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Research Article

The Physiotherapeutic Management of Post Stroke Shoulder Pain: A Systematic Review

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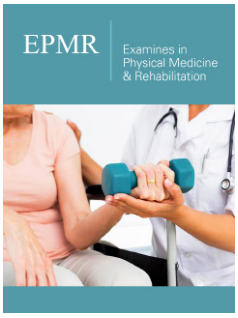

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Abstract

Purpose: No single effective physiotherapeutic management has been suggested for Post Stroke Shoulder Pain (PSSP), the most frequent occurring type of pain after stroke. The aim of this study is to summarize and evaluate the effect of electrotherapy, training, exercise, thermotherapy and taping on PSSP originating from capsulitis, (sub)luxation and contracture.

Materials and methods: Two independent investigators systematically searched relevant databases for Randomized Controlled Trials (RCTs). The methodological quality was evaluated by the PEDro scale. Inclusion criteria were (1) patients from any age, sex or type of stroke; (2) onset of hemiparetic pain after stroke; (3) RCT's evaluating the effect of physiotherapeutic modalities on PSSP with a pain measuring scale.

Results: Nineteen studies out of the identified 266 met de inclusion criteria. They represented 792 participants. Ten studies with a PEDro quality from poor to high reported reduction of PSSP associated with shoulder girdle weakness, capsulitis and subluxation, whereas nine studies with fair to high quality reported no reduction after conventional therapy, electrotherapy, sling and taping or a combination of these.

Conclusion: Some studies reveal evidence for adequate management of PSSP with physiotherapeutic modalities. However, additional research with adequate study designs is necessary to confirm the effect of these modalities.

Keywords: Stroke; Pain; Shoulder; Physiotherapy; Hemiplegic

Introduction

Stroke is an important cause of disability and, therefore, a major public health problem [1]. The disorder leads to a number of consequences of which pain is a frequently observed symptom (32% - 42%) [2,3]. Post stroke pain is common but often neglected, apparently due to prioritization of motor function recovery in physiotherapeutic intervention plans [2]. Post Stroke Shoulder Pain (PSSP) is a common complication after stroke and has a major impact on the quality of life and daily life after stroke [4,5]. The prevalence varies from 21% to 64% [4,6].

Physiotherapeutic management of patients with PSSP comprises of several modalities that treat post stroke pain. These may include exercise, electrotherapy and cryotherapy [3]. However, the effectiveness of these modalities in post stroke patients has not been adequately evaluated. Investigators reviewed the influence of modalities on PSSP, like the effect of acupuncture [7] or electrical stimulation on PSSP [8,9]. Reviews regarding the effect of a multidisciplinary approach on hemiplegic shoulder pain management [10], the physiotherapeutic effect on post stroke patients including those with PSSP [11] and management of hemiplegic shoulder pain [12], all provided relevant information. Yet, none of the studies included the complete spectrum of available physiotherapeutic modalities as defined by the World Confederation for Physical Therapy guidelines [10]. Therefore, this study aimed to summarize and evaluate the effects of various physiotherapeutic modalities for PSSP caused by capsulitis, (sub)luxation and contracture in all stroke patients as reported in the past decade. Moreover, we will report on the usage of any form of evaluation of cognitive and somatosensory dysfunction as it may impede proper assessment of pain in stroke survivors [10,13].

Materials and Methods

Databases and search strategies

A systematic literature search was conducted in PubMed (MEDLINE) (Sept 2008-Sept 2018), Excerpta Medica database (EMBASE) (Jan 2008-Sept 2018), Web of Science (Aug 1997- Sept 2018) and Physiotherapy Evidence Database (PEDro) (Jan 1994- Jan 2017) and included the following string: (stroke OR CVA) AND (ache OR pain) AND (shoulder OR glenohumeral) AND (electrotherapy OR thermotherapy OR exercise OR training OR treatment OR taping) AND (subluxation OR contracture OR capsulitis) AND (physical therapy OR physiotherapy) AND (hemiparetic OR hemiplegic). After the selection of potential studies from these four databases, the investigators also screened the reference lists of the relevant studies for eligibility.

