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RESEARCH ARTICLE

Limited evidence of physical therapy on balance after stroke: A systematic review and meta-analysis

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Abstract

Background

Stroke results in balance disorders and these directly affect autonomy and quality of life. The purpose of this systematic review and meta-analysis was to determine the efficacy of physical therapy (PT) on balance and postural control after stroke.

Methods

We included all randomized controlled trials assessing the efficacy of PT on balance and postural control in adult patients after stroke without language restriction. Medline, Embase/ Scopus, Cochrane Central Register of Controlled Trials, PEDro, Pascal, and Francis databases were searched until January 2019. Primary outcomes were balance (Berg Balance scale and Postural Assessment Scale for Stroke) and postural control with postural deviation or stability measurement in sitting or standing static evaluation. A pair of independent reviewers selected studies, extracted data, and assessed risk of bias. Meta-analyses with subgroups (categories of PT, time post-stroke, and lesion location) and meta-regression (duration of PT) were conducted.

Results

A total of 145 studies (n = 5912) were selected from the 13,123 records identified. For balance, evidence was found in favor of the efficacy of functional task-training alone (standardized mean difference 0.39, 95% confidence interval [0.09; 0.68], heterogeneity $l^2 = 63\%$) or associated with musculoskeletal intervention and/or cardiopulmonary intervention (0.37, [0.19; 0.55], $l^2 = 48\%$), electrostimulation (0.91, [0.49; 1.34], $l^2 = 52\%$) immediately after intervention, compared to sham treatment or usual care (ST/UC). For postural deviation eyes open, assistive devices were more effective than no treatment (-0.21, [-0.37; -0.05], l^2 = 0%) immediately after intervention; for postural stability eyes open, functional task-training and sensory interventions were more effective than ST/UC (0.97, [0.35; 1.59], $l^2 = 65\%$ and 0.80, [0.46; 1.13], $l^2 = 37\%$ respectively) immediately after intervention.

Conclusions

Functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention and sensory interventions seem to be immediately effective in improving balance and postural stability, respectively. The heterogeneity of PT and the weak methodological quality of studies limited the interpretation and the confidence in findings.

Introduction

World-wide, approximately 25.7 million people suffered from stroke in 2013 [1], and this was the third most common cause of disability in 2015 [2]. Stroke frequently results in postural disorders characterized by a mediolateral deviation towards the unaffected lower limb and a greater instability of the center of pressure [3–11]. These dysfunctions lead to balance disorders [12] that are responsible for an increased risk of falls [13] and a lower level of activity and participation in stroke patients [14,15]. Balance is associated with ambulation abilities [16–18] and quality of life [19]. Moreover, balance is a predictor for achieving the ability to walk [16,20,21] and is also found among the factors potentially modifiable by physical activity [22]. Therefore, developing physical therapy (PT) interventions for the improvement of balance is relevant for patients with stroke.

PT includes interventions aiming to develop, maintain, and restore movement and functional ability [23]. Current recommendations regarding PT for the improvement of balance after stroke are based on a poor level of evidence [24–26]. Furthermore, most meta-analyses selected only studies published in English language despite it having been established that significant results are more often published in English-language journals [27,28], introducing language bias into article selection. In addition, among the meta-analyses that have investigated the effects of PT in patients with stroke these considered multiple outcomes or some specific approaches of PT [29–42]. Although these did include balance, to the best of our knowledge no meta-analysis has investigated the effects of all PTs specifically on balance and postural control after stroke without language restriction. Therefore, the objective of this systematic review and meta-analysis was to determine the efficacy of PT (overall and by category of PT) on these parameters in adult patients with stroke.

Methods

The protocol was developed using the PRISMA guidelines [43] and Cochrane recommendations [27], registered in PROSPERO (CRD42016037966), and published in BMJOpen [44] (S1 Checklist and S1 Protocol). Therefore, methods are described only briefly.

Definitions

According to the World Health Organization, stroke is defined as "rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 h or leading to death with no apparent cause other than that of vascular origin" [45]. PT is defined by the World Confederation for Physical Therapy as "services to individuals and populations to develop, maintain and restore maximum movement and functional ability throughout the life-span" and "physical therapy is concerned with identifying and maximizing quality of life and movement potential within the spheres of promotion, prevention, treatment/intervention, habilitation and rehabilitation" (http://www.wcpt.org/policy/ps-descriptionPT) [23]. Human posture is the position of body parts relative to each other [46]. We defined postural control as the function of body stabilization based on a sensorimotor complex skill, and of body orientation based on internal representation of body scheme [47]. We further defined balance as a posture in which an ideal body mass distribution is achieved and which provides the body carriage stability and conditions for normal functions in stationary position or in movement (Medline Subject Heading; MeSH).

Eligibility criteria

All types of randomized controlled trials assessing the efficacy of PT on balance or postural control in adult patients (18 years or above) with stroke were included without language restriction. Inspired by the meta-analysis conducted by Pollock *et al.* [40], we included all PTs that may be used by physiotherapists during rehabilitation without restriction to only PTs that had a stated objective of promoting recovery of balance or postural control. We included PTs using electric devices (such as functional electric stimulation), treadmills, and assistive devices (such as a cane or orthosis). The classification of PT categories, based on that used by Pollock *et al.* [40], included assistive devices, constraint-induced therapy, cardiopulmonary intervention, functional task-training, musculoskeletal intervention, sensory interventions, and other intervention (Table 1). Only the outcomes defined as primary in the following paragraph were considered for selection of trials.

Outcomes

For this meta-analysis, we studied both balance and postural control. Based on the International Classification of Functioning, Disability and Health (ICF), we considered balance as a level of activity reflecting functional abilities, and postural control as a body structure function reflecting both orientation and stabilization body [47]. Therefore, the primary outcomes were: balance measured by the Berg Balance Scale (BBS) or the Postural Assessment Scale for Stroke (PASS); postural deviation measured by the weight bearing asymmetry (WBA) on lower limbs or the mediolateral and anteroposterior position of the center of pressure (COP); and postural stability measured by all COP sway or limit of stability (LOS) parameters. BBS and PASS are two clinical scales measuring the functional abilities of patients for various balance skills [44] (**S1 Protocol**). BBS is very widely used in studies and has metrological properties that make it

Table 1. Categories of physical therapy.

Categories	Component of categories		Definition					
Assistive devices	Cane and aid to stand or walk		Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 361 [40]: "Devices to assist walking, including sticks and frames"					
	Orthosis		Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 361 [40]: "Externally applied orthoses to assist walking, including AFO, knee braces"					
Constraint-induced	Weight, resistance		Passive and external constraint imposed on movements or mobility of					
Constraint-induced therapy Cardiopulmonary intervention Functional task-training	Body or limb positioning		patients					
	Wedge, lift							
Cardiopulmonary intervention	Fitness, endurance, aerobic training		Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 361 [40]: "Activities to improve cardiopulmonary fitness"					
Functional task-training	Balance training		Task-oriented training specifically focus on balance in various modalities.					
	Gait training		Task-oriented training of specifically focus on gait in various modalities.					
	Sit-to-stand training		Task-oriented training of specifically focus on sit-to-stand in various modalities.					
	Transfer training		Task-oriented training of specifically focus on transfers in various modalities.					
	Reach or upper limb training		Task-oriented training of specifically focus on reach or function of upper limb in various modalities.					
	Daily activity training		Task-oriented training of specifically focus on activities of daily living in various modalities.					
	Other task-oriented training		Other task-oriented training in various modalities such as coordination tasks					
Musculoskeletal intervention	Active	Strengthening	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "Practice of activities to progressively increase the ability to generate muscle force, including using body weight and external resistance"					
		Mobilization	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "Moving a limb through its range of movement, under the patient's active control without assistance"					
	Active assisted	Mobilization	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "Moving a limb through its range of movement, under the patient's active control with assistance"					
		Electrostimulation	Electrical current used to produce a muscle contraction					
	Passive	Mobilization	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "Moving a limb through its range of movement, whilst the patient is passive"					
		Stretching	Lengthening of muscle to improve elasticity and control muscle tone.					
		Immobilization	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "placing a limb or body part in a supported position, to maintain optimal alignment "					
		Verticalization	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "To promote early lower limb loading"					
		Massage	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "Manipulation of soft tissue, using the hands or a tool designed for the purpose					
Neurophysiological intervention	Bobath, Proprioceptive neuromuscular facilitation and other neurodevelopmental interventions		Described in additional Table 1 in Pollock <i>et al.</i> , 2014, p. 356–362 [40]: "Intervention which is described as facilitation of movement"					
Sensory interventions	Tactile, vibration, thermal, proprioception		Practice of stimulation, perturbation or modification of sensorial input					
	Visual		(<i>e.g.</i> tactile, thermal, proprioception, visual, vestibular) by different					
	Vestibular		inculous.					

(Continued)

Table 1. (Continued)

Categories	Component of categories	Definition							
Other intervention	Acupuncture	Described in additional Table 2 in Pollock <i>et al.</i> , 2014, p. 362 [40]: "Devices to assist walking, including sticks and frames"							
	Aquatic therapy	Use of aquatic environment to assist or stimulate function or mobility of body							
	Body awareness therapy	Practice aimed at being aware of one owns body and reflect upon how the body feels when performing the movements							
	Other								

This classification was based on the classification reported in Pollock *et al.*, 2014, a Cochrane meta-analysis (additional Table 1 p. 356–361 and additional Table 2 p. 361–363).

