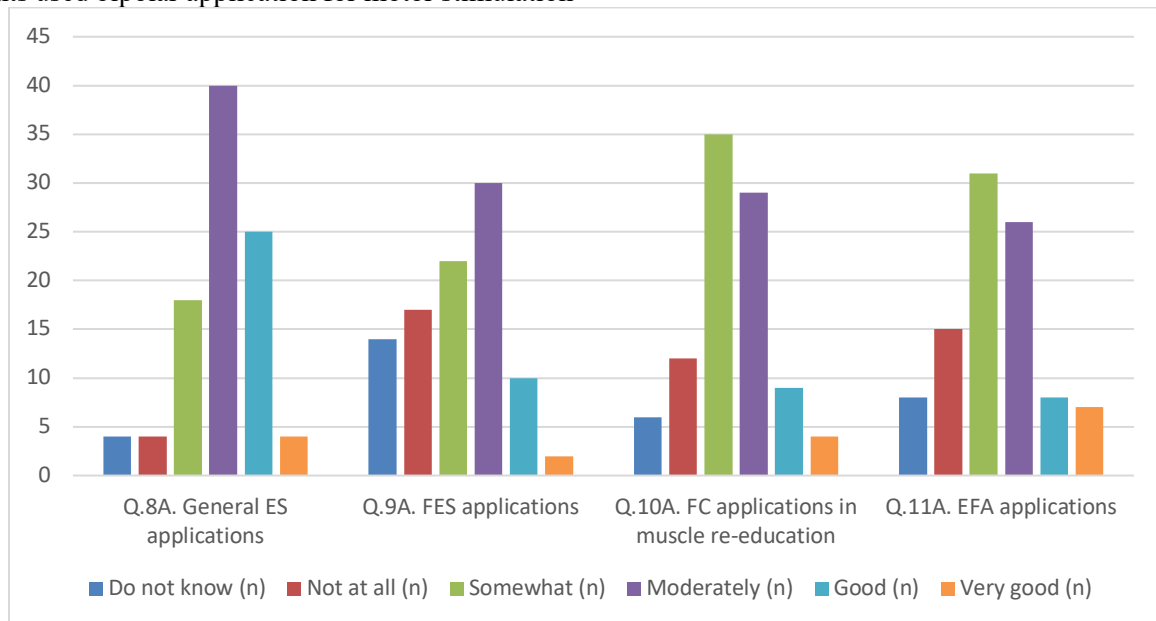


Figure 2. Participants' self-assessment of their skill levels regarding electrical stimulation on different topics

**Table 3.** Participants' skill levels about electrical stimulation

Q.8A. Physiotherapists' level of skill in electrical stimulation applications (self-assessment)					
Do not know n (%)	Not at all n (%)	Somewhat n (%)	Moderately n (%)	Good n (%)	Very good n (%)
4 (4.2)	4 (4.2)	18(18.9)	40 (42.1)	25(26.3)	4 (4.2)
Q.8B. Electrode placement preference of the physiotherapists					
Monopolar n (%)		Bipolar n (%)	Quadripolar n (%)	Under water n (%)	
24 (26.5)		71 (78)	21 (23.1)	4 (4.4)	
Q.9A. Physiotherapists' level of skill in using FES applications (self-assessment)					
Do not know n (%)	Not at all n (%)	Somewhat n (%)	Moderately n (%)	Good n (%)	Very good n (%)
14 (14.7)	17 (17.9)	22(23.2)	30(31.6)	10(10.5)	2(2.1)
Q.9B. Indication preference of FES of the physiotherapists					
Options			n (%)		
Loss of functionality			67 (74.4)		
Loss of muscle functionality			75 (83.3)		
Paralysis			59 (65.6)		
Loss of sensation			20 (22.2)		
Atrophy			47 (52.2)		
Weight loss			4 (4.4)		
Q.10A. Physiotherapists' level of skill in application of 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 (%)
6 (6.3)	12 (12.6)	35(36.8)	29 (30.5)	9(9.5)	4 (4.2)
Q.10B. Electrode type and application position of labile technique					
Options			n (%)		
Pen electrode - 45-degree angle to the skin			16 (19.5)		
Pen electrode - 90-degree angle to the skin			51 (62.2)		
Filet electrode - full contact to the skin			4 (4.9)		
Filet electrode to the motor point of muscle			10 (12.2)		
Filet electrode - under water			1 (1.2)		
Q. 11A. Physiotherapists' level of skill in application of Interferential Current (self-assessment)					
Do not know n (%)	Not at all n (%)	Somewhat n (%)	Moderately n (%)	Good n (%)	Very good n (%)
8 (8.4)	15 (15.8)	31(32.6)	26 (27.4)	8(8.4)	7 (7.4)
Q.11B. Application name and duration before Diadynamic Currents					
Options			n (%)		
After 2 minutes of Basis, 3 minutes of Dosis application			46 (56.8)		
After 5 minutes of Basis, 10 minutes of Dosis application			24 (29.6)		
After 10 minutes of Basis, 20 minutes of Dosis application			6 (7.4)		
After 5 minutes of Dosis, 10 minutes of Basis application			5 (6.2)		
After 10 minutes Dosis, 20 minutes of Basis application			0 (0)		



