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Availability and Usage of Electrophysical Agents by Portuguese Physiotherapists: an online Survey
Disponibilidad y uso de agentes electrofísicos por los fisioterapeutas portugueses: cuestionario online

Manuel Paquete, Pedro Harry-Leite, Diana Bernardo, Luís Moreira
Instituto Piaget Vila Nova de Gaia (Portugal)

Abstract. Objective: The aim of this study is to describe the availability and usage of Electrophysical Agents (EPAs) by Portuguese Physiotherapists (PTs), and identify factors affecting its' usage, such as PTs expertise, setting and autonomy.
Methods: A cross-sectional study was carried out between July and September 2018. Physiotherapists currently practicing in Portugal were invited to complete an online survey. The online survey included questions regarding the participants' practice, such as years of experience, rehabilitation autonomy, number of clients per hour, context and availability and use of EPAs. Results: From a total of 544 PTs that responded to the survey, 424 (78 %) used EPAs on their daily practice. The most common available EPAs are Transcutaneous Eletrical Nerve Stimulation (99%) and Ultasound (91%). When available, more than 80% of the participants reported using the different EPAs at least one time. All participants reported using the different EPAs more than 80%, when they are available. PTs expertise does not influence the selection of EPAs however, the autonomy and setting influenced the selection of almost of the different EPAs. Discussion: EPAs are commonly available and generally used by Portuguese PTs. PTs that works autonomously tend to use less EPAs. The EPAs selection seems to be dependent on the setting, number of clients per hour and autonomy.
Keywords: Electrophysical agents, Physiotherapy, usage, availability; TENS; US

Resumen. Objetivo: El objetivo de este estudio es describir la disponibilidad y el uso de los Agentes Electrofísicos (AEFs) por parte de los Fisioterapeutas (FT) portugueses, e identificar los factores que afectan a su uso, como la experiencia, el entorno y la autonomía de los FT. Métodos: Se realizó un estudio transversal entre julio y septiembre de 2018. Se invitó a los fisioterapeutas que actualmente ejercen en Portugal a completar un cuestionario online. Lo cuestionario online incluía preguntas sobre la práctica de los participantes, como años de experiencia, autonomía de rehabilitación, número de clientes por hora, contexto y disponibilidad y uso de AEF. Resultados: De un total de 544 fisioterapeutas que respondieron a lo cuestionario, 424 (78 %) utilizaban AEFs en su práctica diaria. Los AEFs disponibles más comunes son la estimulación nerviosa eléctrica transcutánea (99%) y el ultrasonido (91%). Cuando estaban disponibles, más del 80% de los participantes afirmaron haber utilizado los diferentes AEF al menos una vez. Cuando estaban disponibles, más del 80% de los participantes afirmaron haber utilizado los distintos AEF al menos una vez. La experiencia de los fisioterapeutas no influye en la selección de los AEFs; sin embargo, la autonomía y el entorno influyeron en la selección de casi todos los AEFs. Discusión: Los AEFs están comúnmente disponibles y son generalmente utilizados por los FT portugueses. Los FT que trabajan de forma autónoma tienden a utilizar menos AEFs. La selección de los AEFs parece depender del entorno, el número de clientes por hora y la autonomía.
Palabras-clave: Agentes electrofísicos; Fisioterapia; uso; Ultrasonido; TENS; US

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Diana Bernardo
ftdianabernardo@gmail.com

Introduction

Electrophysical agents (EPAs) are a therapeutic resource widely used by Physiotherapists (PTs), as an adjunct to other intervention modalities in a number of health conditions and populations (Chipchase et al., 2009; Gandolfi et al., 2017; Niño et al., 2022; Springer et al., 2015; Watson, 2000). The International Society for Electrophysical Agents in Physical Therapy refers that EPAs can be used for evaluation, treatment and prevention of deficits in functions and structures, limitation in activity and participation restriction of people and populations (WCPT, 2018). The correct use of EPAs can maximize the results of physiotherapy intervention (Chipchase, 2012; Niño et al., 2022; Sánchez-Gómez et al., 2022) while, inappropriate use compromises the treatment results (Abe et al., 2016), can harm the client (Houghton et al., 2010) and ultimately damages the profession's image.