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a gold standard to assess balance in patients with stroke. We included studies that assessed postural control with postural deviation or stability measurement in sitting or standing static evaluation on a force plate with eyes open (EO) or closed (EC). Postural deviation included mediolateral postural deviation (measured by WBA and mediolateral position of COP) and anteroposterior postural deviation (measured by anteroposterior position of COP). Additionally, we included studies that measured WBA by means of another device than force plate, such as weight scale, if the measure was done in static position. The secondary outcome was autonomy measured by the Barthel Index, the Functional Independence Measure, the Activities of Daily Living or the Instrumental Activities of Daily Living scales.

Data sources

Medline, Elsevier databases (*i.e.* EMBASE until October 2015, SCOPUS thereafter), Cochrane Central Register of Controlled Trials, PEDro, Pascal, and Francis databases were searched from inception until January 14, 2019 (<u>S1 Table</u> and <u>S1 Protocol</u> for search strategy [44]). Scopus was replaced by Embase because we had no longer access to it. These two databases are both produced by Elsevier and the recall by Scopus of references found by Embase was optimal or suboptimal that is considered as acceptable [48]. Unpublished studies, conferences, and presentations were searched without language restriction.

Study selection

Based on eligibility criteria, two authors (AH, JDM) independently selected the studies. The judgment of three other authors (IB, FG, GR) was used to resolve potential conflicts [44] (S1 Protocol). No language restriction was applied.

Data extraction

Two authors (AH and JDM) independently extracted data; potential conflicts were resolved with the help of three other authors (IB, FG, GR). In case of unclear or missing data, we contacted the authors of the respective studies. Extracted data included: study design, participant characteristics, risk of bias, PT characteristics, and outcomes (S1 Protocol [44]). All outcomes were statistically treated as continuous measures. We extracted the mean value, the standard deviation (SD), and the number of participants to the outcome measurements in each intervention group. The change-from-baseline was used to determine the outcome. Due to poor, variable or incomplete reporting of change score, different methods were used to obtain the mean and SD of changes when necessary. The most parsimonious statistical treatment was preferred. Finally, when only mean and SD values for before and after intervention assessments were given, SD was imputed by using a correlation coefficient with respect to the most conservative approach.

Risk of bias assessment

Two authors (AH and JDM) independently assessed the seven items of the risk of bias tool from the Cochrane Collaboration [27] for each study, and used the Grades of Recommendation, Assessment, Development, and Evaluations (GRADE) as reported in Cochrane Handbook [27] to assess the overall quality of evidence of this meta-analysis. The judgment of two other authors (MC, FG) was used to resolve potential conflicts.

Data synthesis and analysis

Statistical analyses were performed using R (R Foundation for Statistical Computing, Vienna, Austria; available in http://www.R-project.org/; version 3.5.2). Concordance between authors for the selection of studies was estimated using the Cohen's Kappa coefficient and the recommendations of Landis and Kock [49]. Post-intervention effects were investigated by calculating the change from baseline to the immediate post-intervention assessment, and persisting effects by computing the change from baseline to the last follow-up assessment. These changes were compared between groups. The inverse-variance method was applied to summarize effects across studies. The summary effect estimate for all scales was calculated as the mean difference and its 95% confidence interval (95%CI). The estimate for outcomes was calculated as the standardized mean difference (SMD) and its 95%CI [44] because each outcome pooled several scales. We used Hedges'g to calculate SMD. The fixed-effect model was applied by default and the random-effect model was used in case of substantial heterogeneity ($I^2 \ge 50\%$) [44] (S1 Protocol). We summarize effects of crossover trials by following the recommendations of Cochrane Handbook (chapter 16.4) [27]. When several scales were available for the same outcome and to prevent any overweight of a study in a same SMD analysis, we ranked the scales based on the frequency of use in all trials. We selected the most frequent scales.

We performed subgroup analyses according to categories of PT, time post-stroke, and location of stroke lesion. We also performed sensitivity analyses to explore the effects of methodological quality according to appraisal of risk of bias. We investigated publication bias by funnel plots, contour-enhanced funnel plot, and Egger tests [27,50,51]. If publication bias was suspected, we performed the trim and fill method as a form of sensitivity analysis of the pooled estimate [50,52,53]. To determine the impact of the dose of PT, effect estimates were correlated with parameters of duration of PT using meta-regression. We compared PT versus no treatment (NT) and PT versus sham treatment (ST) or usual care (UC), irrespective of the design of study used (direct design, *e.g.* A versus B; or "add-on" design, *e.g.* A+C versus B+C). ST was a placebo treatment or a control treatment different from a PT, such as music or relaxation, delivered using the same protocol as that used in the experimental group. UC was various and non-protocoled standard care freely defined by therapists according to practices at that time.

Results

Study selection

Among the 13,123 records identified, 10,663 single records were screened. For title screening, 8345 studies were excluded because they clearly did not address the topic of stroke or that did not include human subjects, or that the design mentioned in the title was explicitly different from a randomized controlled trial. The reasons for exclusion of records during the abstract screening then the full-text assessment are reported in the flow chart (Fig 1). For assessment of



Fig 1. Flow-chart.

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full-text eligibility, 56 studies were translated by co-authors (Chinese: n = 27, German: n = 6, Korean: n = 5, Spanish: n = 4, Russian: n = 3, Italian: n = 2, Persian: n = 2, Portuguese: n = 2, Turkish: n = 2, Japanese: n = 1, Norwegian: n = 1, Polish: n = 1). A total of 145 studies were selected (Fig 1 and S2 Table). The mean concordance between the two independent authors for the three steps of selection process, was substantial (kappa = 0.64). The authors of 130 of the 145 studies regarding unclear or missing data were contacted; answers were received for 20 studies.

Study and participant characteristics

A total of 91 comparisons of PT versus NT in 76 studies and 81 comparisons of PT versus ST/ UC in 70 studies were analyzed; 1 study was included in both comparisons. Among these 145 studies, 18 were of crossover design and 127 parallel group design; they included a total of 5912 participants (mean: 40.8, SD: 42.9, range: 7–408). Weighted participant age was 60.8 years (SD: 44.3, range: 46.9–78.5; <u>S3 Table</u>).

Risk of bias

Risk of bias was low for random sequence generation in 55% of studies, for allocation concealment in 13% of studies, for blinding outcome assessment in 44% of studies, for incomplete outcome data in 17% of studies, and for selective reporting in 16% of studies. Most studies had a high or unclear risk of bias for blinding of patients and therapists (99%) but a low risk for other bias (92%; S1 Fig and S4 Table). Funnel plots and Egger tests found no evidence of publication bias for PT versus NT on balance, mediolateral postural deviation EO, postural stability EO, or autonomy; whereas for comparison PT versus ST/UC, there was a potential publication bias on balance (post-intervention effects and persisting effects), postural stability EO (postintervention effects), and autonomy (post-intervention effects and persisting effects). The number of unpublished studies estimated by the trim and fill method was 0 for post-intervention effects on postural stability EO and post-intervention effects on autonomy, 1 for postintervention effects on balance, 4 for persisting effects on autonomy, and 9 for persisting effects on balance (S2 Fig and S5 Table).

Physical therapy

Functional task-training (including balance training) and assistive devices were the most common categories of PT that were compared to NT. Functional task-training, musculoskeletal interventions, and sensory interventions were the most common categories of PT that were compared to ST/UC (S6 Table).

Expressed as median values, participants received an additional 300 minutes dispensed in 12 sessions of 20 minutes for 3 weeks (PT versus NT). When PT was compared to ST/UC, treatment was delivered over 570 minutes, and dispensed in 16 sessions of 30 minutes for 5 weeks (S7 Table).

Outcomes/Measures

BBS was the most common scale of balance used in studies for both post-intervention and persisting effects. For autonomy, the Barthel Index was the most frequent scale used. Sixty-four different parameters for WBA, LOS, and COP were identified. Fifty-one of these were assessed in \leq 5 studies and the most common parameter was assessed in 23 studies (S8 Table).

Effects

Balance. PT had a significantly beneficial post-intervention effect compared to NT (37 studies, 1721 participants, SMD 0.46, 95%CI [0.37; 0.56]) with low heterogeneity ($I^2 = 19\%$). Significant positive SMDs were found for constraint-induced therapy, functional task-training, functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention, musculoskeletal intervention with body awareness therapy, and musculoskeletal intervention by active strengthening; and non-significant SMDs for acupuncture, musculo-skeletal intervention by electrostimulation, sensory interventions and other intervention (no significant between-subgroup difference, p = 0.29; Fig 2). There were significant positive SMDs for acute-subacute stroke patient and chronic stroke patient subgroups without significant between-subgroup difference (p = 0.50; S9 Table). A significant positive SMD was found for a subgroup of studies that included only supratentorial stroke patients (S10 Table). There



Test for subgroup differences (fixed effect): $\chi_0^2 = 9.61$, df = 8 (ρ Test for subgroup differences (random effects): $\chi_0^2 = 9.65$, df = 1

Fig 2. Forest plot of PT versus NT. Outcome: Balance, post-intervention effects. Risk of bias: A, Random sequence generation; B, Allocation concealment; C, Blinding of outcome assessment; D, Incomplete outcome data; E, Blinding of participants and therapists; F, Selective reporting; G, Other bias. Risk of bias: green color corresponds to low risk, yellow color unclear risk, and red color high risk. Abbreviations: CI, Confidence interval; SD, Standard deviation; SMD, Standardized mean difference.