When Figure 3 is examined, only 9(9.5%) of the participants stated that they had good, 2 (2.1%) very good knowledge in sports traumatology (Q.12A) and 8(8.4%) good or 4 (4.2%) very good in stimulation of healthy muscles with ES (Q.13A), while TENS (42.2%), which is the most commonly used ES method in sports traumatology, was followed by NMES application with a rate of 41.1% (Q.12B). In the pediatric group, FES preference with 22.7% was followed by NMES application and TENS with 17.0% (Q.13B, Table 4).

In the questioning about the level of attitude, 29 of the participants (30.5%) preferred EA or FES application for urinary incontinence problem (Q.14A, Table 5), while in parallel with the general improvement, it was determined that only 4 of the physiotherapists (4.3%) always made current changes and the others either did not do so or made current changes at varying frequencies (Q.14B, Table 5).

While 22 of the participants (23.2%) frequently and only 1 (1.1%) always preferred ES approaches to prevent movement restriction and provide orthotic support (Q.16A, Figure 3), the most preferred current was FES application with 39 participants (44.8%) (Q.16B). While the most commonly used application to increase muscle strength was NMES with 49.5% (47 participants) (Q.17), 26 of the participants (27.4%) stated that they preferred the 50-70 Hz frequency to stimulate fast-twitch muscle fibers after nerve degeneration (Q.18, Table 4). However, it was determined that only 33 (34.7%) participants gave the correct answer to the question of the preferred current to obtain local muscle contraction from DDA with the answer "Rhythm Syncope" (Q.19, Table 5).

Table 4. Participants' management levels regarding electrical stimulation

Q.12A. Level of management about electrical stimulation in sports traumatology (self-assessment)								
Do not know n (%)		Not at all n (%)		Somewhat n (%)		Moderately n (%)		Good n (%)
10 (10.5)		11 (11.6)		32(33.7)		31 (32.6)		9(9.5)
Q.12B. Type of electrical stimulation preference for sports traumatology								
FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)
12 (13.3)	37 (41.1)	29 (32.2)	38 (42.2)	19 (21.1)	23 (25.6)	27 (30)	69 (76.7)	2 (2.2)
Q.13A. Knowledge about electrical stimulation of pediatrics (self-assessment)								
Do not know n (%)		Not at all n (%)		Somewhat n (%)		Moderately n (%)		Good n (%)
7 (7.4)		11 (11.6)		30(31.6)		35 (36.8)		8(8.4)
Q.13B. Type of electrical stimulation preference for pediatrics of the physiotherapists								
FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)
1 (1.1)	15 (17)	7 (8)	15 (17)	7 (8)	13 (14.8)	20 (22.7)	5 (5.7)	3 (3.4)

FC: Faradic Current; NMES: Neuromuscular Electrical Stimulation; HVPGS: High Voltage Pulsed Galvanic 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;

