

Electrophysical agents in clinical practice of orthopedic and sports physical therapists in Brazil

Agentes eletrofísicos na prática clínica de fisioterapeutas ortopédicos e esportivos no Brasil

Agentes electrofísicos en la práctica clínica de fisioterapeutas ortopédicos y deportivos en Brasil

Francine Pereira da Silva¹, Lucas Severo-Silveira², Rodrigo Della Múa Plentz³, João Luiz Quagliotti Durigan⁴, Bruno Manfredini Baroni⁵

ABSTRACT | Studies have described the use of electrophysical agents (EPA) by physical therapists worldwide. However, the use of EPA by Brazilian physical therapists remains undetermined. This study aims to describe the availability, use, and perception about EPA by orthopedic and sports physical therapists in Brazil. Professionals of the area were invited to answer an online questionnaire. Demographic data and information regarding the availability, use and perception about EPA in their current clinical practice were asked. Out of 376 physical therapists included in this study, 89% declared to use EPA in clinical practice. Sensory electrotherapy with pulsed current (TENS), therapeutic ultrasound, excitomotor electrotherapy with pulsed current (FES/NMES), and cryotherapy are available for more than 3/4 of interviewees. Scientific articles and clinical experience, respectively, are the most influential factors for the choice of EPA. Ultrasound is the most frequently used EPA, followed by TENS, cryotherapy, photobiomodulation, hot packs, and FES/NMES. The top-five most useful EPA in clinical practice chosen by physical therapists are: (1) ultrasound; (2) photobiomodulation; (3) TENS; (4) cryotherapy; and (5) FES/NMES. In conclusion, EPA are widely used by orthopedic and sports physical therapists in Brazil. Therapeutic ultrasound, TENS, FES/NMES, photobiomodulation, cryotherapy, and hot packs are the most used EPA in clinical practice of these physiotherapists.

Keywords | Physical Therapy; Electric Stimulation Therapy; Ultrasonic Therapy; Cryotherapy.

RESUMO | Estudos têm descrito a utilização de agentes eletrofísicos (AE) por fisioterapeutas ao redor do mundo. No entanto, o uso de AE por fisioterapeutas brasileiros permanece inexplorado. O objetivo deste estudo é descrever o acesso, a utilização e a percepção sobre os AE de fisioterapeutas ortopédicos e esportivos no Brasil. Os profissionais foram convidados a responder um questionário on-line. Foram solicitados dados demográficos e informações sobre o acesso, utilização e percepção dos profissionais sobre os AE na prática clínica. Dentre os 376 fisioterapeutas incluídos, 89% declararam ser usuários de AE na prática clínica. Eletroterapia sensorial com corrente pulsada (TENS), ultrassom terapêutico, eletroterapia excitomotora com corrente pulsada (FES/NMES) e crioterapia são acessíveis para mais de 3/4 dos participantes. Artigos científicos e experiência clínica são os fatores de maior influência na escolha por AE. O ultrassom é o AE mais frequentemente utilizado, seguido por Tens, crioterapia, fotobiomodulação, bolsas quentes e FES/NMES. Os cinco AE elencados pelos fisioterapeutas como mais úteis na prática clínica são: (1) ultrassom; (2) fotobiomodulação; (3) TENS; (4) crioterapia; e (5) FES/NMES. Em conclusão, os AE são largamente usados pelos

Study conducted at Federal University of Health Sciences of Porto Alegre (UFCSA), Porto Alegre (RS), Brazil.

¹Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSA) – Porto Alegre (RS), Brazil. E-mail: franh.pereira@hotmail.com. Orcid: 0000-0002-1311-1864

²Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSA) – Porto Alegre (RS), Brazil. E-mail: severo.fisio@gmail.com. Orcid: 0000-0002-5517-0053

³Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSA) – Porto Alegre (RS), Brazil. E-mail: roplentz@yahoo.com.br. Orcid: 0000-0002-2662-8192

⁴Universidade de Brasília (UnB) – Brasília (DF), Brazil. E-mail: joaodurigan@gmail.com. Orcid: 0000-0002-7511-5289

⁵Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSA) – Porto Alegre (RS), Brazil. E-mail: bmbaroni@yahoo.com.br. Orcid: 0000-0002-8669-5565

Corresponding address: Bruno Manfredini Baroni – Rua Sarmento Leite, 245 – Porto Alegre (RS), Brazil – Zip Code: 90050-170 – E-mail: bmbaroni@yahoo.com.br – Financing source: nothing to declare – Conflict of interests: nothing to declare – Presentation: June 3rd, 2019 – Accepted for publication: Apr 28th, 2020 – Approved by the Research Ethics Committee of the Universidade Federal de Ciências da Saúde de Porto Alegre under Protocol No. 1,197,677.

fisioterapeutas ortopédicos e esportivos no Brasil. Ultrassom terapêutico, TENS, FES/NMES, fotobiomodulação, crioterapia e bolsas quentes são os AE mais usados na prática clínica desses fisioterapeutas.