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Study	Total	Experi Mean	imental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	AI	Ri B (isk of C D	fbia	s E F	G
Constraint-induced therapy Zhang et al., 2015 Fixed effect model Random effects model Heterogeneity: not applicable	30 30	16.40	8.93	30 30	23.35	10.04	+	-0.72 -0.72 -0.72	[-1.25; -0.20] [-1.25; -0.20] [-1.25; -0.20]	11.9% 11.9% 	10.4% 	•	•	•		•	•
Functional task-training Buyukavci et al., 2016 Fritz et al., 2013 Karasu et al., 2018 Kunkel et al., 2013 Fixed effect model Random effects model Heterogeneity: $t^2 = 0\%$, $t^2 = 0$, $p = 0.46$	32 15 12 4 63	23.90 2.00 9.90 12.80	20.51 12.19 8.35 13.22	32 13 11 3 59	11.10 0.00 0.30 9.30	16.99 8.63 8.95 10.10		0.67 0.18 1.07 0.24 0.60 0.60	[0.17; 1.18] [-0.56; 0.93] [0.18; 1.96] [-1.27; 1.75] [0.23; 0.96] [0.23; 0.96]	12.9% 5.9% 4.2% 1.4% 24.4%	10.6% 7.9% 6.6% 3.2% 						
Functional task-training and Askim et al., 2010 Cabanas-Valdes et al., 2015 Holmgren et al., 2010 Kunkel et al., 2010 Vahlberg et al., 2017 Fixed effect model Random effects model Heterogeneity: $l^{2} = 10\%$, $t^{2} = 0.01$, $p = 0$.	musculo 30 36 15 7 34 122 35	skeletal in 20.30 5.80 -0.20 6.00 1.30	nterventic 16.47 7.95 14.64 5.48 5.40	on and/or 32 32 19 3 33 119	cardiop 21.40 2.50 0.20 9.30 -0.60	ulmonary 17.13 4.64 16.46 10.10 3.40	intervention	-0.06 0.49 -0.02 -0.43 0.41 0.22 0.21	[-0.56; 0.43] [0.01; 0.98] [-0.70; 0.65] [-1.80; 0.94] [-0.07; 0.90] [-0.04; 0.47] [-0.06; 0.49]	13.2% 14.0% 7.1% 1.7% 13.9% 50.0%	10.7% 10.9% 8.6% 3.7% 10.9% 44.8%						
Musculoskeletal intervention Lindvall et Forsberg, 2014 Fixed effect model Random effects model Heterogeneity: not applicable	+ body a 24 24 24	awarenes 3.58	s therapy 3.80	22 22	1.27	3.13		0.65 0.65 0.65	[0.05; 1.24] [0.05; 1.24] [0.05; 1.24]	9.2% 9.2% 	9.6% 9.6%	•		• •		•	•
Musculoskeletal intervention Katz-Leurer et al., 2006 Fixed effect model Random effects model Heterogeneity: not applicable	: active s 10 10	trengther 12.40	ning 3.56	14 14	8.30	4.97		0.89 0.89 0.89	[0.03; 1.75] [0.03; 1.75] [0.03; 1.75]	4.5% 4.5% 	6.8%	•	•	•		•	•
Fixed effect model Random effects model Heterogeneity: $I^2 = 60\%$, $\tau^2 = 0.16$, $p < 0$. Residual heterogeneity: $I^2 = 1\%$, $p = 0.42$ Test for subgroup differences (fixed effect	249 01 2): $\chi_4^2 = 20.57$	7, df = 4 (p < 0	0.01)	244			-3 -2 -1 0 Favours experimental 3	0.27 0.29	[0.09; 0.45] [-0.02; 0.59]	100.0% 	 100.0%						

Fig 3. Forest plot of PT versus NT. Outcome: Balance, persisting effects. Risk of bias: A, Random sequence generation; B, Allocation concealment; C, Blinding of outcome assessment; D, Incomplete outcome data; E, Blinding of participants and therapists; F, Selective reporting; G, Other bias. Risk of bias: green color corresponds to low risk, yellow color unclear risk, and red color high risk. Abbreviations: CI, Confidence interval; SD, Standard deviation; SMD, Standardized mean difference.

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was no significant meta-regression with duration of PT. For each item of bias, removing the studies judged as having high or unclear risk found a similar direction of SMDs favoring PT (except for blinding of patients and therapists because all studies showed a high or unclear risk; <u>S3 Fig</u>).

There was a non-significant SMD between PT and NT for persisting effects (11 studies, 493 participants, SMD 0.29, 95%CI [-0.02; 0.59]) with substantial heterogeneity ($I^2 = 60\%$). A significant between-subgroup difference was found (p<0.01); there were significant positive SMDs for subgroups of functional task-training, of musculoskeletal intervention with body awareness therapy and of musculoskeletal intervention by active strengthening; a significant negative SMD for the subgroup of constraint-induced therapy; and non-significant SMDs for the subgroup of functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention (Fig 3). There was a significant positive SMD for the subgroup of chronic stroke patients and a non-significant SMD for the subgroup of acute-subacute stroke patients, without significant difference between subgroups (p = 0.64; S9 Table).

PT had a significantly beneficial post-intervention effect compared to ST/UC (46 studies, 2051 participants, SMD 0.43, 95%CI [0.28; 0.59]) with substantial heterogeneity ($I^2 = 61\%$). There was a significant between-subgroup difference (p<0.01). There were significant positive SMDs for functional task-training alone or associated with musculoskeletal intervention and/ or cardiopulmonary intervention, musculoskeletal intervention by electrostimulation, and respiratory training; and non-significant SMDs for musculoskeletal intervention by active strengthening or by immobilization and sensory interventions (Fig 4). There were significant positive SMDs for acute-subacute stroke patient and chronic stroke patient subgroups, without between significant between-subgroup difference (p = 0.16; S9 Table). A non-significant SMD was found for a subgroup of studies that included only supratentorial stroke patients (S10 Table).