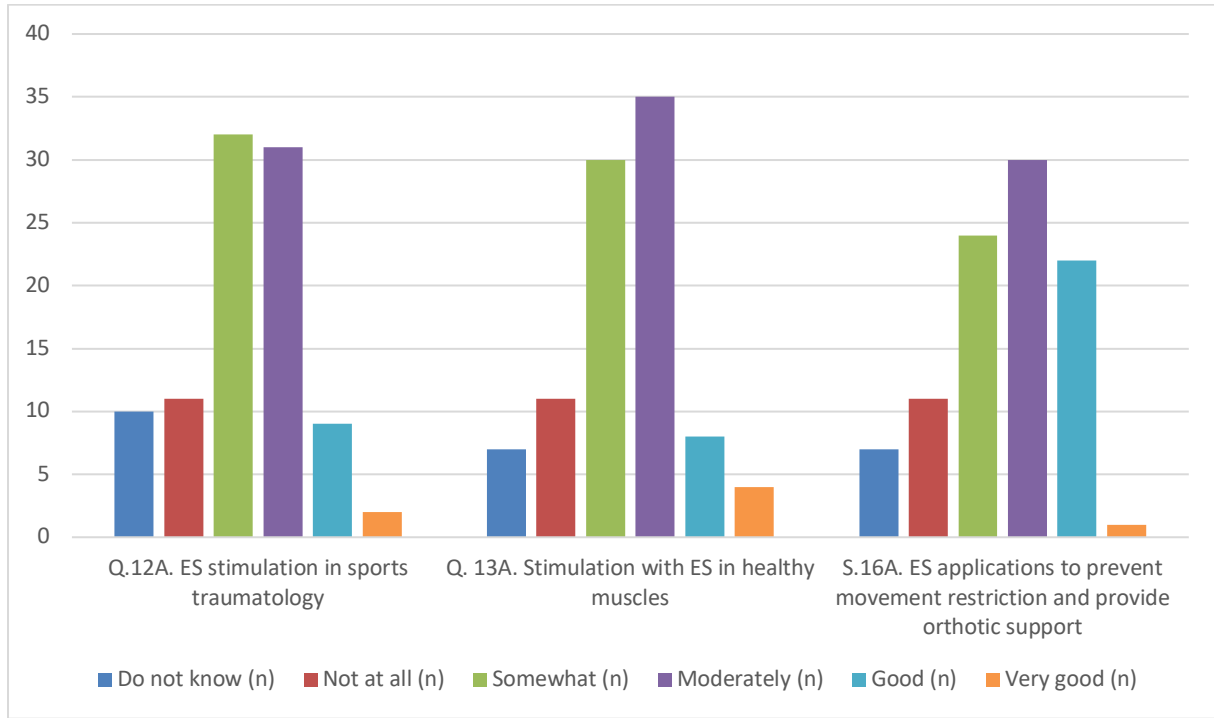


Figure 3. Participants' self-assessment of their management and attitude levels regarding electrical stimulation on different topics

Table 5. Participants' attitudes towards electrical stimulation

Q.14. Type of electrical stimulation preference for urinary problems of the physiotherapists										
FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other(s) (M) n (%)
16 (16.8)	22 (23.2)	11 (11.6)	8 (8.4)	29 (30.5)	19 (20)	29 (30.5)	11 (11.6)	4 (4.2)	8 (8.4)	1 (1.1)
Q.15. Preference of the type of current change parallel with the recovery (self assessment)										
Do not know n (%)		Never n (%)		Rarely n (%)		Sometimes n (%)		Often n (%)		Always n (%)
7 (7.5)		2 (2.26)		14 (15.1)		41 (44.1)		25 (26.9)		4 (4.3)
Q. 16A. Preference of the electrical stimulation to prevent the limitation in range of motion and to provide orthotic support										
Do not know n (%)		Never n (%)		Rarely n (%)		Sometimes n (%)		Often n (%)		Always n (%)
7 (7.4)		11 (11.6)		24 (25.3)		30 (31.6)		22 (23.2)		1 (1.1)
Q.16B. Type of electrical stimulation preference to provide orthotic support of the physiotherapists										
FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other(s) n (%)
3 (3.4)	11 (12.6)	2 (2.3)	7 (8)	4 (4.6)	7 (8)	39 (44.8)	10 (11.5)	1 (1.1)	1 (1.1)	0 (0)
Q.17. Type of electrical stimulation preference to increase muscle strength of the physiotherapists										