Descritores | Fisioterapia; Terapia por Estimulação Elétrica; Terapia por Ultrassom; Crioterapia.

RESUMEN | Los estudios ya han descrito el uso de agentes electrofísicos (AE) por fisioterapeutas en todo el mundo. Todavía no se ha explorado el uso de los AE por fisioterapeutas brasileños. El presente estudio tuvo como objetivo describir el acceso, el uso y la percepción sobre los AE por fisioterapeutas ortopédicos y deportivos en Brasil. Se invitó a los profesionales para responder a un cuestionario en línea. Se solicitaron los datos demográficos e informaciones sobre el acceso, el uso y la percepción de profesionales sobre los AE en la práctica clínica. Entre los 376 fisioterapeutas

incluidos, el 89% declararon utilizar los AE en la práctica clínica. La electroterapia sensorial con corriente pulsada (TENS), el ultrasonido terapéutico, la electroterapia excitomotora con corriente pulsada (FES/NMES) y la crioterapia son accesibles para más de 3/4 de los participantes. Los artículos científicos y la experiencia clínica son los factores que más influyeron en la elección de los AE. El ultrasonido es el AE más utilizado, seguido de Tens, crioterapia, fotobiomodulación, bolsas calientes y FES/NMES. Los cinco AE más útiles en la práctica clínica enumerados por los fisioterapeutas fueron: (1) ultrasonido; (2) fotobiomodulación; (3) TENS; (4) crioterapia; y (5) FES/NMES. Los AE son ampliamente utilizados por los profesionales de la ortopedia y el deporte en Brasil. El ultrasonido terapéutico, TENS, FES/NMES, fotobiomodulación, crioterapia y bolsas calientes son los AE más utilizados en la práctica clínica por estos fisioterapeutas.

Palabras clave | Terapia por Estimulación Eléctrica; Electroterapia; Terapia por Ultrasonido; Crioterapia.

INTRODUCTION

According to the World Confederation for Physical Therapy (WCPT), “electrophysical agents” (EPA) is the contemporary expression to describe the use of electrophysical and biophysical energies to evaluate, to treat and to prevent impairments, activity limitations, and participation restrictions¹. Physical therapists have used electrical, electromagnetic, mechanical, thermal, and light energy sources to promote biophysical effects on cells, tissues, and organs in order to generate physiological and therapeutic effects for optimization of health for several decades (or centuries, in some cases)²⁻⁴. However, EPA remain an adjunct treatment within physical therapists’ multimodal approach^{5,6}. In face of scientific and technological advances, novel devices have emerged and new applications for traditional techniques have been tested⁶. Therefore, teaching EPA in physical therapy courses must evolve constantly^{7,8} and should be guided by scientific evidence, availability of equipment in the market, and physical therapists’ preferences.

Since the 1990s, studies have been conducted to describe the availability and use of EPA by physical therapists in different countries, such as Australia⁹⁻¹¹, the United States of America^{12,13}, Canada¹⁴, England¹⁵, Ireland¹⁶, Israel¹⁷, and Japan¹⁸. After extensive review of studies published between 1990 and 2010, Shah & Farrow¹⁹ concluded that the use of EPA underwent

significant changes throughout that period. According to studies published in the last decade^{11,13,17,18}, therapeutic ultrasound, sensory electrotherapy with pulsed current (popularly known as TENS – transcutaneous electrical nerve stimulation), hot packs and cryotherapy are the EPA most commonly used by physical therapists. The therapeutic arsenal of physical therapists also includes: excitomotor pulsed currents, commonly known as FES (functional electrical stimulation) or NMES (neuromuscular electrical stimulation); alternating currents (e.g., interferential current and Russian current); direct current (galvanic current); short-wave diathermy; microwave diathermy; photobiomodulation/phototherapy with light amplification by stimulated emission of radiation (LASER) and/or light emitting diode (LED); and biofeedback, among others^{11,13,17,18}.

Information regarding the availability and use of EPA by physical therapists have been provided by studies conducted in Oceania⁹⁻¹¹, North America¹²⁻¹⁴, Europe^{15,16}, and Asia^{17,18}. Since physical therapists working in different countries have specific trends in the use of EPA¹⁹, previous findings do not represent the Brazilian scenario, a country with around 240,000 of these professionals²⁰. Moreover, physical therapy comprises a range of clinical specialties meeting the needs of different groups of patients, and professionals present a selectivity of EPA according to their specialty (e.g., musculoskeletal, neurological, or cardiorespiratory rehabilitation). Many Brazilian physical therapists are involved with rehabilitation of

musculoskeletal disorders, but their usage profile of EPA remains unknown. Therefore, this study aims to describe the availability, use and perception about EPA by orthopedic and sports physical therapists in Brazil.