Study	Total	Mean	SD	Total	Mean	SD	Difference Standardised Mean	SMD	95%-CI	(fixed)	(random)	ABC	DE	F	G
Functional task-training Bunketory-Hail et al., 2017 Bunketory-Hail et al., 2017 Geiger et al., 2010 Geiger et al., 2010 Geiger et al., 2011 Huh et al., 2015 In et al., 2016 Knox et al., 2018 Rajaratham et al., 2013 Schuster et al., 2018 Tripp and Knox 2014 Xie et al., 2018 Random effects model Random effects model	40 41 8 72 15 23 13 13 10 13 12 120 377	0.98 1.80 4.51 4.00 7.90 9.00 0.30 1.00 11.00 8.00	2.79 2.30 6.47 4.38 2.44 3.79 3.80 1.859 15.68 1.70 2.70 2.5 8.89	21 20 8 6 12 12 12 12 24 9 7 7 7 15 124 297	0.12 0.12 -0.88 7.67 2.10 3.50 3.69 1.33 4.00 2.67 1.90 8.87 9.00	2.09 2.09 6.82 3.98 2.41 1.72 14.87 3.65 3.00 3.00 9.08 6.67		0.33 0.74 0.77 0.64 1.10 1.24 0.35 0.44 -0.69 -0.31 0.24 0.23 0.24 0.39	[-0.20; 0.86] [0.19; 1.29] [-0.26; 1.79] [-1.63; 0.61] [-0.19; 1.46] [0.33; 1.86] [-0.33; 1.67] [-0.34; 0.33] [-0.34; 0.26] [-1.24; 0.63] [-1.24; 0.63] [-1.24; 0.63] [-0.39; 0.12] [-0.39; 0.40] [-0.99; 0.68]	2.9% 2.6% 0.8% 0.6% 1.3% 1.1% 3.4% 0.9% 0.9% 0.9% 12.8% 32.6%	2.5% 2.5% 1.4% 1.8% 1.9% 2.1% 1.7% 2.6% 1.6% 1.5% 1.5% 3.3% 				
Functional task-training + other Goliwas et al., 2017 Fixed effect model Random effects model Heterogeneity: not applicable	20 20	5.80	16.51	17 17	3.10	17.91		0.15 0.15 0.15	[-0.49; 0.80] [-0.49; 0.80] [-0.49; 0.80]	1.9% 1.9% 	2.2% 	•••	••	• • •	•
Functional task-training and mu Ambatchen tai al. 2018 Duncan et al. 2008 Globas et al. 2012 Han et al. 2012 Langbarnmer et al. 2009 Construction of the state of the state Shahi et al. 2005 Yatav et al. 2015 Yatav et al. 2015 Yatav et al. 2015 Yatav et al. 2015 Pun et al. 2016 Random effects endel Random effects endel	10 14 18 30 25 32 10 10 12 25 12 18 246	celetal into 12.80 4.36 1.80 16.24 14.30 2.80 1.30 3.20 2.50 4.50 3.02 7.00	4.93 4.71 9.12 13.95 22.56 26.33 1.50 12.09 15.52 6.01 1.72 5.72	and/or ca 10 48 18 26 23 35 14 8 12 26 12 12 18 250	ardiopula 9,40 1.70 -0.90 13.22 9,60 10,00 1.80 1.10 -0.20 -0.80 1.50 2.00	5.26 3.60 16.21 15.10 20.93 22.74 3.50 17.97 8.20 6.01 0.80 3.47	ntervention	0.64 0.63 0.20 0.21 -0.29 -0.17 0.13 0.21 0.87 1.09 1.03 0.37 0.38	[-0.27; 1.54] [-0.45; 0.86] [-0.45; 0.86] [-0.36; 0.78] [-0.77; 0.19] [-0.98; 0.64] [-0.80; 1.06] [-0.59; 1.01] [0.29; 1.44] [0.33; 1.73] [0.19; 0.55] [0.12; 0.64]	1.0% 4.6% 2.9% 2.5% 3.5% 1.2% 0.9% 1.3% 2.4% 1.6% 24.9%	1.6% 2.8% 2.5% 2.5% 2.7% 1.8% 1.5% 1.8% 2.4% 1.7% 2.1% 2.1%				
Musculoskeletal intervention: au Fernandez-Gonzalo et al., 2016 Kamps et Schule, 2005 Knox et al., 2018 Page et al., 2008 Fixed offect model Random effects model Heterogeneity: $l^2 = 84\%$, $l^2 = 0.99$, $p < 0.0$	ctive str 14 16 45 4 79	engthenii 3.77 4.40 6.00 4.00	ng 2.23 12.06 12.73 1.50	15 15 24 3 57	-1.64 1.87 4.00 -1.00	2.23 15.89 14.87 1.70		2.36 0.18 0.15 2.66 0.52 1.05	[1.38; 3.34] [-0.53; 0.88] [-0.35; 0.64] [0.07; 5.24] [0.15; 0.90] [-0.08; 2.18]	0.8% 1.6% 3.3% 0.1% 5.9%	1.5% 2.0% 2.6% 0.3% 				•
Musculoskeltal intervention: el Chen D et al., 2014 Chen D et al., 2014 Cho MK et al., 2015 Cho MK et al., 2015 Chung et al., 2015 Chung et al., 2014 Hwang et al., 2014 Tan et al., 2014 Fixed effect model Random effects model Retergenere, f ² = 32 ⁴ , s ⁴ = 0.21, p = 0.0	ectrosti 18 15 10 10 9 15 6 21 16 120 4	mulation 37.00 31.00 2.30 5.20 14.60 12.13 4.20 1.75 21.90	8.00 10.00 5.87 8.41 3.90 3.44 11.38 1.52 20.11	8 7 11 10 9 15 6 21 15 102	21.00 21.00 1.70 2.30 5.90 8.00 2.00 0.40 8.90	11.00 11.00 7.81 5.87 2.60 2.98 6.86 0.88 24.77		1.73 0.93 0.08 0.38 2.50 1.25 0.22 1.07 0.56 0.89 0.91	[0.75; 2.70] [-0.01; 1.88] [-0.77; 0.94] [-0.50; 1.27] [1.19; 3.81] [0.46; 2.04] [-0.92; 1.35] [0.42; 1.72] [-0.16; 1.28] [0.60; 1.17] [0.49; 1.34]	0.8% 0.9% 1.1% 1.0% 0.5% 0.6% 1.9% 1.6% 9.7%	1.5% 1.5% 1.6% 1.0% 1.8% 1.2% 2.2% 2.2% 1.4.5%				
Musculoskeletal intervention: in Bae et al., 2015 Fixed effect model Random effects model Heterogeneity: not applicable	nmobiliz 15 15	zation 2.75	3.10	15 15	0.75	4.02		0.54 0.54 0.54	[-0.19; 1.27] [-0.19; 1.27] [-0.19; 1.27]	1.5% 1.5% 	2.0%	•••	••	•	•
Respiratory training Lee HJ et al., 2018 Fixed effect model Random effects model Heterogeneity: not applicable	10 10	2.80	1.55	10 10	1.10	1.10		1.21 1.21 1.21	[0.24; 2.18] [0.24; 2.18] [0.24; 2.18]	0.9% 0.9% 	1.5% 1.5%	•••	••	•	•
Sensory intervention Brogarch et al., 2012 Hsu et al., 2013 Kwong et al., 2018 Lau RWK et al., 2018 Lung et al., 2012 Lynch et al., 2007 Mg et al., 2006 YanNes et al., 2006 Fixed effect model Random effects model Random effects model	16 11 40 41 15 10 20 37 27 217	2.10 1.10 2.20 1.50 15.90 2.40 2.30 9.90 16.70	3.44 2.70 5.76 10.58 11.07 11.08 6.28 9.49 19.57	15 12 40 41 15 11 20 39 26 219	-0.30 0.20 2.50 1.20 21.00 -1.00 2.80 8.82 17.40	2.80 1.50 5.26 7.21 8.81 18.49 15.50 13.22 23.46		0.74 0.40 -0.05 0.03 -0.50 0.21 -0.04 0.09 -0.03 0.05 0.05	[0.01; 1.47] [-0.43; 1.23] [-0.49; 0.38] [-0.40; 0.47] [-1.22; 0.23] [-0.65; 1.07] [-0.66; 0.58] [-0.36; 0.54] [-0.57; 0.51] [-0.14; 0.24]	1.5% 1.2% 4.2% 4.3% 1.5% 1.1% 2.1% 4.0% 2.8% 22.7%	2.0% 1.8% 2.8% 2.0% 1.7% 2.3% 2.7% 2.5% 20.5%				
Fixed effect model Random effects model Heterogeneity: $l^2 = 61\%$, $r^2 = 0.17$, $p < 0.0$ Residual heterogeneity: $l^2 = 57\%$, $p < 0.01$ Test for subgroup differences (fixed effect)	1084 $\chi_7^2 = 28.8$	1, df = 7 (p	0.01)	967			-3 -2 -1 0 Favours control 0 Favours experimental 3	0.32 0.43	[0.23; 0.41] [0.28; 0.59]	100.0% 	100.0%				



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There was a significant negative meta-regression between SMD and the number of weeks of PT (p = 0.04; S4 Fig). Removing all studies judged as having high or unclear risk for random sequence generation, blinding of participants and therapists, blinding of outcome assessment, incomplete outcome data, and other bias found a similar direction of SMDs favoring PT, whereas for allocation concealment and selective reporting SMDs became non-significant (S5 Fig). The summary post-intervention effect estimate adjusted for the potential publication bias concerning balance for the comparison PT versus ST/UC was similar and still in favor of PT (1 missing point, SMD 0.43, 95%CI [0.27; 0.58], $I^2 = 61\%$ according to the trim and fill method).

PT had a significantly beneficial persisting effect compared to ST/UC (18 studies, 1150 participants, SMD 0.18, 95%CI [0.06; 0.30]) with moderate heterogeneity ($I^2 = 49\%$). A significant positive SMD was only found for the subgroup of musculoskeletal intervention by electrostimulation (Fig 5). There were significant positive SMDs for acute-subacute stroke patient and chronic stroke patient subgroups (S9 Table); and a non-significant SMD for a subgroup of