Study selection

Studies conducted between 2008 and 2018, published in English and designed as a Randomized Controlled Trial (RCT) that reported the effect of a physical therapy modality as treatment for shoulder pain among patients with stroke using a pain measuring scale were eligible for inclusion. Furthermore, studies with patients of any age, sex, type and phase of stroke as well as studies concerning the onset of hemiparetic shoulder pain after stroke were included. Studies regarding shoulder deficiencies originating from neurological disorders other than stroke were excluded. Since our study obtained data from literature already published, no approval was required from the institutional review board and patient consent was not necessary.

Data extraction

Two independent researchers systematically reviewed the selected studies. They screened the records of the databases on title and abstracts according to the eligibility criteria. Once the selected studies met the eligible criteria, the researchers subsequently read the full-text of those publications. Finally, they screened the reference lists of these publications for studies that met the inclusion criteria. With the aid of the PEDro scale eligible studies were assessed for their methodological quality [14] based on the Delphi list.

The total score for this assessment tool ranged from 0 to 10 Criterion 1 deals with external validity opposed to the internal or statistical validity of the trial. It has been included in the PEDro scale to complete all items as represented in the Delphi list. For this reason, the PEDro score does not include criterion 1 for calculation. Studies met the classification of high methodological quality with a score between 6-10; fair quality with a score between 4 and 5 and poor quality with a score less than four. Although, the Cochrane Collaboration prefers the term "bias" above "quality" [15], the latter was still chosen in order to compare the obtained results with those found in previous studies. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement resulted in an outline of possible inclusion in this review [16]. The investigators submitted the protocol at the International Prospective Register of Systematic Reviews (PROSPERO) on the 26th of February 2019 (CRD42019126744).

Results

Two hundred and sixty-six studies were initially screened (EMBASE (N=55); PubMed (N=59); PEDro (N=52); and Web of Science (N=100)) (Figure 1). After adjusting for duplicates, a total of 132 studies remained. On the basis of title and abstract, another 108 studies were excluded for the following reasons: (1) studies older than 2008; (2) outcome measurements other than pain; (3) patients without the diagnosis of stroke; (4) study design other than an RCT or studies without a physiotherapeutic modality (Figure 1).

Out of the remaining 24 studies, 17 studies met the inclusion criteria after examination of the full text. Furthermore, references of these 17 studies led to the inclusion of 2 additional studies. Therefore, the present systematic review included a total of 19 studies (Figure 1).

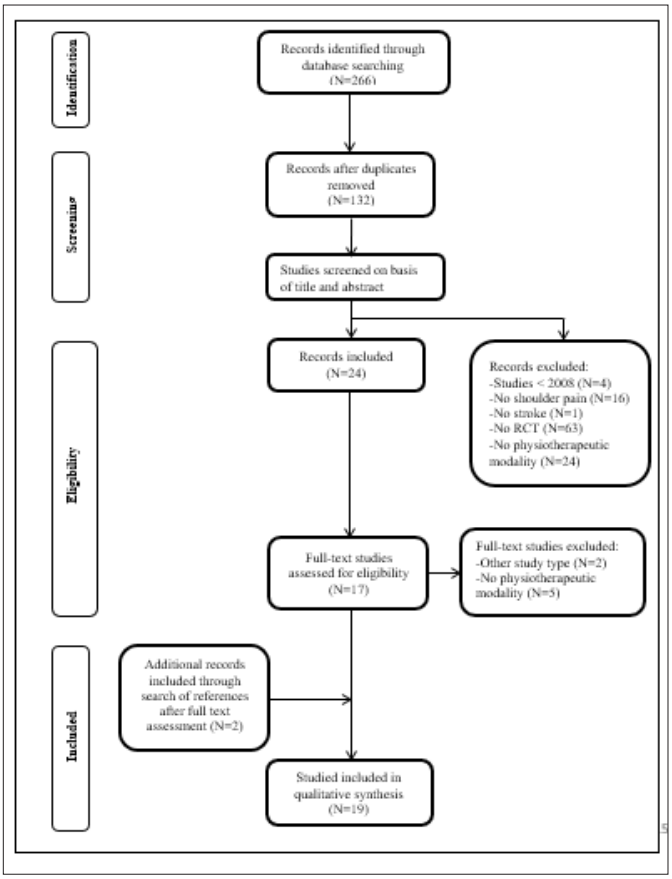

Figure 1: Selection of the studies included in the systematic review.