METHODOLOGY

Study design

In this cross-sectional study, participants answered an online questionnaire on the availability, use and perception about EPA. All participants agreed to participate, signing an online consent term.

Participants

Announcements were posted on social networks linked to physical therapy in Brazil, inviting physical therapists to access the online survey-website and to respond the questionnaire. Professionals working anywhere in Brazil and without specialty-related restriction were accepted in this phase. Then, only professionals who declared to work in orthopedic and/or sports physical therapy were considered for analysis, regardless of the facilities where they provided the service (e.g., office, clinic, ambulatory, hospital, sports club, etc.).

Survey

A draft questionnaire was created using models provided by studies on the use of EPA published in the last decade^{11,13,17,18}. Three physical therapists with PhD degree, researchers in the field of EPA, and involved with teaching EPA in universities throughout Brazil, reviewed the draft questionnaire for content validity and also to address potential differences in nomenclature for Portuguese language. The online version of the final questionnaire was available in the Google Forms website (<https://www.google.com/forms/about/>).

The online questionnaire had two phases. The first phase comprised demographic data: gender, age, location (state), type of university where they attended the physical therapy graduation (public or private), graduation year, highest academic degree, daily workload (in hours), and occupation area (e.g., orthopedic physical therapy, sports physical therapy). The last question in that phase was: "Do you use EPA in your clinical practice?" When participant answered "NO," the survey was finished; and

they advanced to the next phase when the answer was "YES." In the second phase, the following multiple choice questions were asked for interviewees:

- 1) "*What EPA are available at your workplace?*" – Participants were free to mark as many options as they preferred, including: therapeutic ultrasound, direct current (galvanic), sensory electrotherapy with pulsed current (TENS), excitomotor electrotherapy with pulsed current (FES/NMES), interferential current, Russian current, photobiomodulation (LASER/LED), cryotherapy, hot packs, infrared lamp, ultraviolet lamp, microwave diathermy, short-wave diathermy, biofeedback, others (participant was asked to describe).
- 2) "*How do the factors listed below influence the choice of EPA in your clinical practice?*" – Participants were asked to mark one of the possible answers (i.e., large influence; medium influence; little influence; or no influence) for each of the following factors: scientific articles; books; websites; undergraduate classes; courses/events; clinical experience; contact with colleagues; patient's preference.
- 3) "*What is the approximate percentage of patients that you use each EPA?*" – Participants should mark one of the following answers for each EPA: I use it with all my patients; I use it with more than 75% of my patients; I use it with about 50-75% of my patients; I use it with about 25-50% of my patients; I use it with less than 25% of my patients; or I do not use it with my patients.
- 4) "*Classify (in order of relevance) the five EPA you consider most useful in clinical practice.*" – Participants were asked to mark their opinion from the first to the fifth most useful EPA.

According to our pilot studies, participants did not need more than 10 minutes to complete the questionnaire. The survey disclosure and the availability of the online questionnaire for those interested in participating were maintained for a period of six months (March to August 2016). At the end of this period, the questionnaire was deactivated, and data were then extracted for analysis.

Statistical analysis

Absolute and percentage distributions were assessed in each question. For the question that asked participants to list the five most useful EPA in the physical therapists' clinical practice, we adopted the following scale: 5 points

attributed to EPA listed in the first place; 4 points for the EPA listed in second; 3 points for the third; 2 points for the fourth; and 1 point for the fifth. The points obtained by each EPA were summed and the five highest scores were presented in the results.

RESULTS

In total, 460 physical therapists answered the online questionnaire. A total of 84 participants were excluded from data analysis for not meeting the inclusion criteria regarding the occupation area (i.e., orthopedic and/or sports physical therapy) or due to mistakes identified in filling out the questionnaire. Table 1 presents the characteristics of the 376 physical therapists included in the study.

Table 1. Characteristics of the participants

	N	%
Age		
20-29 years	169	44.95
30-39 years	147	39.10
40-49 years	46	12.23
≥50 years	14	3.72
Location		
Southeast	164	43.62
South	152	40.43
Northeast	39	10.37
Midwest	13	3.46
North	8	2.13
Experience as physical therapist		
Up to 5 years	137	36.44
6 to 10 years	108	28.72
11 to 15 years	62	16.49
15 to 20 years	39	10.37
>20 years	30	7.98
Highest academic degree		
Undergraduate course	106	28.19
Specialization / Residence	199	52.93
Master's degree	52	13.83
PhD	19	5.05
Daily workload as physical therapist		
1 to 4 hours	40	10.64
5 to 8 hours	165	43.88
9 to 12 hours	171	45.48
Current occupation area		
Orthopedic Physical Therapy	217	57.71
Sports Physical Therapy	21	5.59
Orthopedics + Sports Physical Therapy	138	36.70
Use of EPA in clinical practice		
Yes	336	89.36
No	40	10.64

N: number of physical therapists; %: percent value (total: 376 participants).