Study	Total	Exper Mean	imental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	A	в	Risk C	of b	ias E F	G
Functional task-training Bunketorp-Kall et al., 2017 Hosseini et al., 2012 Knox et al., 2018 Noh et al., 2018 Noh et al., 2018 Kie et al., 2018 Fixed effect model Random effects model Heterogeneity. $F = 35\%$, $\tau^2 = 0.11$, $p = 0$	40 41 15 51 10 120 277	1.21 1.12 6.90 10.00 7.60 8.00	4.00 3.66 3.70 13.74 6.20 11.85	21 20 15 24 10 124 214	0.20 0.20 3.90 5.00 2.20 10.00	2.09 2.09 4.19 15.35 4.00 8.15		0.29 0.28 0.74 0.35 0.99 -0.20 0.09 0.30	[-0.24; 0.82] [-0.26; 0.82] [0.00; 1.48] [-0.14; 0.84] [-0.45; 0.05] [-0.09; 0.28] [-0.05; 0.65]	5.1% 5.0% 2.6% 6.0% 1.6% 22.6% 42.8%	5.6% 5.5% 3.8% 6.0% 9.0% 32.7%						
Functional task-training and Erbil et al., 2018 Langhammer et al., 2009 Stein et al., 2014 Yun et al., 2018 Fixed effect model Random effects model Heterogeneity: $t^2 = 75\%$, $t^2 = 0.41$, $p < 0$	musculo 29 19 10 18 76	skeletal i 2.70 2.20 6.30 13.00	nterventi 1.90 26.33 12.89 6.82	on and/o 14 18 10 18 60	r cardiop 0.70 8.40 3.10 6.10	oulmonary 0.90 23.38 7.47 4.84	r intervention	1.19 -0.24 0.29 1.14 0.59 0.60	[0.50; 1.88] [-0.89; 0.40] [-0.59; 1.17] [0.43; 1.85] [0.23; 0.95] [-0.13; 1.32]	3.0% 3.4% 1.8% 2.8% 11.1%	4.2% 4.5% 3.0% 4.0% 	•	•				
Musculoskeletal intervention Knox et al., 2018 Fixed effect model Random effects model Heterogeneity: not applicable	n: active s 45 45	strengthe 7.00	ning 11.22	24 24	5.00	15.35		0.15 0.15 0.15	[-0.34; 0.65] [-0.34; 0.65] [-0.34; 0.65]	5.8% 5.8% 	6.0%	•	•	•	• •	•	•
Musculoskeletal intervention Tan et al., 2014 Tan et al., 2016 Tan et al., 2016 Fixed effect model Random effects model Heterogeneity: $t^2 = 0\%$, $t^2 = 0$, $p = 0.72$	n: electro 16 29 15 60	stimulatio 25.50 11.00 7.00	on 18.64 9.22 7.81	15 7 7 29	15.40 3.00 3.00	25.00 6.40 6.40		0.45 0.89 0.52 0.60 0.60	[-0.27; 1.16] [0.04; 1.74] [-0.39; 1.43] [0.13; 1.07] [0.13; 1.07]	2.8% 2.0% 1.7% 6.5%	4.0% 3.2% 2.9% 	:	:				
Sensory intervention Hsu et al., 2013 Kwong et al., 2018 Lau RWK et al., 2010 Liang et al., 2012 Lynch et al., 2010 VanNes et al., 2000 Fixed effect model Random effects model Heterogeneity: $I^2 = 0$, $r^2 = 0$, $p = 0.81$	11 40 41 15 10 37 27 181	0.80 2.30 1.30 37.00 2.60 11.27 20.40	2.40 5.70 10.45 10.55 18.77 10.18 18.38	12 40 41 15 11 39 26 184	0.00 2.40 1.30 30.80 0.82 10.67 21.20	2.30 5.33 7.28 8.52 18.55 12.39 22.08		0.33 -0.02 0.00 0.63 0.09 0.05 -0.04 0.08 0.08	[-0.50; 1.15] [-0.46; 0.42] [-0.43; 0.43] [-0.11; 1.36] [-0.77; 0.95] [-0.40; 0.50] [-0.58; 0.50] [-0.13; 0.28]	2.1% 7.4% 7.6% 2.6% 1.9% 7.1% 4.9% 33.8%	3.3% 6.6% 6.7% 3.9% 3.1% 6.5% 5.5% 35.6%						
Fixed effect model Random effects model Heterogeneity: $l^2 = 49\%$, $t^2 = 0.08$, $p < 0$ Residual heterogeneity: $l^2 = 45\%$, $p = 0$. Test for subgroup differences (fixed effect	639 0.01 02 ct): $\chi^2_4 = 9.87$	df = 4 (p = 0	.04)	511			-3 Favours control ⁰ Favours experimental ³	0.18 0.29	[0.06; 0.30] [0.11; 0.47]	100.0% 	 100.0%						

Fig 5. Forest plot of PT versus ST/UC. Outcome: Balance, persisting effects. Risk of bias: A, Random sequence generation; B, Allocation concealment; C, Blinding of outcome assessment; D, Incomplete outcome data; E, Blinding of participants and therapists; F, Selective reporting; G, Other bias. Risk of bias: green color corresponds to low risk, yellow color unclear risk, and red color high risk. Abbreviations: CI, Confidence interval; SD, Standard deviation; SMD, Standardized mean difference.

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studies that included only supratentorial stroke patients (S10 Table). The summary persisting effect estimate adjusted for the potential publication bias on balance for the comparison PT versus ST/UC became non-significant (9 missing points, SMD 0.03, 95%CI [-0.17; 0.23], $I^2 = 67\%$, according to the trim and fill method).

Mediolateral postural deviation. PT had a significantly beneficial post-intervention effect EO compared to NT (11 studies, 329 participants, SMD -0.23, 95%CI [-0.36; -0.09]) without heterogeneity ($I^2 = 0\%$). There were significant negative SMDs for assistive device and functional task-training; and a non-significant SMD for constraint-induced therapy and musculo-skeletal intervention by immobilization; with a significant between-subgroup difference (p = 0.06; Fig 6). There was a significant negative SMD for the subgroup of acute-subacute stroke patients and a non-significant SMD for the subgroup of chronic stroke patients (1 study), without between significant between-subgroup difference (p = 0.34). There was a non-significant SMD for a subgroup of studies that included only supratentorial stroke patients (S9 and S10 Tables). We found no significant meta-regression with duration of PT. Removing all studies judged as having high or unclear risk for incomplete outcome data and other bias showed a similar direction of SMDs favoring PT, whereas for random sequence generation and selective reporting, SMDs became non-significant (S6 Fig).

A non-significant SMD was found between PT and NT for persisting effects EO (3 studies, 50 participants, SMD -0.44, 95%CI [-1.05; 0.16]), without heterogeneity ($I^2 = 0\%$) and significant difference between categories of PT (p = 0.96; Fig 6).

A: PT versus no treatment, post-intervention effects / Crossover RCTs

Study		TE	seTE	Tota	al		Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	Risk of bias A B C D E F G
Assistive devices Laufer, 2003 Milczarek et al., 1993 Milczarek et al., 1993 Milczarek et al., 2009 Waldron et Bohamon, 1989 Wang PY, Vin 1999 Wang PY, Vin Let al., 2005 (par Fixed effect model Random effects model Bandom effects model	rt A) rt B)	0.03 0.05 -0.39 -0.34 -0.70 -0.04 -0.11 -0.25 -0.37 -0.42 -0.13	0.26 0.26 0.39 0.39 0.32 0.32 0.32 0.32 0.32 0.19 0.23 0.18	30 30 14 14 8 20 20 20 20 58 42 61				0.03 0.05 -0.39 -0.34 -0.70 -0.04 -0.04 -0.11 -0.25 -0.37 -0.42 -0.13 -0.21	[-0.47; 0.54] [-0.46; 0.56] [-1.16; 0.38] [-1.11; 0.42] [-1.79; 0.39] [-0.66; 0.58] [-0.74; 0.51] [-0.78; 0.013] [-0.75; 0.013] [-0.37; -0.05] [-0.37; -0.05]	7.2% 7.2% 3.1% 3.2% 4.8% 4.8% 4.8% 4.7% 13.0% 9.3% 14.5% 73.5%	7.2% 7.2% 3.1% 3.2% 4.8% 4.8% 4.8% 4.7% 9.3% 13.0% 9.3% 14.5%	
Constraint-induced therapy Chen CH et al., 2010 Chen CH et al., 2010 Fixed effect model Random effects model Heterogeneity: $l^2 = 22\%, \tau^2 = 0.07, p = 0.26$		-0.87 -0.09	0.52 0.45	10 10				-0.87 -0.09 -0.42 -0.43	[-1.90; 0.16] [-0.97; 0.79] [-1.09; 0.25] [-1.19; 0.33]	1.7% 2.4% 4.1%	1.7% 2.4% 	
Functional task-training Rougier et Boudrahem, 2010 Fixed effect model Random effects model Heterogeneity: not applicable		-0.70	0.23	39			<u></u>	-0.70 -0.70 -0.70	[-1.14; -0.25] [-1.14; -0.25] [-1.14; -0.25]	9.4% 9.4%	9.4% 9.4%	•••••
Musculoskeletal intervention: in Sohn et al., 2015 Sohn et al., 2015 Fixed effect model Random effects model	nmot	0.13 0.04	0.27 0.27	27 27				0.13 0.04 0.09 0.09	[-0.40; 0.67] [-0.49; 0.57] [-0.29; 0.46] [-0.29; 0.46]	6.5% 6.5% 13.0%	6.5% 6.5% 	••••
Heterogenesity: $r = 0\%$, $r = 0, p = 0.81$ Fixed effect model Random effects model Heterogenesity: $r = 0\%$, $r = 0, p = 0.55$ Residual heterogenesity: $r = 0\%$, $p = 0.05$ Test for subgroup differences (laved effect); χ_0^2 Test for subgroup differences (random effects	² ₃ = 7.32): χ ₃ ² =	?, df = 3 (p = 7.28, df = 3 (0.06) p = 0.06)	430				-0.23 -0.23	[-0.36; -0.09] [-0.36; -0.09]	100.0% 	100.0%	
B: PT versus no treatmen	nt, p	Experi Mean	ng effe	Total	Mean	Control	Standardised Mean	SMD	95%-CI	Weight (fixed)	Weight (random)	Risk of bias
Functional task-training Khumsapsiri et al., 2018 Kunkel et al., 2013 Mudie et al., 2002 Mudie et al., 2002 Fixed effect model Random effects model Heterogeneity, I ² = 0%, x ² = 0, p = 0.88	8 4 6 8 6	-4.90 4.90 -0.59 -0.68	10.83 26.52 6.21 4.61	8 2 3 2 15	2.00 6.70 0.82 0.82	5.85 11.04 3.93 3.93		-0.75 -0.06 -0.22 -0.30 -0.44 -0.44	[-1.77; 0.28] [-1.76; 1.64] [-1.61; 1.17] [-1.86; 1.26] [-1.11; 0.23] [-1.11; 0.23]	35.0% 12.7% 18.9% 15.1% 81.7%	35.0% 12.7% 18.9% 15.1% 81.7%	
Functional task-training and mu Kunkel et al., 2013 Fixed effect model Random effects model Heterogeneity: not applicable	6 6 6	oskeleta -0.70	14.74	ntion and/ 3 3	or card 6.70	iopulmona 11.04	ry intervention	-0.48 -0.48 -0.48	[-1.89; 0.94] [-1.89; 0.94] [-1.89; 0.94]	18.3% 18.3%	18.3% 	•••••
Fixed effect model 3 Random effects model Heterogeneity: $I^2 = 0\%$, $p = 0.95$ Residual heterogeneity: $I^2 = 0\%$, $p = 0.88$ rest for subgroup differences (fixed effect): χ Test for subgroup differences (random effects	2 $r_1^2 = 0.0$ s): $\chi_1^2 =$	0, df = 1 (p = 0.00, df = 1	: 0.96) (p = 0.96)	18			³ Favours experimental ⁰ Favours control ³	-0.44 -0.44	[-1.05; 0.16] [-1.05; 0.16]	100.0% 	 100.0%	
C: PT versus sham treatr	nen	t/usual	care,	post-int	erven	tion effe	cts.					
Study To	otal	Mean	rimental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	(fixed)	(random)	Risk of bias
Functional task-training + other Goliwas et al., 2017 Fixed effect model Random effects model Heterogeneity: not applicable	20 20	-3.50	15.46	17 17	-0.20	12.02		-0.23 -0.23 -0.23	[-0.88; 0.42] [-0.88; 0.42] [-0.88; 0.42]	31.5% 31.5%	28.6%	•••••
Functional task-training and mus Furnari et al., 2014 Fixed effect model Random effects model Heterogeneity: not applicable	20 20 20	skeletal i -10.20	nterventi 6.12	on and/or 20 20	cardiop -14.20	oulmonary 16.20	ntervention	0.32 0.32 0.32	[-0.30; 0.94] [-0.30; 0.94] [-0.30; 0.94]	34.1% 34.1% 	29.6%	•••••
Sensory intervention Chan KS et al., 2012 Tilikete et al., 2001 Tilikete et al., 2001 Fixed effect model Random effects model Heteropenety: ² = 24%, s ² = 0.13, n = 0.97	15 5 25	-3.47 -4.24 18.37	4.30 14.04 35.42	15 2 3 20	-0.20 1.38 1.38	2.88 20.09 20.09		-0.87 -0.31 0.47 -0.55 -0.45	[-1.62; -0.12] [-1.96; 1.35] [-0.99; 1.94] [-1.17; 0.07] [-1.24; 0.34]	23.4% 4.8% 6.2% 34.4%	24.5% 7.8% 9.6% 41.8%	
Fixed effect model Random effects model Heterogenety: $l^2 = 38\%_{rs} t^2 = 0.12, p = 0.17$	65			57				-0.15 -0.16	[-0.52; 0.21] [-0.66; 0.34]	100.0% 	100.0%	