In Portugal, EPAs are part of Physiotherapy undergraduate training. However, there are few postgraduate trainings that enable PTs to update their knowledge in this resource. Several authors recommend constant updating for the use of EPAs based on available evidence and usage trends (Chipchase et al., 2009). EPAs modalities used in the past are not so popular nowadays or are not currently recommended and so, in recent years, we have seen profound changes in EPAs usage (Watson, 2010). Shah et al. (2007) stated that in the past 20 years there have been a decrease in the availability and use of the different EPAs, pointing out as main reasons the lack of evidence on its efficacy, PTs concerns about its safety, reduced knowledge and poor familiarity with the various modalities. External factors such as availability of the equipment and busy schedules, and internal factors such as PT experience and self-confidence operating the device, can influence the patterns of usage and availability of the different EPAs during PT intervention (Abe et al., 2016; Greco et al., 2018). Besides Japan and United Sates, we can find studies in countries such as Australia (Chipchase et al., 2009), India (Salian et al., 2014), England (Shah et al., 2007), Israel (Springer et al., 2015), Papua New Guinea (Ramalingam & Milanese, 2015), among others, that showed the common and universal use of EPAs by PTs, revealing new usage trends. However, as far as we know, there is no data concerning the usage of the different EPAs modalities by Portuguese PTs.

Therefore, the aim of this study was to identify the

current use pattern and availability of the different EPAs modalities by Portuguese PTs and whether PTs' experience, setting and PTs' autonomy influences the use of EPAs.

Methods

Study Design

An observational cross-sectional study was conducted between July and September 2018, follow the STROBE guidelines. PTs practicing in Portugal were invited to complete an online survey about their use of EPAs in their own practice. Recruitment was made via social media by placing a general request with the link to the Web based survey (ex. Facebook, Facebook groups); email invitation, with an introductory text (study purposes, duration of the survey and guarantees of anonymity and confidentiality) with the hyperlink to the Web based survey, and through the Portuguese Physiotherapist Association mailing list.

All participants gave their online informed consent at the beginning of the survey, after presented with an introduction with the study purposes, duration of the survey and guarantees of anonymity and confidentiality.

This study was conducted in line with the Declaration of Helsinki and received approval from the Ethic Committee of Instituto Piaget (001/2018, April 5th 2018).

Participants

A convenience sample was used of PTs currently engaged in clinical practice in Portugal, that agreed and were eligible to participate in this study. All PTs that were unemployed at the time of the study were excluded.

Data Collection

The online survey implemented in the Google™ Forms platform, collected first the demographic information, with questions regarding gender, age and highest education level. The next section included questions regarding the participants' practice, such as years of practice, setting, geographical location, practice area, main population of intervention, autonomy (independent or dependent of a prescription of a rehabilitation physician) and number of clients treated per hour. The last section consisted of questions regarding availability (yes/no) of the different EPAs, in which participants were asked to rank the frequency of use (never, rarely, sometimes, always).

The investigated EPAs, selected based on previous studies (Abe et al., 2016; Chipchase et al., 2009; Shah et al., 2007) were ultrasound (US), transcutaneous electrical nerve stimulation (TENS), interferential current (IFC), neuromuscular electrical stimulation (NMES), microwave diathermy (MWD), shortwave diathermy (SWD), radiofrequency (RF), galvanic current (GC), iontophoresis, Shockwave, percutaneous electrolysis (PE), magnetotherapy (MAG) and Laser.

Data analysis

The total number of PTs with professional certificate from the Central Administration of Health System, as of July 2018, was close to 11.000. A sample size of 554 participants with a 95% confidence level results in a margin of error of 4% was calculated as necessary to be representative.

Data was exported from the online survey to an electronic spreadsheet with missing data removed pairwise. This data was exported to a statistical software (Statistical Package for the Social Sciences (SPSS) version 20.0, IBM Corporation, Armonk, NY, USA). Descriptive statistics were used to summarize the participants' characteristics. Responses about usage and availability and PTs' autonomy and setting were summarized according to the number (%) of respondents. The PTs' experience was established by the number of years of practice (<5 years were considered novices, >5 years were considered experienced (Forbes et al., 2017). Data was analyzed using Chi-square with adjusted p values with a significance determined as $p < 0.05$.