Study Characteristics

Table 1 summarizes the methodological quality of the studies according to the PEDro scale. The PEDro score for twelve studies [17-27] ranged between 6- 8. One study [28] did not specify the eligibility criteria and the randomization of the allocated subjects.

None of the studies reported blinding of the therapist to the therapy itself. Five studies [19-21,25,27] reported blinding of all subjects. And only six studies [17,19,22-24,29] reported "intention to treat" for at least one key outcome measure.

Table 1: Methodological quality of the included studies.

	Study	1	2	3	4	5	6	7	8	9	10	11	Total
1	Ada Louise et al. [17]	Yes	1	1	1	0	0	1	1	1	1	1	8
2	Bladel van Anke et al. [26]	Yes	1	1	1	0	0	0	1	0	1	1	6
3	Chatterjee Subhasish et al. [18]	Yes	1	0	1	0	0	1	1	0	1	1	6
4	Heo Min-Yeong et al. [28]	No	0	0	0	0	0	0	1	0	1	1	3
5	Hochsprung Anja et al. [29]	Yes	1	1	1	0	0	1	0	1	1	1	7
6	Huang Yu-Chi et al. [21]	Yes	1	0	1	1	0	1	1	0	1	1	7
7	Huang Yen-Chang et al. [20]	Yes	1	1	1	1	0	1	1	0	1	1	8
8	Jeon So-myung et al. [31]	Yes	1	1	0	0	0	0	1	0	1	1	5
9	Jong de Lex et al. [19]	Yes	1	1	1	1	0	1	0	1	1	1	8
10	Karaahmet Ozgur et al. [32]	Yes	1	1	1	0	0	0	0	0	1	1	5
11	Koyuncu Engin et al. [34]	Yes	1	0	1	0	0	0	1	0	1	1	5
12	Mangold Sabine et al. [22]	Yes	1	0	1	0	0	0	1	1	1	1	6
13	Manigandan Bala et al. [33]	Yes	1	0	0	0	0	1	1	0	1	1	5
14	Moniruzzaman M et al. [35]	Yes	1	0	1	0	0	0	1	0	1	1	5
15	Pandian Jeyaraj et al. [23]	Yes	1	1	1	0	0	1	0	1	1	1	7
16	Pillastrini Paolo et al. [24]	Yes	1	1	1	0	0	1	1	1	1	1	8
17	Suriya-Amarit Duangporn et al. [25]	Yes	1	1	1	1	0	1	1	0	1	1	8
18	Turkkan Canan et al. [30]	Yes	1	0	1	0	0	0	1	0	1	1	5
19	Zhou Meimei et al. [27]	Yes	1	1	1	1	0	1	0	0	1	1	7

Table 2 summarizes the number of participants, intervention, outcomes and results of each study. One study [30] included only chronic stroke patients, whereas ten studies [17-19,21-23,28,31-33] included both acute and subacute patients after stroke. The remaining eight studies [20,24-27,29,34,35] did not specify the time after stroke of their study population. Eight studies [18,26,28,30,31-34] reported shoulder subluxation, ten studies [17,19-25,27,29] reported shoulder girdle muscle weakness and one study [35] reported capsulitis as cause of PSSP.

Table 2: Overview of included studies.