Fig 6. Forest plot of PT versus NT and versus ST/UC. Outcome: Mediolateral postural deviation EO. Risk of bias: A, Random sequence generation; B, Allocation concealment; C, Blinding of outcome assessment; D, Incomplete outcome data; E, Blinding of participants and therapists; F, Selective reporting; G, Other bias. Risk of bias: green color corresponds to low risk, yellow color unclear risk, and red color high risk. Abbreviations: CI, Confidence interval; SD, Standard deviation; SMD, Standardized mean difference.

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A non-significant SMD was found between PT and ST/UC for post-intervention effects EO (4 studies, 122 participants, SMD -0.15, 95%CI [-0.52; 0.21]) with moderate heterogeneity ($I^2 = 38\%$). All category of PTs such as functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention, or with another intervention and sensory interventions had non-significant SMDs (Fig 6). There was a significant negative SMD for chronic stroke patients subgroup and a non-significant SMD for acute-subacute stroke patients subgroup (1 study), without significant between-subgroup difference (p = 0.11; S9 Table). A non-significant SMD was found for a subgroup of study that included only supratentorial stroke patients (1 study; S10 Table). There was a positive meta-regression between SMD and the overall duration of PT (5 studies, p = 0.052). Removing all studies judged as having

Study	Total	Exper Mean	imental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	AВ	Risk C E	ofbia	as FG
Acupuncture Tian et al., 2014 Fixed effect model Random effects model Heterogeneity: not applicable	50 50	17.04	15.38	50 50	9.75	17.97		0.43 0.43 0.43	[0.04; 0.83] [0.04; 0.83] [0.04; 0.83]	20.9% 20.9% 	12.5% 12.5%	••	•••	•	••
Functional task-training Cho KH et al., 2012 Cho iH S et al., 2017 Cho iH S et al., 2017 Jung et al., 2018 Khumagasiri et al., 2018 Khumagasiri et al., 2018 Khumagasiri et al., 2018 Song et al., 2016 Song et al., 2014 Song et al., 2014 Tung et al., 2014 Random effects model Random effects model	11 12 12 12 12 12 12 13 12 10 10 10 16 154	-0.12 0.31 0.00 0.01 0.60 3.20 6.79 0.04 0.09 32.10 24.50 9.20	0.21 0.17 0.21 0.13 1.20 35.29 9.87 8.10 0.53 0.06 29.76 37.21 14.60	11 6 11 11 12 15 13 2 5 5 16 131	-0.04 0.06 0.03 -0.10 -0.10 5.67 1.14 -0.08 0.01 21.30 21.30 6.60	0.06 0.05 0.05 0.08 1.61 24.40 28.52 3.25 0.49 0.13 18.26 18.26 18.30		-0.50 1.66 1.30 -0.18 0.48 0.10 0.05 0.89 0.23 0.76 0.38 0.76 0.38 0.15 0.35 0.37	$ \begin{bmatrix} -1.35; \ 0.35] \\ 0.50; \ 2.81] \\ 1.22; \ 2.39] \\ -1.02; \ 0.66] \\ -1.035; \ 1.31] \\ -0.35; \ 1.31] \\ -0.35; \ 1.31] \\ -0.75; \ 0.85] \\ -0.75; \ 0.85] \\ -0.75; \ 0.85] \\ -0.75; \ 0.85] \\ -0.71; \ 0.85; \ 1.17; \\ -0.98; \ 1.17] \\ -0.98; \ 1.17; \\ -0.54; \ 0.85] \\ \hline [0.11; \ 0.59] \\ \hline [0.07; \ 0.66] \\ \hline \end{tabular} $	4.5% 2.5% 4.7% 4.7% 3.4% 5.1% 4.7% 2.8% 2.8% 6.8% 56.2%	5.2% 3.5% 5.4% 4.2% 6.2% 6.0% 3.6% 3.6% 7.0%				
Functional task-training and i Park J et al., 2017 Fixed effect model Random effects model Heterogeneity: not applicable	musculo 13 13	skeletal i 0.37	nterventi 0.28	on and/or 13 13	0.17	ulmonary 0.32	intervention	0.64 0.64 0.64	[-0.15; 1.44] [-0.15; 1.44] [-0.15; 1.44]	5.2% 5.2% 	5.8%	••	• •	•	••
Musculoskeletal intervention Hsieh, 2019 Fixed effect model Random effects model Heterogeneity: not applicable	28 28 28	ation 23.14	36.15	28 28	2.82	28.79		0.61 0.61 0.61	[0.08; 1.15] [0.08; 1.15] [0.08; 1.15]	11.4% 11.4% 	9.4% 	••	••	•	••
Other Salgueiro et Marquez, 2018 Fixed effect model Random effects model Heterogeneity: not applicable	6 6	0.15	0.25	5 5	-0.07	0.25		0.80 0.80 0.80	[-0.45; 2.06] [-0.45; 2.06] [-0.45; 2.06]	2.1% 2.1% 	2.8%	••	• •	•	••
Sensory intervention Morioka et Yagi, 2003 Fixed effect model Random effects model Heterogeneity: not applicable	12 12	11.60	8.80	14 14	1.70	3.80		1.46 1.46 1.46	[0.57; 2.34] [0.57; 2.34] [0.57; 2.34]	4.2% 4.2%	5.0% 	••	••	•	••
Fixed effect model Random effects model Heterogeneity. $t^2 = 29\%$, $t^2 = 0.07$, $p = 0$. Residual heteropeneity. $t^2 = 32\%$, $p = 0.1$ Test for subgroup differences (fixed effect Test for subgroup differences (random eff	263 12 3): $\chi_5^2 = 6.48$, ects): $\chi_5^2 = 5$	df = 5 (p = 0 i.92, df = 5 (p	.26) = 0.31)	241			-3 -1 0 Favours experimental ³	0.47 0.48	[0.29; 0.65] [0.25; 0.70]	100.0% 	 100.0%				
B: PT versus no treatmen	t, persi	sting eff	ects.												
Study	Total	Exper Mean	imental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	A B	Risk C E	ofbia) E	as FG
Functional task-training Chen IC et al., 2002 Karasu et al., 2018 Khumsapsiri et al., 2018 Fixed effect model Random effects model Heterogeneity: $l^2 = 12\%$, $t^2 = 0.02$, $p = 0$.	23 12 8 43	1.06 0.95 -0.80	5.03 1.14 29.30	18 11 8 37	0.78 0.00 -7.50	3.17 0.94 29.14		0.06 0.87 0.22 0.31 0.32	[-0.55; 0.68] [0.01; 1.74] [-0.77; 1.20] [-0.14; 0.76] [-0.16; 0.81]	52.5% 26.8% 20.7% 100.0%	49.8% 28.0% 22.2% 100.0%	•	•		
Fixed effect model Random effects model Heterogeneity: $l^2 = 12\%$, $r^2 = 0.02$, $p = 0$. Residual heterogeneity: $l^2 = 12\%$, $p = 0.3$ Test for subgroup differences (fixed effect Test for subgroup differences (random eff	43 32 2 (): $\chi_0^2 = 0.00$, (ects): $\chi_0^2 = 0$, df = 0 (p = N 0.00, df = 0 (p	IA) = NA)	37			-3 ² ² ¹ ¹ ¹ ¹ ¹ ¹ ² ¹ ¹ ¹ ¹ ² ¹	0.31 0.32	[-0.14; 0.76] [-0.16; 0.81]	100.0% 	 100.0%				

A: PT versus no treatment, post-intervention effects

Fig 7. Forest plot of PT versus NT. Outcome: Postural stability EO. Risk of bias: A, Random sequence generation; B, Allocation concealment; C, Blinding of outcome assessment; D, Incomplete outcome data; E, Blinding of participants and therapists; F, Selective reporting; G, Other bias. Risk of bias: green color corresponds to low risk, yellow color unclear risk, and red color high risk. Abbreviations: CI, Confidence interval; SD, Standard deviation; SMD, Standardized mean difference.