Table 1.
Participants characteristics

Characteristics	Participants (n = 544)
Age (years), mean (±SD), range	31 (7.9), 21-63
Male, n (%)	156 (28.7)
Highest degree, n (%)	
Bachelor's	12 (2.2)
Degree	447 (82.2)
Master's	83 (15.3)
Doctorate	2 (0.4)
Years of experience n (%)	
Novice ≤ 5 years	255 (46.9)
Expert > 5 years	289 (53.1)
Population of intervention n (%)	
Adults	414 (76.1)
Geriatrics	108 (19.9)
Pediatrics	18 (3.3)
Area of intervention n (%)	
Musculoskeletal	444 (81.6)
Neurological	79 (14.5)
Other	21 (3.9)
Setting n (%)	
Private Rehabilitation Clinic	201 (36.9)
Private office and Sports facility	187 (34.4)
Hospital	80 (14,7)
Others	76 (13.9)
Region of practice n (%)	
North	230 (42.3)
Center	146 (26.8)
Metropolitan Area of Lisbon and Tejo Valley	119 (21.9)
Algarve	23 (4.2)
Azores	10 (1.8)
Alentejo	8 (1.5)
Madeira	8 (1.5)
Level of independence n (%)	
Autonomously	332 (61.0)
PMR prescription	212 (39.0)

Abbreviations: PMR-prescription of a rehabilitation physician

Results

Characteristics of the participants

A total of 544 PTs participated in this study. Table 1 presents the demographic and clinical characteristics of the sample. Most of the participants were women 386 (71%), with a mean age of 31 ±7.9 years. The years of clinical practice was on average 8.4 ±7.8. Two-hundred and one

(36.9%) PTs worked on Private Rehabilitation Clinics, 187 (34.4%) worked in their own office. The majority worked mainly with adults (n=414; 76%) and with musculoskeletal conditions (n=444; 82%). Of the 544 participants, the majority (n=313; 58%) attended one or two patients per hour.

EPAs modalities most used by Portuguese PTs

Of the 544 participants, 424 (77.9%) PTs confirmed that they used EPAs on their daily practice, but only 44 (8%) participated in postgraduate courses about EPA's.

The most common available EPAs in their setting were TENS (100%), US (91%) and NMES (85%), while Shockwave (16%), MAG (15%), RF (13%) and PE (6%) were amongst the less available. Figure 1 shows the availability and usage of the 12 EPAs studied.

All the participants reported using the different EPAs more than 80%, when they are available. The resources more available like TENS (99.7%) and the less available RF (98.2%) and PE (100%) are used almost by 100% of the PTs. US (98%), Laser (95.6 %), NMES (92.6%) and SWD (92.5 %) are used less than 99%, finally MWD (89.0 %), MAG (88.9 %), Shockwave (86.6%), GC (83.7%) and IFC (82.6%) are used less than 90%. Figure 2 presents the percentages of usage (never/rarely vs. sometimes/always) for each EPA. The five EPAs sometimes/always used by Portuguese PTs are TENS (76%), US (68%), Iontophoresis (61%) NMES (60%) and RF (51%); and the top three never or rarely used are Shockwave (74%), SWD (74%) and MWD (72%).