Study	Participants	PEDro	Interventions	Intensity	Pain Outcomes	Results
Ada L, et al. [17]	C: N= 23 (F12: M11) Age 71±11 E: N= 23 (F8: M15) Age 67±10	08-Oct	C: Hemi-sling (sitting, standing, walking) E: Lap- tray (sitting) + Triangular sling (standing, walking)	4 week (waking hours)	VAS scale at rest + during passive external rotation of the shoulder At pre- and post Tx.	No pain reduction
van Bladel A, et al. [26]	C: N= 9 (F4: M5) Age 56±9 E1: N= 9 (F3: M6) Age 62±12 E2: N= 10 (F4: M6) Age 47±14	06-Oct	C: without a sling (with proper positioning of the arm) E1 : Actimotive sling E2 : Shoulder lift	6 week during the active time of the day	1.VAS 2.Shoulder Rating Questionnaire At pre- and post Tx.	No pain reduction
Chatterjee S, et al. [18]	C: N= 15 (F7: M8) Age 62.8 ± 4.5 E: N=15 (F6: M9) Age 63.2±4	06-Oct	C: Neuro-rehab. Only E: Neuro-rehab. + CTPT	6 week	VAS scale At pre- and post Tx.	Pain reduction
Heo M, et al. [28]	C: N= 18 (F7: M11) Age 60.3±10.4 E: N= 18 (F8: M10) Age 57.1±10.6	03-Oct	C: Bed PT E: Bed PT + inelastic taping	8 week	VAS scale At pre-, 4 weeks and post Tx.	Pain reduction

Hochsprung A, et al. [29]	C: N= 7 (F2: M5) Age 63.71±6.1 E1: N= 7 (F1: M6) Age 63±11.63 E2: N= 7 (V5: M2) Age 60.85±13.15	07-Oct	C: conventional training E1: conventional training+ KT (deltoid muscle) E2: conventional training+ NMES (deltoid muscle)	C: 24 week E1/E2: KT/ NMES first 4 week. After 4 week continued with conventional training	VAS scale At pre-, 12 weeks and post Tx.	No pain reduction
Huang Yu-Chi, et al. [21]	C: N= 23 (F8: M15) Age 62.2±9.6 E: N= 21 (F6: M15) Age 60.4±11.8	07-Oct	C: SHAM KT + conventional training E: Therapeutic KT + conventional training	3 week KT or SHAM KT (application for 3 days followed by 1 day of no taping)	VAS scale At pre- and post Tx	No pain reduction
Huang Yen-Chang, et al. [20]	C: N= 10 (F4: M6) Age 59±13 E: N= 11 (F3: M8) Age 56±13	08-Oct	C: conventional training + SHAM KT E: conventional training + therapeutic KT	KT 3 week (twice per week) for 3 days and then remove the tape for 24h	1.NRS 2.SPADI At pre- and post Tx.	Pain reduction**
Jeon S, et al. [31]	C: N= 10 (F4: M6) Age 56.9±12.1 E: N= 10 (F2: M8) Age 50.7±10.4	05-Oct	C: cyclic FES + conventional PT E: task- oriented EMG-triggered stimulation+ conventional PT	4 week	VAS scale At pre-, post Tx.	Pain reduction
de Jong L, et al. [19]	C: N=23 (F11: M12) Age 58.4±9.6 E: N=23 (F8: M15) Age 56.6±14.2	08-Oct	C: Sham arm positioning (no stretch) + Sham NMES (TENS) with no motor effect E: Arm stretch(static) positioning + motor amplitude NMES	NMES or TENS: 5 days a week (8 week)	Shoulder Q At pre-, 4 week and post Tx.	No pain reduction
Karaahmet O, et al. [32]	C: N= 9 (F2: M7) Age 58±15.4 E: N= 12 (F6: M6) Age 56±17.5	05-Oct	C: standard rehab program E: standard rehab program + FES cycling	4 week	NRS scale at rest + PROM At pre- and post Tx.	Pain reduction
Koyuncu E, et al. [34]	C: N= 25 (F16: M9) Age 62.0±9.72 E: N= 25 (F20: M5) Age 60.7±9.49	05-Oct	C: conventional methods E: conventional methods + FES to supraspinatus and posterior deltoid muscles	5 days a week (4 week) 1 hour daily	VAS scale evaluation in resting, PROM and AROM in flexion and abduction of the shoulder. At pre- and post Tx.	No pain reduction
Mangold S, et al. [22]	C: N=11 (F4: M7) Age 62±16.2 E: N=12 (F2: M10) Age 57.5±16.7	06-Oct	C: conventional training E: FES + conventional training	4 week (12 training sessions)	CMSA At pre- and post Tx.	No pain reduction
Manigandan B, et al. [33]	C: N= 12 (F4: M8) Age 51.83±7.64 E: N= 12 (F3: M9) Age 50.16±8.55	05-Oct	C: ES to supraspinatus and posterior deltoid + conventional PT E: ES to supraspinatus, posterior deltoid and long head of biceps + conventional PT	5 week	Passive Pain Free external rotation and shoulder abduction AROM measured goniometer At pre- and post Tx.	Pain reduction
Moniruzzaman M, et al. 35]	C: N= 23 (F10: M13) Mean age 53.91 E: N= 22 (F9: M13) Mean age 56.59	05-Oct	C: TENS + NSAID + Exercise + ADL instruction E: UST + NSAID + Exercise, ADL instruction	5 visits at every 2 weeks (8 week)	Lattinen test score At pre- and post Tx.	Pain reduction*
Pandian J, et al. [23]	C: N= 82 (F33: M49) Age 59.5±13.2 E: N= 80 (F23: M57) Age 55.7±13.1	07-Oct	C: Sham taping + conventional training E: Tri-Pull method + conventional training	30 days	1.VAS scale 2.SPADI At pre-, 14 days and post Tx.	No pain reduction