A total of 336 physical therapists (89% of respondents) reported using EPA in their clinical practice. Figures 1 to 4 present the results for these 336 professionals. TENS, ultrasound, FES/NMES, and cryotherapy were available for more than 3/4 of interviewees, followed by LASER/LED and hot packs (Figure 1). Information from scientific articles and clinical experience were considered factors with large influence on the EPA choice by 71% and 64% of physical therapists, respectively; whereas website information and patient's preference were the least relevant factors (Figure 2).

Therapeutic ultrasound was used in more than half of their patients by 61% of the respondents, followed by TENS (54%), cryotherapy (50%), LASER/LED (46%), hot packs (31%), and FES/NMES (31%), as illustrated in Figure 3. In the elected top-five EPA for clinical practice (Figure 4), the physical therapists' votes established the following ranking: (1) ultrasound; (2) LASER/LED; (3) TENS; (4) cryotherapy; and (5) FES/NMES.

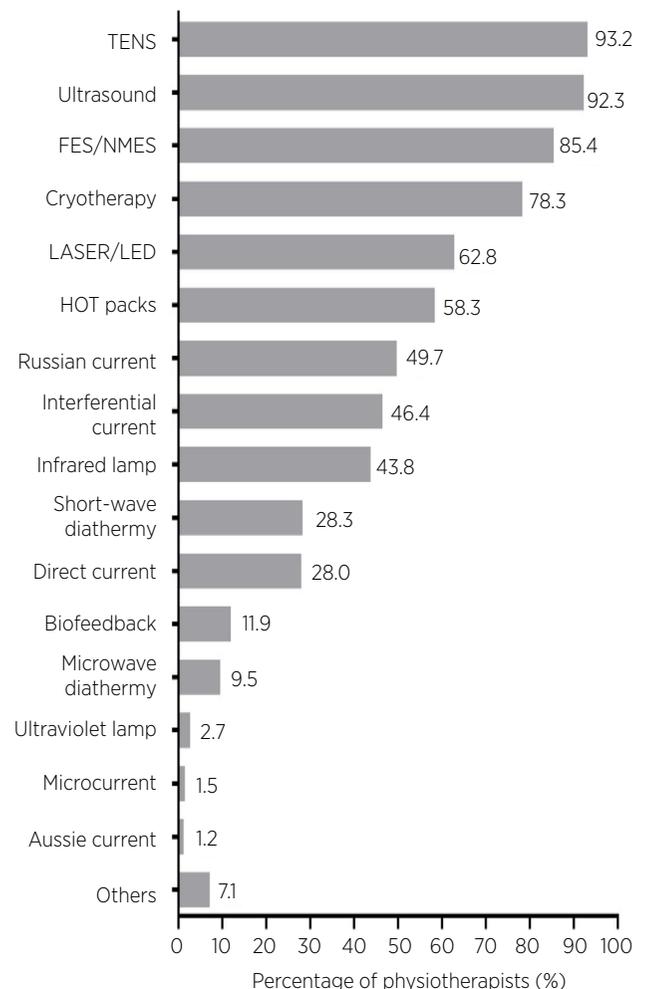


Figure 1. Availability of electrophysical agents at the physical therapists' workplaces

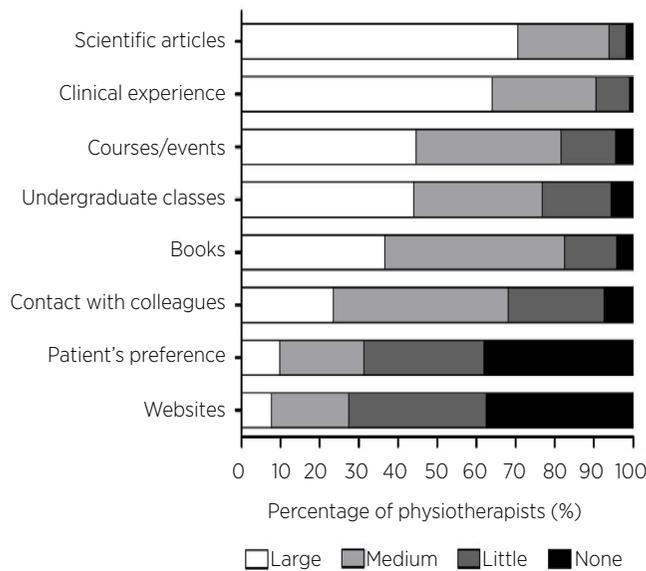


Figure 2. Influence of choice-factors for electrophysical agents by physical therapists