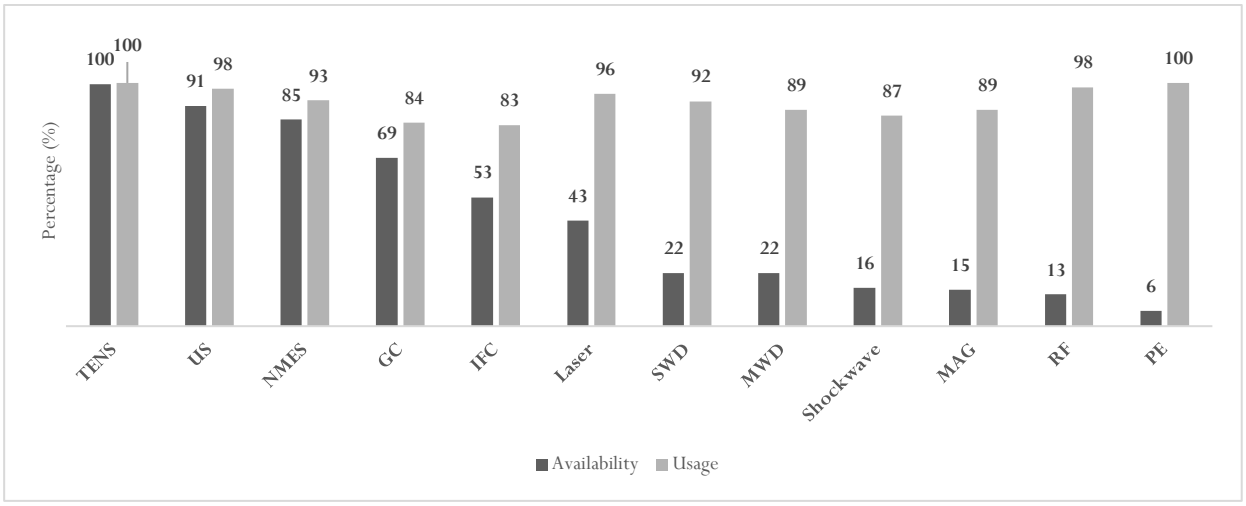

Figure 1. Availability and usage rates of each Electrical Physical Agents. Abbreviations: transcutaneous electrical nerve stimulation (TENS), ultrasound (US), neuromuscular electrical stimulation (NMES), galvanic current (GC), interferential current (IFC), shortwave diathermy (SWD), microwave diathermy (MWD), magnetotherapy (MAG), radiofrequency (RF), percutaneous electrolysis (PE).

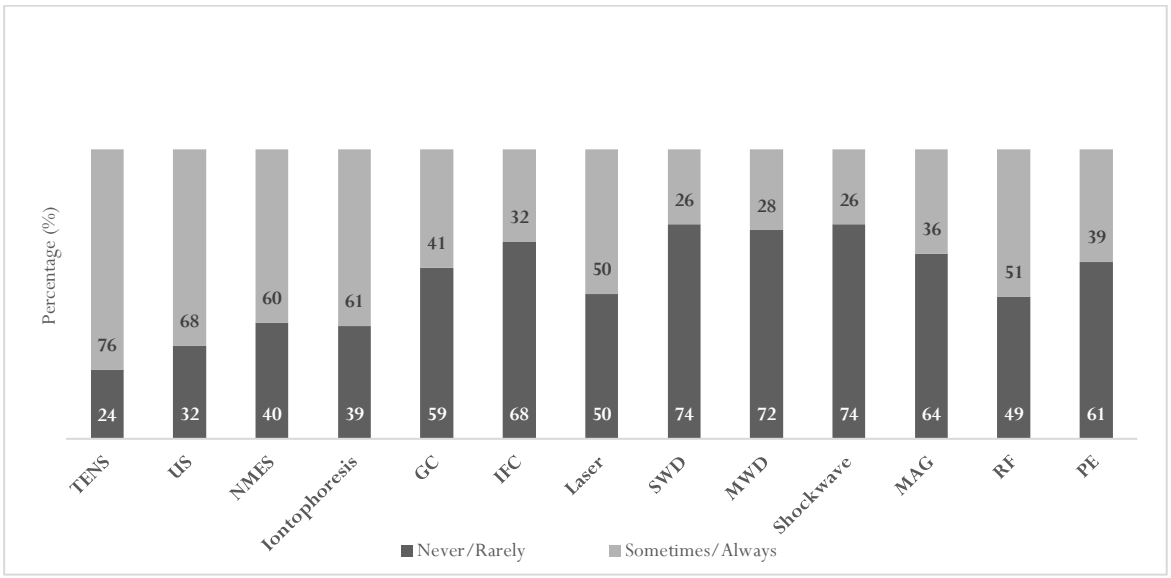

Figure 2. Frequency of use of the different Electrical Physical Agents. Abbreviations: transcutaneous electrical nerve stimulation (TENS), ultrasound (US), neuromuscular electrical stimulation (NMES), galvanic current (GC), interferential current (IFC), shortwave diathermy (SWD), microwave diathermy (MWD), magnetotherapy (MAG), radiofrequency (RF), percutaneous electrolysis (PE).

Role of PTs experience, autonomy and setting in the usage of the different EPAs in Portugal

Regarding the association between clinical experience and use of the different EPAs during the PTs' practice, globally, novice (43.6%) used less EPAs than experts (56.4%), however, some exceptions were found concerning use of Shockwave (51.7%) and RF (53.7%). Only the MAG was significantly used less by novice than experts (39.3% vs 60.7%, $p = 0.05$). These results can be found in supplementary material (Table S1).

PTs that worked with an autonomous practice significantly used less the US (48%, $p < 0.001$), NMES (49%, $p = 0.02$), Iontophoresis (34%, $p < 0.001$), GC (34%, $p < 0.001$), IFC (38%, $p = 0.008$), Laser (42%, $p = 0.001$), SWD (23%, $p < 0.001$), MWD (20%, $p < 0.001$) and MAG (34%, $p = 0.003$) than those working under PMR prescription. The RF was used significantly less (22%, $p < 0.001$) by PTs that work with medical prescriptions, these results are shown on Table 2.