Pillastrini P, et al. [24]	C: N= 15 (F6: M9) Age 66 ±11 E: N= 16 (F3: M13) Age 66 ± 8	08-Oct	C: standard PT E: standard PT + NMT	4 week	VAS scale At pre-, post Tx. (4 week), after 4 week of Tx. (8 week)	Pain reduction
Suriya-Amarit D, et al. [25]	C: N= 15 (F9: M6) Age 67.13±10.84 E: N= 15 (F9: M6) Age 65.87±9.35	08-Oct	C: Placebo ES + conventional PT E: IFC + conventional PT	Once for 20 minutes	NRS scale At pre- and post Tx.	Pain reduction
Türkkan C, et al. [30]	C: N=12 (F10: M2) Age 66.7±18.1 E: N=12 (F4: M8) Age 61.5±10.4	05-Oct	C: conventional PT E: NMES to supraspinatus, upper trapezius and posterior deltoid muscles + conventional PT	C: not specify E: NMES 5 days a week (4 week)	VAS scale At pre-, 2 week and post Tx.	No pain reduction
Zhou M, et al. [27]	C: N= 18 (F 17%) Age 63.78±11.17 E1: N= 36 (F 33%) Age 59.35±10.78 E2: N= 36 (F 19%) Age 58.5±9.07	07-Oct	C: Rehabilitation program E1: NMES to supraspinatus and deltoids (medial and posterior parts) + Rehabilitation program. E2: TENS on the same areas + Rehabilitation program	4 week	NRS scale At pre-, 2 week, post Tx. (4 week) and after 4 week of Tx. (8 week)	Pain reduction

ADL=Activities of Daily Living; AROM=Active Range of Motion; C=Control; CMSA=Chedoke McMaster Stroke Assessment; CTPT=California Tri-Pull Taping; E=Experimental; EMG=Electromyography; ES=Electrical Stimulation; F=Female; FES=-Functional Electrical Stimulation; IFC=Interferential Current Stimulation; KT=Kinesio Taping; M=Male; NMES=Neuro-Muscular Electrical Stimulation; NMT=NeuroMuscular Taping; NRS=Numeric Rating Scale; NSAID=Non-Steroidal Anti Inflammatory Drug; PROM=Passive Range of Motion; PT=Physiotherapy; SPADI=Shoulder Pain and Disability Index; TENS= Transcutaneous Electrical Nerve Stimulation; Tx=Therapy; UST=Ultrasonic Therapy; VAS=Visual Analogue Scale.

*TENS and UST both are effective, but TENS may be safer and superior to Age is mean (years) with SD.