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high or unclear risk for blinding of outcome assessment and blinding of patients and therapists changed the direction of SMDs favoring PT, whereas for incomplete outcome data and other bias, SMDs still were non-significant (<u>S7 Fig</u>). No study investigated persisting effects of PT compared to ST/UC.

Postural stability. PT had a significantly beneficial post-intervention effect EO compared to NT (16 studies, 504 participants, SMD 0.47, 95%CI [0.29; 0.65]) with low heterogeneity ($I^2 = 29\%$). There was a significant positive SMDs for acupuncture, functional task-training, musculoskeletal intervention by mobilization, and sensory interventions; and non-significant SMDs for functional task-training associated with musculoskeletal intervention and/or cardio-pulmonary intervention and for other interventions; without significant between-subgroup difference (p = 0.26; Fig 7). There was a significant positive SMD for acute-subacute stroke patients subgroup, and a non-significant SMD for chronic stroke patients subgroup, without significant between-subgroup difference (p = 1.00; S9 Table). A non-significant SMD was found for a subgroup of study that included only supratentorial stroke patients (S10 Table). There was no significant meta-regression with duration of PT. Removing all studies judged as

having high or unclear risk for random sequence generation, blinding of outcome assessment, incomplete outcome data and other bias showed a similar direction of SMD favoring PT, whereas for concealment allocation and selective reporting, SMDs became non-significant (S8 Fig). For EC, PT had a significantly beneficial post-intervention effect compared to NT (9 studies, 229 participants, SMD 0.34, 95%CI [0.08; 0.61]) without heterogeneity ($I^2 = 0\%$; S9 Fig).

PT had a significantly beneficial post-intervention effect EO compared to ST/UC (15 studies, 574 participants, SMD 0.96, 95%CI [0.55; 1.37]) with substantial heterogeneity ($I^2 = 78\%$). There were significant positive SMDs for functional task-training, musculoskeletal intervention by mobilization, and sensory interventions; and non-significant SMDs for assistive devices, functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention or with another intervention, musculoskeletal intervention by active strengthening and musculoskeletal intervention by immobilization; without significant between-subgroup difference (p = 0.29; Fig 8). There was a significant positive SMD for chronic stroke patients subgroup and a non-significant SMD for acute-subacute stroke patients subgroup, with a significant between-subgroup difference (p = 0.09; <u>S9 Table</u>). We found a non-significant SMD for a subgroup of study that included only supratentorial stroke patients (1 study; S10 Table). There was a significant positive meta-regression between postintervention effects and the overall duration of PT for the subgroup of sensory interventions (S4 Fig). Removing all studies judged as having high or unclear risk for random sequence generation, blinding of outcome assessment, and other bias showed a similar direction of SMD favoring PT, whereas for incomplete outcome data, SMD became non-significant. All studies showed a high or unclear risk of bias for concealment allocation and for blinding of patients and therapists (S10 Fig). The summary post-intervention effect estimate adjusted on the potential publication bias concerning postural stability EO for the comparison PT versus ST/ UC was not changed (0 missing point according to the trim and fill method). Considering the atypical treatment effect of a study, Furnari et al. (2014) [54] compared to other studies, we performed a sensitivity analysis that found a summary SMD still in favor of PT (14 studies, 534 participants, SMD 0.72, 95%CI [0.45; 0.98], $I^2 = 46\%$). For EC, there was a significantly beneficial post-intervention effect of PT (10 studies, 352 participants, SMD 1.02, 95%CI [0.38; 1.67]) with substantial heterogeneity ($I^2 = 86\%$; S9 Fig). A sensitivity analysis removing one study, Furnari et al. (2014) [54], found a summary SMD still in favor of PT (SMD 0.62, 95%CI [0.25; 0.98], $I^2 = 57\%$). For either EO or EC, the persisting effects of PT compared to NT and these of PT compared to ST/UC are reported in Figs 7 and 8 and in S9 Fig.

Other outcomes and quality of evidence. The results of analyses on data extracted for autonomy are presented in <u>S11–S13</u> Figs and in <u>S9</u> and <u>S10</u> Tables. Moreover, the quality of evidence according to GRADE for all outcomes is presented in <u>S11 Table</u>.

Discussion

The present study found that the overall post-intervention effects were in favor of PT compared to NT for balance, mediolateral postural deviation EO, and postural stability (EO or EC), and compared to ST/UC for balance and postural stability (EO or EC) after stroke. Few categories of PT were more effective than NT in improving balance after stroke immediately after intervention. However, caution should be taken when interpreting these results owing to a small number of studies, participants, or substantial heterogeneity within subgroups. The findings therefore only support that functional task-training alone had a beneficial effect in improving balance compared to NT, owing to the absence of heterogeneity and a sufficient number of trials and participants. For instance, a beneficial effect for functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention could be concluded if there

A: PT versus sham treatment/usual care, post-intervention effects.													
Study	Total	Exper Mean	imental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	Risk of bias	
Assistive devices Ferreira et al., 2017 Fixed effect model Random effects model Heterogeneity: not applicable	12 12	8.61	27.44	8 8	-2.97	20.07		0.45 0.45 0.45	[-0.46; 1.35] [-0.46; 1.35] [-0.46; 1.35]	3.8% 3.8%	5.6% 	••••	
Functional task-training Au-Yeung et al., 2009 In et al., 2016 In et al., 2016 Kim JC et Lee, 2018 Fixed effect model Random effects model Heterogenebr, <i>I</i> [*] = 65%, <i>s</i> [*] = 0.25, <i>p</i> = 0	74 13 13 11 111 04	13.86 2.89 7.09 32.33	32.49 2.98 5.48 30.28	62 12 12 10 96	0.41 0.36 0.35 -6.29	32.96 2.55 1.91 18.62		0.41 0.88 1.56 1.46 0.66 0.97	[0.07; 0.75] [0.05; 1.71] [0.65; 2.48] [0.47; 2.44] [0.38; 0.95] [0.35; 1.59]	27.1% 4.6% 3.8% 3.2% 38.7%	7.4% 5.9% 5.6% 5.4% 		
Functional task-training + ot Goliwas et al., 2017 Fixed effect model Random effects model Heterogeneity: not applicable	20 20 20	-2.49	25.35	17 17	-4.70	15.23		0.10 0.10 0.10	[-0.55; 0.75] [-0.55; 0.75] [-0.55; 0.75]	7.5% 7.5%	6.5%	•••••	
Functional task-training and Arabzadeh et al., 2018 Furnari et al., 2014 Fixed effect model Random effects model Heterogeneity: $J^2 = 98\%$, $\tau^2 = 15.76$, $p <$	musculo 10 20 30	skeletal in 6.03 1.89	10.22 0.23	on and/or 10 20 30	cardiop 2.92 0.52	ulmonary 10.97 0.22	intervention	0.28 5.97 1.73 3.09	[-0.60; 1.16] [4.46; 7.48] [0.97; 2.49] [-2.48; 8.66]	4.1% 1.4% 5.4%	5.7% 3.8% 		
Musculoskeletal intervention Lee NK et al., 2013 Lee NK et al., 2013 Fixed effect model Random effects model Heterogeneity: $J^2 = 81\%$, $\tau^2 = 1.57$, $p = 0$	a: active s 11 11 22	trengthen 0.33 0.10	ning 0.10 0.16	6 5 11	0.07 0.07	0.14 0.14		2.15 0.18 0.97 1.13	[0.86; 3.44] [-0.88; 1.24] [0.15; 1.79] [-0.79; 3.05]	1.9% 2.8% 4.7%	4.4% 5.1% 9.5%		
Musculoskeletal intervention Bae et al., 2015 Fixed effect model Random effects model Heterogeneity: not applicable	: immobi 15 15	lization -0.66	0.62	15 15	-1.15	7.18		0.09 0.09 0.09	[-0.62; 0.81] [-0.62; 0.81] [-0.62; 0.81]	6.1% 6.1%	6.3% 	••••	
Musculoskeletal intervention Kim SL et Lee, 2018 Fixed effect model Random effects model Heterogeneity: not applicable	: mobiliz 15 15	ation 5.70	3.18	15 15	2.70	2.98		0.95 0.95 0.95	[0.19; 1.71] [0.19; 1.71] [0.19; 1.71]	5.4% 5.4%	6.1% 6.1%	••••	
Sensory intervention Cho HY et al., 2013 Jung et al., 2017 Lee SW et al., 2013 Park et al., 2014 Tilikete et al., 2001 Tilikete et al., 2001 Fixed effect model Random effects model Reterogeney; $l^2 = 37\%$, $s^2 = 0.11, p = 0$	22 20 16 15 5 83	10.14 21.00 11.91 0.58 -1.07 2.04	16.18 16.35 14.28 0.44 3.24 5.25	20 20 15 14 3 2 74	6.25 8.80 -0.80 0.04 -2.78 -2.78	15.99 13.25 4.73 0.10 5.01 5.01		0.24 0.80 1.15 1.62 0.38 0.78 0.80 0.84	[-0.37; 0.85] [0.16; 1.45] [0.38; 1.92] [0.76; 2.47] [-1.08; 1.83] [-0.97; 2.53] [0.46; 1.13] [0.39; 1.28]	8.5% 7.5% 5.3% 4.3% 1.5% 1.0% 28.2%	6.6% 6.5% 6.1% 5.8% 3.9% 3.2%		
Fixed effect model Random effects model Heterogeneity: $l^2 = 78\%$, $l^2 = 0.55$, $p < 0.1$ Residual heterogeneity: $l^2 = 84\%$, $p < 0.1$ Test for subgroup differences (fixed effec Test for subgroup differences (random eff	308 .01)1 t): $\chi_7^2 = 14.56$ fects): $\chi_7^2 = 8$, df = 7 (p = 0 53, df = 7 (p =	1.04) = 0.29)	266			-3 ² Favours control ⁰ Favours experimental	0.70 0.96	[0.53; 0.88] [0.55; 1.37]	100.0% 	 100.0%		
B: PT versus sham treatm	nent/usu	al care,	persisti	ng effec	ts.								
Study	Total	Experir Mean	mental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	Risk of bias A B C D E F G	
Functional task-training							1						