FC n (%)	NMES n (%)	HVPGS n (%)	TENS n (%)	IC n (%)	EMS n (%)	FES n (%)	RC n (%)	GC n (%)	DDC n (%)	Other(s) (B) n (%)
26 (27.4)	47 (49.5)	38 (40)	9 (9.5)	17 (17.9)	39 (41.1)	38 (40)	72 (75.8)	10 (10.5)	10 (10.5)	1 (1.1)
Q.18. Physiotherapists' frequency preferences for stimulating fast-twitch muscle fibers after neurodegeneration										
10-30 Hz n (%)		30-50 Hz n (%)		50-70 Hz n (%)		70-90 Hz n (%)		90-110 Hz n (%)		
21 (22.1)		22 (23.2)		26 (27.4)		13 (13.7)		13 (13.7)		
S.19. Physiotherapists' diadynamic current modality preferences for achieving local muscle contraction										
Diphase fixed n (%)		Monophase fixed n (%)		Short period n (%)		Long period n (%)		Rhythm syncope n (%)		
15 (15.8)		22 (23.2)		15 (15.8)		10 (10.5)		33 (34.7)		

FC: Faradic Current; NMES: Neuromuscular Electrical Stimulation; HVPGS: High Voltage Pulsed Galvanic 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;; M: Magnetotherapy; B: Biofeedback

Discussion

ES approaches are widely used in physiotherapy and rehabilitation clinics and research laboratories to treat and/or evaluate a wide range of diseases, signs and symptoms. ES approaches are often performed to relieve pain, stimulate muscles and even help wound healing (19). Various universities and institutes such as PAU, SDÜ, HKMU, BU, MAKÜ, UCV, SVK and THCC have been conducting research in the field of electrotherapy and electrophysics for years. However they have been various training courses and workshops are provided to undergraduate and graduate students and physiotherapists on the use of these agents. However, this information transfer provided by academics at universities can only reach a limited number of physiotherapists working in the field, and the lifelong professional training needs of physiotherapists regarding ES approaches cannot always be met. It is also known that there are regional differences in professional training and information transfer from universities across Europe. Although ES approaches are widely accepted as a method for the treatment of many dysfunctional conditions, their mechanisms of action are not widely agreed upon and are often misunderstood (19). There are many ES approaches in the literature for different purposes. To obtain the best results in physiotherapy and rehabilitation, ES applications should be specific to the disease, findings and symptoms, and sometimes ES parameters should be changed and two or more ES approaches should be used together. The use of ES without considering the necessary parameters may

cause the desired therapeutic effect not to be achieved, even if used at the right time. Therefore, it is essential that ES approaches are applied purposefully and specifically to the disease (18).

Approximately 61 percent of the patient's clinical treatment time can be devoted to ES applications (20). The widespread use of ES is primarily due to its well-documented therapeutic effects (18). Today, ES approaches vary in terms of practical skills. Therefore, it is important for physiotherapists to make evaluations according to their preferences, and as a result, to review their training programs to increase clinical competence, to update their knowledge and to continue their education throughout their professional lives by adding their experiences (21). It is reported that the basic contents on this subject should not be static, absolute or permanent, and should be revised periodically to reflect global trends in health care education (22). However, the large number of old and new ES approaches that have been shown to be effective can make it difficult for physiotherapists to make a choice. As more current and popular applications are adopted and integrated into physiotherapy and rehabilitation programs, ES applications of the past have begun to be used less frequently. As a result of both international and national research, curricula have inevitably been expanded as more up-to-date ES approaches have been included in the curriculum by curriculum planners while trying to preserve basic ES approaches. This may lead to physiotherapists having detailed knowledge about a less commonly used method or not having sufficient knowledge about a more



commonly used ES application (23). According to the knowledge level analysis of our study, it was determined that physiotherapists mostly stated that they had “moderate” level of knowledge regarding the use of ES for healthy muscle, denervated muscle and muscle contraction. The most preferred applications in healthy muscle stimulation were NMES, Russian Current, EMS and FES, respectively. While the majority of the participants (46.30%) stated that they had “moderate” level of knowledge regarding the application of ES approach to provide muscle contraction, all but 15.40% were found to have basic knowledge. However, the percentages of none of the items were at a satisfactory level. Participants preferred muscle stimulation especially to strengthen muscles (77.90%), manage pain (75.80%) and provide more contraction (72.60%). Approximately 30% of the participants stated that they did not have sufficient knowledge about denervated muscle stimulation. When we questioned their preferences regarding denervated muscle contraction, it was determined that the rate of physiotherapists who had knowledge about the correct application was only 16.90%. The majority of participants stated that they had “some” (29.50%) or “moderate” (41.10%) knowledge about upper motor neuron lesions, while the most preferred applications were NMES (53.90%) and FES (42.70%). Significant differences in preferences among participants reveal the need to develop a standard application protocol. A limited percentage of participants stated that they had “moderate” (38.9%), “good” (12.60%) or “very good” (3.20%) knowledge in applications for nerve degeneration. It was noted that 41.80% of participants did not prefer the correct ES applications to support recovery after nerve lesion. This situation shows that the margin of error in ES applications for nerve recovery is quite high. Participants mostly preferred GA (59.10%) to treat denervated muscles, while FA (40.90%), NMES application (28%) or HVPGS (28%) were preferred at lower rates.