** There is greater reduction in SPADI, pain and improvement in shoulder flexion, external and internal rotation after 3 weeks of therapeutic KT intervention.

The scales applied to assess the degree of pain were not consistent in the studies and included:

1. The Visual Analog Scale (VAS) [35] score [17,18,21,24,28-31,34];
2. The Numeric Rating Scale (NRS) [35] score [25,27,32];
3. The Lattinen [35] score [35];
4. The Shoulder Q [35] Questionnaire [19];
5. The pain-free range of Passive Lateral Rotation (PLRL) [33];
6. The Chedoke McMaster Stroke Assessment [35] (CMSA) [22];
7. The Shoulder Pain and Disability Index [35] (SPADI) [35] and
8. The Shoulder Rating [35] Questionnaire [36].

The Shoulder Rating Questionnaire and the VAS were paired in two studies [23,26]. One study used the SPADI in combination with the VAS [35] and one study used the SPADI together with the NRS score [20]. The VAS score was used in eleven studies. In nine studies [17,19-23,26,29,30,34,35] no significance of pain reduction was reported between the control and intervention groups.

In total 792 participants were studied. Sample sizes in each study ranged from 20 to a maximum of 162. Thirteen studies [17,20-22,24,26,28-33,35] reported a small sample size and only three studies [19,23,27] reported a power-based calculated sample size. The mean age in the studies varied from 47(±14) to 71(±11) years. All the studies included men and women of which 39% were women.

Four studies [28,34,36,37], measured cognitive status with the Mini Mental State Examination (MMSE) whereas 8 [22,23,25-27,29-31] ignored to mention a specific scale. Five studies evaluated the ability to communicate and cooperate [32]. The remaining two [32] did not evaluate cognition. Ten studies [19,22,25,27,30-35] focused on various forms of electrotherapy and eight studies [17,18,20,21,23,24,26,28,29] on diverse forms of taping and sling. Furthermore, one study [29] had a combination of electrotherapy and taping. All 19 studies combined the modality with a form of rehabilitation program or conventional therapy mainly consisting of one type of exercise and training. None of the studies reported the use of thermotherapy or a specific type of exercise intensity or frequency.

Significant difference of pain reduction

Electrotherapy: Six studies [25,27,31-33] applied various forms of electrotherapy with a significant reduction of pain. Varieties of electrotherapy were:

1. Electro Stimulation (ES) [33];
2. Functional Electrical Stimulation (FES) [32];
3. Electromyography (EMG) triggered ES versus FES [31];

4. NeuroMuscular Electrical Stimulation (NMES) versus Transcutaneous Nerve Stimulation (TENS) [27];

5. TENS versus Ultrasonic therapy [27] and

6. Interferential Current Stimulation (IFC) versus ES [25].

Of these only one single study [27] presented a power-based calculated desired sample size of 90 whereas others reported sample sizes that varied between 20 and 45 participants. All of these studies scored between 5 and 8 on the PEDro scale.

Taping: Four studies [18,24,28] of taping found significant difference of pain reduction compared to other interventions. They utilized three various taping methods:

1. California Tri-Pull Taping (CTPT) [18],

2. NeuroMuscular Taping (NMT) [24],

3. Kinesio Taping (KT) [18] and

4. Inelastic Taping [28].

These studies scored between 3 and 8 on the PEDro scale and had a random sample size with unknown power.

No significant difference of pain reduction

Electrotherapy: Four [19,22,30,34,35] studies focused on modalities with electrotherapy, and showed no reduction of PSSP. These studies utilized:

1. Functional Electrical Stimulation (FES) [22,34] and

2. Electrical Stimulation (ES) [19,30].

The PEDro score of the studies was between 5 and 8. Only 1 study [19] presented a calculated sample size, whereas the other studies contained a random sample size with unknown power. [29] applied a combination of the modalities taping and NMES, and did not find a significant difference of pain reduction. This study had a sample size of 21 of unknown power and a PEDro score of 7.