We found that the usage patterns of TENS and PE were not associated with the setting. Yet, the use of all the others EPAs were significantly associated with the setting, namely US (50%, $p < 0.001$), IF (54%, $p < 0.001$) and MWD (73%, $p < 0.001$) were more used by PTs working in Private Rehabilitation Clinic and less by PTs working in Private Office & Sports Facility. Iontophoresis (59%, $p < 0.001$), GC (59%, $p < 0.001$), Laser (57%, $p < 0.001$) and SWD (70%, $p < 0.001$) were more used by PTs that work in the context of a Private Rehabilitation Clinic and less selected by PTs that worked in Private Office and others contexts. Only the RF (54%, $p = 0.02$) was more selected by PTs that were working in Private Office & Sports Facility. NMES (7%, $p = 0.004$) were less used by PTs that were working on other contexts. MAG (57%, $p = 0.01$) and Shockwave (59%, $p = 0.006$) were more selected by PTs in Private Rehabilitation Clinics and less by PTs in Public Hospitals. These results can be found in supplementary material (Table S2).

We also observed that the usage of TENS, Shockwave, RF and PE was not associated to the number of clients per hour. But opposite findings were seen in the remaining modalities. Laser was the only modality that PTs that worked with one client selected (14%, $p = 0.009$) significantly more when compared with the others PTs with busy schedules. These results can be found in supplementary material (Table S3).

Table 2.
Association between PTs' autonomy and use of the different EPAs during Physiotherapy intervention

	n	Autonomous practice n (%)	PMR Prescription n (%)	p-value
TENS	418	219 (52.4)	199 (47.6)	0.060
US	375	180 (48)	195 (52)	<0.001[a]
NMES	333	164 (49.2)	169 (50.8)	0.024[a]
Iontophoresis	262	90 (34.4)	172 (65.6)	<0.001[a]
GC	246	83 (33.7)	163 (46.3)	<0.001[a]
IFC	185	70 (37.8)	115 (62.2)	0.008[a]
Laser	175	74 (42.3)	101 (57.7)	0.001[a]
SWD	86	20 (23.3)	66 (76.7)	<0.001[a]
MWD	81	16 (19.8)	65 (80.2)	<0.001[a]
Shockwave	58	25 (43.1)	33 (56.9)	0.074
MAG	56	19 (33.9)	37 (66.1)	0.003[a]
RF	54	42 (77.8)	12 (22.2)	<0.001[a]
PE	27	18 (66.7)	9 (33.3)	0.225

[a] $p < 0.05$ represents significant difference. Abbreviations: PMR-prescription of a rehabilitation physician; transcutaneous electrical nerve stimulation (TENS), ultrasound (US), neuromuscular electrical stimulation (NMES), galvanic (GC), interferential current (IFC), shortwave diathermy (SWD), microwave diathermy (MWD), magnetotherapy (MAG), radiofrequency (RF), percutaneous electrolysis (PE).

Discussion

To the best of authors knowledge, this is the first study that explored the use and availability of the different EPAs by Portuguese PT's.

As in previous studies (Abe et al., 2016; Robertson, 2008; Shah et al., 2007; Shah & Farrow, 2012; Springer et al., 2015), TENS, US and NMES were the modalities more available across the different Portuguese settings. TENS, RF and PE, when available, were used by almost all Portuguese PT's. The proportion of Portuguese PTs that used TENS (99.7%) was higher than that reported in other countries (Abe et al., 2016; Shah et al., 2007; Springer et al., 2015). TENS can be used as an additional resource across a diversity of clinical conditions and it is a popular EPA because it is inexpensive, easy to administer and safe (Johnson & Jones, 2017; Moreno et al., 2016). As expected, our results showed that availability seems to affect the usage of the different modalities, and the most available were those that PTs used more. Probably the availability of EPA influence PTs decision-making (Abe et al., 2016; Shah & Farrow, 2012) and it may indicate that although they recognize the efficiency of other techniques, they may not use them because they are unavailable (Springer et al., 2015). Our results showed that, when available, all PT's used PE, but this was the less available modality. It should be noted that it is an expensive and recent resource, that requires additional training, although its positive effects on the rehabilitation of musculoskeletal conditions such as tendinopathies (Abat et al., 2016; Moreno et al., 2016) or plantar fasciopathy (Fernández-Rodríguez et al., 2018). The high usage rate may also be due to the fact that PTs attempt to make a return on investments made (e.g., device, training).