Various studies on the general knowledge, skills, attitudes and behaviors of physiotherapists indicate that rehabilitation success cannot be achieved without transforming knowledge into skills (4,18,24). As recorded in our study, the skill level of ES application was at a moderate level. When our results were examined, we

concluded that the participants could correctly adjust the electrode placement for motor point stimulation. However, the fact that 17.90% of the participants did not have knowledge about FES application, 14.70% did not even have awareness of application skills and only 12.60% reported that they were skilled in the subject indicated that increasing training for the development of skill levels is an issue that should be considered. Approximately 55% of the participants reported their skill level as below the “moderate” level in FA and OFA (S10-11). The fact that only 62.20% of the participants answered correctly to the labile technique application position (S10) and 56.80% to the DDA application question (S11) reveals that the error rate in the application may be at a moderate level. ES studies in physiotherapy and rehabilitation in the literature have also used different treatment techniques, different current formats and different patient populations due to their different intensity levels in different situations. Generalizations should be made with caution in these multivariate situations. It is generally accepted that ES can be used as an effective way to increase weakened muscle strength. The characteristics of the current parameters and the application technique are often missing in published articles. Considering the fact that there are many possible combinations of ES current parameters and application techniques for each, physiotherapists need to know which technique is more advantageous under which conditions (25).

ES parameters have a significant impact on the treatment efficacy and changes in these settings can positively or negatively affect any treatment outcome. When the aim is to optimize the effectiveness of the physiotherapy and rehabilitation program, it is not always appropriate to apply the same protocol for all sessions and for each patient. Physiotherapists need to know how each parameter can affect the short- and long-term effectiveness of the treatment (19). It was noted that the lack of self-awareness of physiotherapists regarding the use of ES in different areas was highest in sports traumatology (10.50%) and pediatric rehabilitation (7.40%). It was also concluded that the fact that several questions regarding the preference of ES type were left blank revealed a lack of experience in ES management in pediatric cases. For the level of knowledge on ES approaches in sports



traumatology, only 9.50% of the participants reported “good” and 2.10% reported “very good”, while for ES approaches in pediatric cases, only 8.40% of the participants reported “good” and 4.20% reported “very good” knowledge, which is associated with a very low level of management. These low rates may be explained by the fact that the information learned at the undergraduate level is not up-to-date due to the lack of practice. We also think that there may be a lack of self-awareness regarding the use of electrical stimulation, especially in the field of pediatric rehabilitation.

The professional attitude levels of physiotherapists are affected by different factors (4). The higher the level of education of physiotherapists, especially in ES applications, the higher their level of knowledge, the more positive their attitudes are, the better the prerequisites are and the fewer obstacles they encounter (24). In the Patel study, it was reported that 68% of physiotherapists used electrotherapy+exercise therapy in treatment, 12% used ES only, 38% used ES in the first days of treatment of a patient who had just started rehabilitation, 45% combined ES with exercise application and 20% did not use ES at all. However, it was emphasized that 66% of the participants used ES due to its short-term effects (16). When the attitude levels of physiotherapists towards ES in Turkey were examined, it was observed that the distribution between the preferred ES approaches was very wide. This situation makes standardization difficult in practice. When the questions of “frequency preferences for stimulating fast-twitch muscle fibers after neurodegeneration (Q18)” and “DDA modality preferences for achieving local muscle contraction (Q19)” regarding the effective application of preferred ES approaches were questioned, the percentage of correct answers being below 30% in question 18 and below 20% in question 19 indicates that physiotherapists do not have sufficient attitudes towards ES application in these matters. However, the fact that only approximately 31% of the participants changed the current type in parallel with the recovery suggests that ES is used effectively, for targeted and patient-specific purposes in a limited patient population.