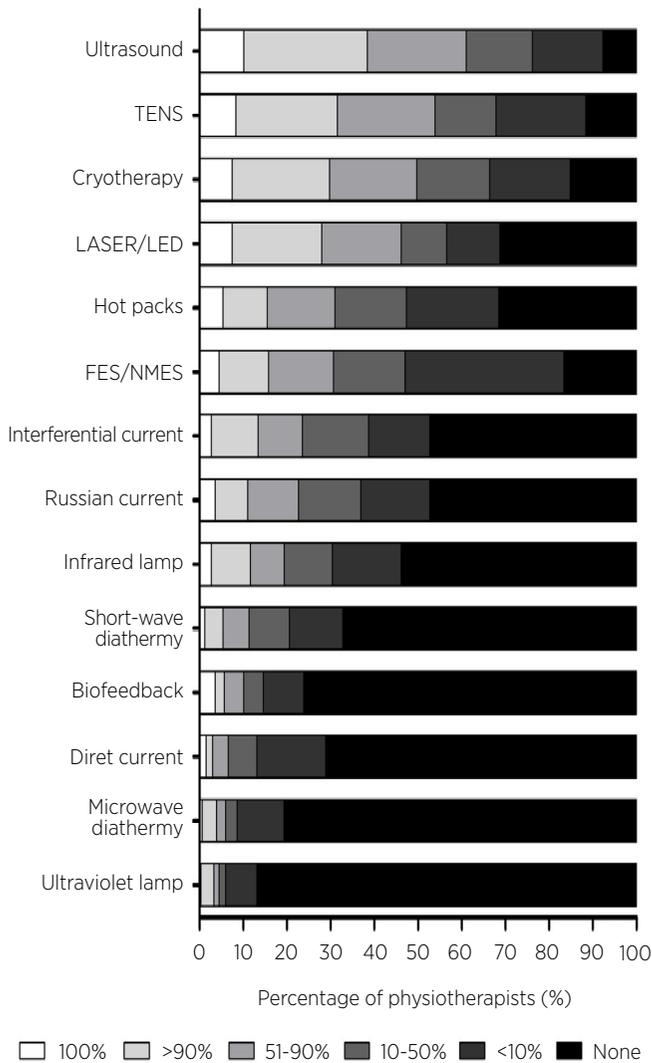


Figure 3. Percentage of patients treated with each electrophysical agent by physical therapists

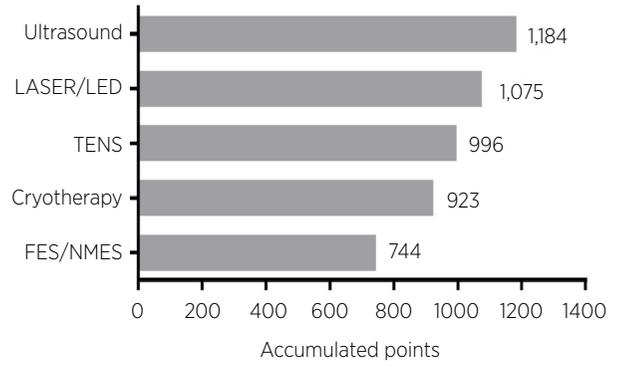


Figure 4. Top-five electrophysical agents elected by physical therapists as the most useful in clinical practice

DISCUSSION

To the best of our knowledge, this is the first study to describe the use profile of EPA by Brazilian physical therapists. Our main findings were: (1) EPA are widely used by orthopedic and sports physical therapists in Brazil; (2) ultrasound therapy, sensory (TENS) and excitomotor (FES/NMES) electrotherapy with pulsed currents, photobiomodulation (LASER / LED), cryotherapy, and hot packs are the most commonly available and used EPA; and (3) scientific articles and clinical experience are the most influential factors in choosing the EPA.

Physical therapy was recognized as profession in Brazil at 1969, and the scientific/technological progress regarding EPA has been important along these 50 years. Interestingly, approximately 45% of respondents in our study were younger than 30 years old, and almost 2/3 hold their undergraduate degrees in the last decade. The young profile of most participants may be related to the preferences reported in this study. Note that our study assessed only professionals who declared work in orthopedic and/or sports physical therapy, unlike the studies published in the last decade that investigated physical therapists from mixed areas^{11,13,17,18}. Moreover, physical therapy courses are not uniform worldwide. In Brazil, physical therapy is an undergraduate program carried out on a university basis of 4 to 5 years, whereas in some developed countries, physical therapists are trained in 2-3-year courses based on a technical program²¹. These distinct educational processes and other specificities of the profession in each country may influence the decision-making of physical therapists regarding the EPA. All aforementioned factors should be considered when interpreting our results and comparing them with previous studies in this field.