Besides PE, other EPAs were poorly available, namely

SWD, MWD, Shockwave and RF. Shockwave and RF are expensive resources and that may be the main reason for their low availability. The same occurs with MWD and SWD (Shah et al., 2007; Shields et al., 2001), but in this case there are also issues related with safety, efficacy and the lack of scientific evidence because these are the less studied modalities by scientific community and these reasons could be responsible for their low availability (Qaseem et al., 2017; Shah & Farrow, 2012; Shields et al., 2001). Our results seem to reinforce that, even when available, MWD and SWD are rarely used. Other modalities that were rarely used were IFC and Shockwave. In Portugal, the focused Shockwave are made by physicians and that might be the reason for the less use by PTs. Concerning IFC, the main reason could be related to the fact that TENS have similar effects (Almeida et al., 2018; Dias et al., 2021), while its cheaper.

Previous experience is another important factor in the process of decision making (Abe et al., 2016; Springer et al., 2015). Some studies found that recently graduated PTs may feel less confident when selecting and using EPAs (Chipchase et al., 2008; Mistry, 2019). In our study, the PTs with more years of practice did not make different decisions regarding EPAs selection. An exception was observed with MAG, where PTs with more years of practice used significantly more during its practice. We did not measure the number of training hours during the graduation or its content, but in the absence of differences, we can raise the question whether schools are updating their syllabus about EPAs.

Regarding the autonomy, our research showed that this variable seems to influence the use of EPAs. PTs that works with a PMR used more often this resource, especially the US, Iontophoresis, GC, SWD and MWD. We should point out that the preferences in selecting EPAs, in this case, are made by the physician and not by the PTs. These results are reinforced by the setting, i.e., those who work at Private Rehabilitation Clinic, closely associated with PMR, tend to use more EPAs than those who work at Public Hospital, Private Hospital and Private Office & Sports Facility. We think that, when the intervention resources are selected by PTs, they seem to rely on other strategies such as manual therapy or therapeutic exercise (Chipchase, 2012; Kelly et al., 2018). Regarding the choice of EPAs, those who work without PMR use significantly more RF and tend to use more TENS and PE. This choice may be related with PTs efficacy perception, but also with continuing education and previous experience in using these resources (Kumaran & Watson, 2019; Springer et al., 2015).

Busy schedules can influence the selection of EPAs and PTs may reduce their use when they have busy and tight schedules at the workplace (Mistry, 2019; Springer et al., 2015). Our results show the opposite. Portuguese PTs that had more clients per hour tend to select more EPAs. There is a correlation between PTs who worked under PMR and those who had more clients per hour. The fact that PTs do not have the autonomy to change the PMR, could be the explanation for this contradiction. This research has some limitations that should be acknowledged. Although this study presents the first information about use of EPAs in Portugal, a selection bias related with EPAs negative or positive viewpoints may have conditioned the responses to the survey. Therefore, PTs more against or prone to the use of this resources were probably the ones that participated. There was a limited geographic diversity, the majority of the sample was from the North of Portugal, and future studies could adapt the dissemination strategies to each region to mitigate future possible regions unbalances.

Conclusion

In conclusion, EPAs are commonly available and generally used by Portuguese PTs. TENS, US and NMES are the most available and PE, TENS and RF the most used. Novice PTs and PTs that work autonomously tend to use less EPAs. Portuguese setting and the autonomy influence the usage of the different EPAs modalities. Further studies should be conducted to understand the variables that influence the decision making regarding the selection of EPAs during the PTs practice. To understand the potential beliefs and perception of efficacy of Portuguese PTs that could influence the use of the different EPAs modalities should be also investigated. Future research is important to know what is being taught about EPAs in Portuguese schools and design a curriculum according to practice patterns and current evidence.

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Datos de los/as autores/as y traductor/a:

Manuel Paquete	manuel.paquete@ipiaget.pt	Autor/a – Traductor/a
Pedro Harry Leite	pedro.leite@ipiaget.pt	Autor/a
Diana Bernardo	diana.bernardo@ipiaget.pt	Autor/a
Luís Moreira	luis.moreira@ipiaget.pt	Autor/a