As with other interventions, ES can be prescribed and implemented by physiotherapists who are competent in the use of ES. Although education in ES applications is

provided at the undergraduate level in university, physiotherapists can increase their competence and gain competence in prescribing ES parameters by attending postgraduate training and workshops or through workplace learning (26). Obtaining data on the variety of ES applications in the field of physiotherapy and rehabilitation and in clinics offers the opportunity to develop strategies for the management of undergraduate education curricula of physiotherapists. In addition, open and transparent processes carried out to determine basic knowledge, skills, management and attitude behaviors can guide educators, employers and professional organizations for the lifelong professional education to be provided to graduate physiotherapists (23). Our results will guide the planning of training programs by revealing the deficiencies of physiotherapists in ES application and by displaying the mistakes that can be made in prescribing ES application parameters, in addition to showing that the knowledge, skill, management and attitude levels of physiotherapists are lower than expected.

There are some limitations to our study. First, since the technological concept of the study was not sufficiently explained to our colleagues who have been working in the field for many years and they were not sufficiently encouraged to participate in the study, a grouping could not be made according to the year of study. Therefore, it could not be determined how the levels of knowledge, skills, management and attitudes changed as the years of professional study increased. Second, the majority of our participants worked in the field of general rehabilitation and the number of participants working in specific areas was small. Another limitation of ours is that the survey was an anonymous survey prepared with the joint opinion of the project partners. However, the participation of distinguished faculty members experienced in ES working in Turkey, Romania, Lithuania and Estonia in the process, both in the creation of the project infrastructure and in the preparation of the survey questions, is our strongest aspect. With the support of the Turkish Physiotherapists Association and the participation of researchers from 5 different universities in Turkey, physiotherapists in different cities and institutions across Turkey were reached in a multi-centered manner.

Physiotherapists need to have knowledge and experience



about both the parameters of the currents used for ES and their correct application. The important thing is to adjust the current and parameters in ES application in accordance with the needs of the patient. Our study results indicate that physiotherapists working in Turkey mostly think that they have moderate knowledge and skills in ES application in their self-assessments, but in fact, their awareness on this subject is low and they have limited knowledge and skills, and that management and attitude behaviors in the field of ES need to be developed. We believe that our results will guide the vocational training projects and collaborations to be organized. In conclusion, it should be emphasized that physiotherapists' awareness and knowledge of the methods used in ES applications, their compliance with the guidelines, their knowledge and skills in performing appropriate ES applications in diagnosing and treating disorders and in using ES approaches and parameters, and their attitudes and ethical principles guide them. It was concluded that physiotherapists should update their knowledge about the physiological properties, effects and parameters (methodology) of ES before optimizing and developing the use of ES in clinical practice, thus ensuring their professional competence and development, and adopting the philosophy of lifelong learning.

Supporting Organization: This situation analysis study was carried out within the scope of the project titled “Clinical Key for Electrical Stimulation in Physiotherapy and Rehabilitation (CK4Stim) (Project No: 2021-1-TR01-KA220-VET-000032970)” supported by the Turkish National Agency and the European Union within the scope of Erasmus+Cooperation Partnerships in Vocational Education. The content contained herein reflects the opinions of the authors, and the European Commission and the Turkish National Agency cannot be held responsible for these opinions.

Conflict of Interest: There is no conflict of interest.

Author Contributions: Concept/Concept: NCK; Design: NCK, MD, LG, EI, EDH, ZOY, FNA, BS, FB, VAA, KR, FC, AI, DG, YK, OBBB; Supervision/Consultancy: NCK; Resources and Funding: Turkish National Agency and European Union; Data Collection and/or Processing: NCK, MD, EDH, ZOY, FNA, BS; Analysis and/or Interpretation: NCK, MD; Literature Search: NCK, MD;

Manuscript Writing: NCK, MD; Critical Review: NCK, MD, ZOY, EDH, FNA, BS, YK, FB, FC, AI.

Acknowledgements: We would like to thank the President of the Turkish Physiotherapists Association for the 2022-2024 term, Prof. Dr. Tülin DÜGER, her board of directors, and all participating physiotherapist colleagues.

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