Ultrasound, TENS, cryotherapy, and hot packs are the most frequently available EPA worldwide^{11,13,17,18}, including Brazil (see Figure 1). As observed in our study, FES/NMES is also highly accessible to physical therapists in the USA¹³ and Israel¹⁷; at the same time, this EPA was found only in about 30-40% of physical therapy services in Australia¹¹ and Japan¹⁸. However, the most noticeable difference between Brazilian physical therapists and professionals from other countries seems to be related to photobiomodulation. While LASER/LED devices were present in 63% of work environments in Brazil (see Figure 1), only 12-30% of physical therapists in other countries have access to this EPA^{11,13,17,18}. The high availability of LASER/LED in Brazil does not seem to be related to costs, since photobiomodulation devices usually are more expensive than most EPA listed in our study. Also, this is not related to the type of equipment commercially available, since the Brazilian regulatory agency (Agência Nacional de Vigilância Sanitária – ANVISA) imposes similar restrictions as agencies from developed countries (e.g., Food and Drug Administration – FDA). Perhaps, the fact that Brazil is one of the world's greatest powers regarding scientific research output on LASER/LED applied to physical therapy is related to the popularity of this EPA among Brazilian physical therapists.

Evidence-based practice (EBP) has been increasingly recognized and used by physical therapists due to the increasing volume and accessibility of high-quality research²¹. The three pillars of EBP are the best scientific evidence, clinical expertise, and patient values²². A previous study found that 67% of the Brazilian interviewed physical therapists agreed that EBP is important for their clinical practice, and 90% of those professionals declared reading articles routinely²¹. This appreciation of the scientific evidence by Brazilian physical therapists is supported by our findings, which indicated to scientific articles as the main influence in the decision-making process on the usage of EPA (see Figure 2). Although clinical experience has been identified as the second most influential factor in the choice of EPA, the third pillar of EBP (i.e., patient values) was clearly devalued by Brazilian physical therapists. Similar results have been reported by Israeli physical therapists¹⁷, suggesting that in different countries patient's preference does not seem to be a key factor for the physical therapists' decision-making. These findings put in stake the actual level of knowledge about EBP by physical therapists.

The availability of EPA may be related to the frequency of use, but this association was not a common result

in previous studies^{10,11,13,15,17}. For instance, Robertson and Spurrirt¹⁰ observed that short-wave diathermy was extremely common in the 1990s, but it was not frequently used by Australian physical therapists. On the other hand, Greco et al.¹³ found that only approximately 10% of respondents had access to photobiomodulation devices in their workplaces, but when accessible this EPA was used by approximately 82% of physical therapists. Moreover, few EPA may not be available in the workplace, but physical therapists may recommend its use at the patients' home, such as hot or cold packs¹¹. However, in our study, the EPA most commonly available to physical therapists at their workplaces coincided with those most frequently used for treating patients: ultrasound, TENS, cryotherapy, LASER/LED, hot packs, and FES/NMES (see Figure 3). This use rate corroborates the EPA chosen by Brazilian physical therapists as the most useful in clinical practice: (1) ultrasound; (2) LASER/LED; (3) TENS; (4) cryotherapy; and (5) FES/NMES (see Figure 4). In other words, there is a congruence between the most commonly available EPA in the physical therapists' care settings, the EPA that professionals use commonly, and EPA to which they attribute higher value to treat their patients.

Ultrasound therapy, sensory electrotherapy (TENS), hot packs and cryotherapy are among the most commonly used EPA by physical therapists from different countries^{11,13,17,18}. Ultrasound²³ and TENS²⁴ have proven to be beneficial for a few patients, but both therapies seem not to be effective for rehabilitation in a range of musculoskeletal disorders²⁵⁻³⁰. At the same time, the therapeutic value of superficial cooling and heating modalities remains unclear³¹, and there is even a trend against the use of icing in musculoskeletal rehabilitation³². Therefore, physical therapists' choice of the most used EPA in clinical practice is probably related to other factors, such as their personal experience. Findings from Greco et al.¹³, suggest that physical therapists who had access to EPA and with more than 10 years of experience were more likely to select "prior positive experience with the EPA" as a rationale for usage.

Interestingly, physical therapists from Australia¹¹, Israel,¹⁷ and Japan¹⁸ have shown appreciation for the interferential current therapy, while this EPA is not used by almost half of the Brazilian physical therapists assessed in this study. There is also a reduced number of Brazilian physical therapists who use microwave and short-wave diathermy. These EPA were part of the routine of most English physical therapists assessed by Pope, Mockett and Wright¹⁵ during the 1990's (around 84% and 97% of

professionals, respectively). However, the lack of research on both microwave and short-wave diathermy seems to have been followed by the skepticism of clinicians, leading these EPA to a progressive decline within the physical therapy practice¹⁹. On the other hand, the use of photobiomodulation with LASER/LED in Brazil seems to be growing over the years, which is probably related to the favorable reports on treatment of several disorders, including tissue regeneration³³, analgesic,³⁴ and anti-inflammatory³⁵ actions.