Taping: Two studies [17,26] applied a sling and two [20,21,23] applied various forms of taping (Tripull method [23] and Kinesiology Taping [20,21]) , but they did not find a reduction in PSSP. These studies scored between 6 and 8 on the PEDro scale, yet a calculated sample size of 162 participants was present in only one single study [23].

Discussion

This systematic review summarized and evaluated the effects of electrotherapy, training, exercise, thermotherapy and taping for hemiparetic Post Stroke Shoulder Pain (PSSP) originating from etiology such as capsulitis, (sub)luxation and contracture in studies published between 2008 and 2018. Most of the studies had sample sizes that were too small and were not triple blinded. The majority included only acute and subacute patients with PSSP originating from subluxation. Consequently, it was not possible to identify an effective physiotherapeutic modality to manage PSSP.

Similar modalities were observed for studies with both, significant difference of pain reduction [24,26,28,30,32,34,36-39] and no significant difference of pain reduction [22,23,25,27,29,31,33,35,40] regarding PSSP for patients with stroke, but all studies had a significant risk of bias due to inadequate study designs, inconsistency of pain measurement, lack of inclusion of full sensory assessment and no description of the content of conventional therapy.

Eleven studies reported blinding of the assessors and patients, although none of the studies reported blinding of the therapists. Understandably the nature of physiotherapeutic interventions makes blinding difficult [37] but not impossible [38,39]. Triple blinding prevents performance bias associated to patient's, therapist's and assessor's expectations [37] by assessing the limitations of each study due to bias control in order to avoid incorrect conclusions of the application of several modalities. It is therefore advisable to use open-label trials in order to have triple-blinded trials [40]. Open-label trials involve the comparison of two very similar trials in order to determine the most effective one [41]. Pain is not consistently described in the reviewed studies. Validity and uniformity is advisable since pain measurement is highly subjective [37]. Additionally, none of the studies reported full sensory assessment of participants. As stroke patients are subject to somatosensory disorders, pain assessment could therefore be biased [13]. Studies reported a prevalence varying from at least 33 to 79% [42,43] regarding somatosensory impairments after stroke.

In line with other reviews [11,44], no reduction for shoulder subluxation and shoulder pain for modalities such as electrotherapy, taping, sling and combination therapy (electrotherapy with taping) are reported. Furthermore, distinct phases and locations of stroke, varying intensities of the modalities and poor description of the content of conventional therapy [11,44] are examples of contributing factors that might mask the findings of all studies. This complex interrelated nature of components of physical therapy during treatment of PSSP makes it, therefore, imminent that the content of conventional therapy in addition to the intervention effect should be defined and reported in detail [15].

A limitation of this systematic review could be the use of the PEDro scale. It does not take the sample size calculation into account in comparison to, for instance, the Downs and Black scale [45]. Therefore, a high score on the PEDro scale is subject to interpretation bias. Yet, the PEDro scale was chosen in this systematic review over the Downs and Black scale in order to compare study results to other physiotherapeutic systematic reviews [11,44], and also due to its common use in the physiotherapeutic field [46]. Secondly, this review only included studies that were published in English, which may have resulted in omission of valid publications in other languages. Thirdly, the difference in severity of stroke among these studies challenges this study to conclude a clear effect of physiotherapeutic management on pain. At last, it should be mentioned that the etiology of PSSP

is diverse and includes glenohumeral subluxation, spasticity of shoulder muscles, impingement, soft tissue trauma, rotator cuff tears, glenohumeral capsulitis, bicipital tendinitis and shoulder hand syndrome, from which we chose the most common etiologies, but future studies are encouraged to include other etiological factors as well in a systematic search [47].

Conclusion

Despite the high prevalence of patients suffering from PSSP, the evidence for effective physiotherapeutic treatment is unclear and no particular intervention appears to be preferred. Adequate study designs such as prospective controlled trials are required in order to have a better assessment for PSSP treatment. At this point, the applicability of physiotherapeutic modalities for PSSP originating from subluxation, contracture or capsulitis remains inconclusive.

Declaration of Interest Statement

The authors report no conflicts of interest.

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