Study	Total	Mean	SD	Total	Mean	SD	Difference	SMD	95%-CI	(fixed)	(random)	A B C D E F	
Functional task-training Au-Yeung et al., 2009 Fixed effect model Random effects model Heterogeneity: not applicable	74 74	15.34	32.39	62 62	2.40	33.82	#\$\$	0.39 0.39 0.39	[0.05; 0.73] [0.05; 0.73] [0.05; 0.73]	76.0% 76.0% 	76.0%	••••	
Sensory intervention Cho HY et al., 2013 Fixed effect model Random effects model Heterogeneity: not applicable	22 22	1.15	17.40	20 20	-0.56	16.00		0.10 0.10 0.10	[-0.51; 0.71] [-0.51; 0.71] [-0.51; 0.71]	24.0% 24.0% 	24.0% 	••••	
Fixed effect model 9 Random effects model Heterogeneity: $l^2 = 0\%$, $\tau^2 = 0$, $p = 0.4$	1		8	2		r		0.32 0.32	[0.02; 0.62] [0.02; 0.62]	100.0%	100.0%		
Residual heterogeneity: J ² = NA%, p = Test for subgroup differences (fixed ef Test for subgroup differences (random	NA fect): $\chi_1^2 = 0$. effects): χ_2^2	.66, df = 1 (p = 0.66, df = 1	= 0.41) 1 ($\rho = 0.41$)			4	Favours control Favours experimental						

Fig 8. Forest plot of PT versus ST/UC. Outcome: Postural stability EO. Risk of bias: A, Random sequence generation; B, Allocation concealment; C, Blinding of outcome assessment; D, Incomplete outcome data; E, Blinding of participants and therapists; F, Selective reporting; G, Other bias. Risk of bias: green color corresponds to low risk, yellow color unclear risk, and red color high risk. Abbreviations: CI, Confidence interval; SD, Standard deviation; SMD, Standardized mean difference.

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was less heterogeneity. The present study also found limited evidence for the effect on balance compared to ST/UC in patients with stroke. The results allow only to conclude a beneficial effect immediately after intervention of functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention but also the lack of efficacy of sensory interventions (such as vibration or tactile stimulation); substantial heterogeneity precludes conclusions as to the efficacy of functional task-training alone, or of musculoskeletal intervention by electrostimulation. Similarly, for persisting effects of PT, only the lack of efficacy for sensory interventions compared to ST/UC could be concluded. Another point of interest of the present study is the investigation of effects on postural control. We could conclude for post-intervention effects that assistive devices were more effective than NT in reducing mediolateral postural deviation EO, and that functional task-training alone and sensory interventions were, respectively, more effective than NT and ST/UC in increasing postural stability (either EO or EC).

Another point is that the beneficial effect of functional task-training alone on both balance, which is considered as activity according to the ICF, and postural stability (EO or EC), which is considered as body structure function according to the ICF, could suggest a transfer of learning from body structure function to activity level. Van Duijnhoven *et al.* (2016) [42] found ambiguous results for outcomes addressing body structure function and beneficial effects for balance (considered as activity) and suggested an optimization of compensatory balance strategies. Fewer studies (n = 36) were included in their meta-analysis than herein, which may go some way to explain this difference. Another important finding of the present meta-analysis is that with respect to comparisons made between PT and NT, those made between PT and ST/UC had smaller effect sizes and/or greater heterogeneity, which leads us to question whether or not there are specific effects of PT. It should be also noted that the reduction or the non-significance of SMD, in most cases, between post-intervention and persisting effects supports a short-term effect of PT.

Treatment modalities, such as the dose or the way to apply the PT, were very different between studies within a category of PT. This could explain part of the heterogeneity, and a better understanding of the mechanisms of action of the various categories of PT could improve the interpretation of any potential effect. More generally, the weak methodological quality of studies and the absence of significant effect when only studies at a low risk of bias were considered indicates that caution should be taken when interpreting the results. Therefore, implications of the present findings for clinical practice are limited. To address this issue, priority should be given to conduct trials of better methodological quality, especially regarding random sequence generation, allocation concealment [55], blinding outcome [56], and incomplete outcome data. It is also of note that data regarding the included population, therapies, and the size and precision of effects were often unclear or missing in the studies identified herein, and could be a source of the heterogeneity observed. This underlines the importance of the quality of reporting, as also identified by the Stroke Recovery and Rehabilitation Roundtable [57]. The sample size of studies was often too small, increasing the risk of overestimate the effect size [58], and the outcome measures used to assess effects were too wide. Larger, multicenter trials with standardization and consensus of outcome measures, as well as a rigorous control of potential bias, should therefore be conducted to provide more robust data.

Conclusion

PT had beneficial overall post-intervention effects on balance and postural stability after stroke. Only functional task-training associated with musculoskeletal intervention and/or cardiopulmonary intervention and sensory interventions seemed to be immediately effective in improving balance or postural stability respectively. The heterogeneity of PT studied and the weak methodological quality of studies strongly limited the meaning and the confidence in findings.

Supporting information

S1 Checklist. PRISMA 2009 checklist. (DOC) S1 Fig. Risk of bias. (DOCX) S2 Fig. Funnel plots. (DOCX) **S3 Fig. Forest plot of physical therapy versus no treatment.** Outcome: Balance, post-intervention effects. Subgroup: risk of bias. (DOCX)

S4 Fig. Meta-regression of effects of PT according to duration of PT. (DOCX)

S5 Fig. Forest plot of physical therapy versus sham treatment or usual care. Outcome: Balance, post-intervention effects. Subgroup: risk of bias. (DOCX)

S6 Fig. Forest plot of physical therapy versus no treatment. Outcome: Mediolateral postural deviation EO, post-intervention effects. Subgroup: risk of bias. (DOCX)

S7 Fig. Forest plot of physical therapy versus sham treatment or usual care. Outcome: Mediolateral postural deviation EO, post-intervention effects. Subgroup: risk of bias. (DOCX)

S8 Fig. Forest plot of physical therapy versus no treatment. Outcome: Postural stability EO, post-intervention effects. Subgroup: risk of bias. (DOCX)

S9 Fig. Forest plot of physical therapy. Outcome: Postural stability EC, post-intervention effects.

(DOCX)

S10 Fig. Forest plot of physical therapy versus sham treatment or usual care. Outcome: Postural stability EO, post-intervention effects. Subgroup: risk of bias. (DOCX)

S11 Fig. Forest plot of physical therapy. Outcome: Autonomy. Subgroup: Categories of PT. (DOCX)

S12 Fig. Forest plot of physical therapy versus no treatment. Outcome: Autonomy, post-intervention effects. Subgroup: risk of bias. (DOCX)

S13 Fig. Forest plot of physical therapy versus sham treatment or usual care. Outcome: Autonomy, post-intervention effects. Subgroup: risk of bias. (DOCX)

S1 Table. Search strategy in databases. (DOCX)

S2 Table. Identification of studies included in the systematic review and meta-analysis. (DOCX)

S3 Table. Characteristics of studies and participants. (DOCX)

S4 Table. Overall score of risk of bias and ethic statement for each study included. (DOCX)

S5 Table. Results of Egger tests detecting bias of publication. (DOCX)

S6 Table. Description of PT. (DOCX)
S7 Table. Duration of PT. (DOCX)
S8 Table. Outcome measures. (DOCX)

S9 Table. Results of subgroup analyses according to the time since post-stroke. (DOCX)

S10 Table. Results of subgroup analyses according to the location of stroke lesion. (DOCX)

S11 Table. Summary of findings and quality of the evidence. (DOCX)

S1 Protocol. Study protocol published. (PDF)

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