Studies regarding the application of EPA by physical therapists from different countries have had widely dispersed sample sizes, ranging between 46¹⁶ and 3,538¹¹ participants. The 376 participants in our study cannot be considered a faithful representation of the large population of Brazilian physical therapists, but our sample size is higher than most studies in this topic worldwide^{9,10,13-17}. Furthermore, note that 84% of respondents worked in South and Southeast regions of Brazil. According to data from the regional councils, these two regions host almost 170,000 physical therapists (i.e., approximately 70% of Brazilian physical therapists); thus, a predominance of participants from South and Southeast of Brazil was expected. However, this irregular geographic distribution may be considered a confounding factor in our study, since we cannot exclude the possibility of specific regional characteristics in the use of EPA.

CONCLUSION

EPA are widely used by orthopedic and sports physical therapists in Brazil who responded to this survey. Therapeutic ultrasound, sensory and excitomotor electrotherapy with pulsed currents, photobiomodulation, cryotherapy, and hot packs are the most used EPA. Physical therapists affirm that their choice of EPA is mainly based on scientific articles and their clinical experience.

REFERENCES

- World Confederation for Physical Therapy subgroups. International Society for Electrophysical Agents in Physical Therapy (ISEAPT) [Internet]. Milwaukee: Marquette University; 2017 [cited 2017 Oct 13]. Available from: <http://www.wcpt.org/iseapt>
- Canadian Physiotherapy Association. Electrophysical Agents: contraindications and precautions: an evidence-based approach to clinical decision making in physical therapy. *Physiother Can.* 2010;62(5):1-80. doi: 10.3138/ptc.62.5
- Cameron M. Physical agents in rehabilitation: from research to practice. Sant Louis: Elsevier; 2003.
- Robertson VJ, Chipchase L, Laakso E, Whelan K, McKenna, L. Guidelines for the clinical use of electrophysical agents. Melbourne: Australian Physiotherapy Association; 2001.
- Watson T. The role of electrotherapy in contemporary physiotherapy practice. *Man Ther.* 2000;5(3):132-41. doi: 10.1054/math.2000.0363
- Chipchase L. Is there a future for electrophysical agents in musculoskeletal physiotherapy? *Man Ther.* 2012;17(4):265-6. doi: 10.1016/j.math.2012.04.001
- Crosbie J, Gass E, Jull G, Morris M, Rivett D, Ruston S, et al. Sustainable undergraduate education and professional competency. *Aust J Physiother.* 2002;48(1):5-7. doi: 10.1016/S0004-9514(14)60276-2
- Laakso EL, Robertson VJ, Chipchase LS. The place of electrophysical agents in Australian and New Zealand entry-level curricula: is there evidence for their inclusion? *Aust J Physiother.* 2002;48(4):251-4. doi: 10.1016/S0004-9514(14)60164-1
- Lindsay D, Dearness J, Richardson C, Chapman A, Cuskelly G. A survey of electromodality usage in private physiotherapy practices. *Aust J Physiother.* 1990;36(4):249-6. doi: 10.1016/S0004-9514(14)60527-4
- Robertson VJ, Spurr D. Electrophysical agents: implications of their availability and use in undergraduate clinical placements. *Physiotherapy.* 1998;84(7):335-44. doi: 10.1016/S0031-9406(05)63462-1
- Chipchase L, Williams MT, Robertson V. A national study of the availability and use of electrophysical agents by Australian physiotherapists. *Physiother Theor Pract.* 2009;25(4):279-6. doi: 10.1080/09593980902782611
- Taylor E, Humphry R. Survey of physical agent modality use. *Am J Occup Ther.* 1991;45(10):924-31. doi: 10.5014/ajot.45.10.924
- Greco J, Lamberg EM, McKenna RF, Muratori LM. Trends in availability and usage of biophysical agents among physical therapists in the United States. *Phys Ther Rev.* 2018;23(2):116-23. doi: 10.1080/10833196.2018.1449921
- Lindsay D, Dearness J, McGinley C. Electrotherapy usage trends in private physiotherapy practice in Alberta. *Physiother Can.* 1995;47(1):30-4.
- Pope GD, Mockett SP, Wright JP. A survey of electrotherapeutic modalities: ownership and use in the NHS in England. *Physiotherapy.* 1995;81(2):82-91. doi: 10.1016/S0031-9406(05)67050-2
- Cooney M, Gallen C, Mullins G. A survey of ownership and use of electrotherapeutic modalities in public outpatient departments and private practice in the Republic of Ireland. *Physiother Irel.* 2000;21:3-8.
- Springer S, Laufer Y, Elboim-Gabyzon M. Clinical decision making for using electro-physical agents by physiotherapists, an Israeli survey. *Isr J Health Policy Res.* 2015;4:14-9. doi: 10.1186/s13584-015-0015-x
- Abe Y, Goh A, Kei Miyoshi K. Availability, usage, and factors affecting usage of electrophysical agents by physical therapists: a regional cross-sectional survey. *J Phys Ther Sci.* 2016;28(11):3088-94. doi: 10.1589/jpts.28.3088

19. Shah SGS, Farrow A. Trends in the availability and usage of electrophysical agents in physiotherapy practices from 1990 to 2010: a review. *Phys Ther Rev.* 2012;17(4):207-26. doi: 10.1179/1743288X12Y.0000000007
20. CoFFiTO-Conselho Federal de Fisioterapia e Terapia Ocupacional. Perguntas mais frequentes: quantitativo de profissionais [Internet]. Brasília, DF: Coffito, 2018 [cited 2019 Jan 20]. Available from: <http://www.coffito.gov.br>
21. Silva TM, Costa LC, Garcia AN, Costa LO. What do physical therapists think about evidence-based practice? A systematic review. *Man Ther.* 2015;20(3):388-401. doi: 10.1016/j.math.2014.10.009
22. Herbert R, Jamtvedt G, Hagen KB, Mead J. Practical evidence-based physiotherapy. 2nd ed. Oxford: Elsevier, 2011.
23. Wu Y, Zhu S, Lv Z, Kan S, Wu Q, Song W, et al. Effects of therapeutic ultrasound for knee osteoarthritis: a systematic review and meta-analysis. *Clin Rehabil.* 2019;33(12):1863-75. doi: 10.1177/0269215519866494
24. Zhu Y, Feng Y, Peng L. Effect of transcutaneous electrical nerve stimulation for pain control after total knee arthroplasty: a systematic review and meta-analysis. *J Rehabil Med.* 2017;49(9):700-4. doi: 10.2340/16501977-2273
25. Griffin XL, Parsons N, Costa ML, Metcalfe D. Ultrasound and shockwave therapy for acute fractures in adults. *Cochrane Database Syst Rev.* 2014;23(6):CD008579. doi: 10.1002/14651858.CD008579.pub3
26. Ebadi S, Henschke N, Nakhostin Ansari N, Fallah E, van Tulder MW. Therapeutic ultrasound for chronic low-back pain. *Cochrane Database Syst Rev.* 2014;(3):CD009169. doi: 10.1002/14651858.CD009169.pub2
27. Brosseau L, Casimiro L, Welch V, Milne S, Shea B, Judd M, et al. WITHDRAWN: Therapeutic ultrasound for treating patellofemoral pain syndrome. *Cochrane Database Syst Rev.* 2013;(2):CD003375. doi: 10.1002/14651858.CD003375.pub2
28. Gibson W, Wand BM, O'Connell NE. Transcutaneous electrical nerve stimulation (TENS) for neuropathic pain in adults. *Cochrane Database Syst Rev.* 2017;(9):CD011976. doi: 10.1002/14651858.CD011976.pub2
29. Khadilkar A, Odebiyi DO, Brosseau L, Wells GA. Transcutaneous electrical nerve stimulation (TENS) versus placebo for chronic low-back pain. *Cochrane Database Syst Rev.* 2008;(4):CD003008. doi: 10.1002/14651858.CD003008.pub3
30. Gibson W, Wand BM, Meads C, Catley MJ, O'Connell NE. Transcutaneous electrical nerve stimulation (TENS) for chronic pain – an overview of Cochrane Reviews. *Cochrane Database Syst Rev.* 2019;2019(4):CD011890. doi: 10.1002/14651858.CD011890.pub3
31. French SD, Cameron M, Walker BF, Reggars JW, Esterman AJ. Superficial heat or cold for low back pain. *Cochrane Database Syst Rev.* 2006;(1):CD004750. doi: 10.1002/14651858.CD004750.pub2
32. Dubois B, Esculier JF. Soft-tissue injuries simply need PEACE and LOVE. *Br J Sports Med.* 2019;54(2):72-3. doi: 10.1136/bjsports-2019-101253
33. Alves AN, Fernandes KP, Deana AM, Bussadori SK, Mesquita-Ferrari RA. Effects of low-level laser therapy on skeletal muscle repair: a systematic review. *Am J Phys Med Rehabil.* 2014;93(12):1073-85. doi: 10.1097/PHM.0000000000000158
34. Chow RT, Johnson MI, Lopes-Martins RA, Bjordal JM. Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomised placebo or active-treatment controlled trials. *Lancet.* 2009;374(9705):1897-908. doi: 10.1016/S0140-6736(09)61522-1
35. Yamaura M, Yao M, Yaroslavsky I, Cohen R, Smotrich M, Kochevar IE. Low level light effects on inflammatory cytokine production by rheumatoid arthritis synoviocytes. *Lasers Surg Med.* 2009;41(4):282-90. doi: 10.1002/lsm.20766