

Supplementary Material

Appendix A: Search strategies

Searches in the databases were conducted on October 20, 2020 using the following strategies:

Medline (Ovid):

- 1) propriocept*.mp.
- 2) exp Proprioception/
- 3) exp Rehabilitation/ or rehabilitation.mp.
- 4) exp Physical Therapy Modalities/
- 5) proprioceptive training.mp.
- 6) training.mp.
- 7) 1 or 2
- 8) perceptual motor learning.mp.
- 9) motor processes.mp.
- 10) exp Kinesthesia/ or kinesthetic perception.mp.
- 11) Discrimination Learning/
- 12) (“form and shape perception”).mp.
- 13) exp Learning/ or learning.mp.
- 14) motor learning.mp.
- 15) exp Central Nervous System Diseases/ or CNS disorders.mp.
- 16) exp Musculoskeletal Diseases/ or musculoskeletal disorders.mp.
- 17) muscular disorders.mp.
- 18) 15 or 16 or 17
- 19) 9 or 18
- 20) 1 or 2 or 10 or 12
- 21) 5 or 8 or 11 or 14

22) 6 or 13 or 21

23) 19 and 20 and 21

24) limit 23 to (humans and yr="2013 -Current" and (chinese or english or german))

25) 20 and 21 26) limit 25 to (humans and yr="2013 -Current" and (chinese or english or german))

27) 1 or 2 or 5

28) 3 or 4

29) 15 or 16 or 17

30) 27 and 28 and 29

31) limit 30 to (humans and yr="2013 -Current" and (chinese or english or german))

32) exp Postural Balance/

33) 1 or 2 or 10 or 12 or 32

34) 21 and 33

35) neuromuscular training.mp.

36) 21 or 35

37) 33 and 36

CINAHL:

(MH proprioception+ OR propriocept*) AND (therapy or treatment or rehabilitation or intervention) AND (learning or training or exercise) NOT Meta-analysis or systematic review in Title or Abstract, limited 2013-current, limited research article & peer reviewed, limit to languages (Chinese, English, German)

SCOPUS:

TITLE-ABS-KEY (propriocept*) AND TITLE-ABS- KEY (human AND (controlled AND study) AND training) AND (LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013)) AND (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE, "German") OR LIMIT-TO (LANGUAGE, "Chinese"))

PsycInfo (Ovid)

1. Proprioception.mp. or exp Proprioception OR (Form and shape perception*).mp. OR (Kinesthetic Perception.mp. or exp Kinesthetic Perception) OR (discrimination/ or cognitive discrimination/ or perceptual discrimination/ or stimulus discrimination/ or discrimination learning/ or perception)

2. (Perceptual motor learning).mp. or exp (Perceptual Motor Learning) OR learning.mp. OR (Proprioceptive training).mp.

3. (Muscular disorders.mp. or exp Muscular Disorders) OR (Motor Processes).mp. or (exp Motor Processes) OR (exp Central Nervous System Disorders)/ or (CNS diseases).mp. OR (Musculoskeletal disorders.mp. or exp Musculoskeletal Disorders)

4. 1 AND 2 AND 3

5. limit 4 to (human and (chinese or english or german) and yr="2013 -Current")

Appendix B: Effect sizes for between-group comparisons showing Cohen's *d* and Hedge's *g*. For studies that applied multiple proprioceptive or motor measures, respectively, only the proprioceptive and motor measure with the largest improvement between pre- and post-intervention measures is shown.

Study	Disease Entity	Outcome Measure	Sample Size		SD _{pooled}	Cohen's <i>d</i>	95 % CI		Hedge's <i>g</i>	95 % CI	
			Control	Training			LL	UL		LL	UL
Active movement/balance											
Alikhani et al., 2019	Healthy adults	Active JPSE	10	12	1.497	1.576	0.717	2.795	1.516	0.556	2.476
		Lower Quadrant Y-Balance test			7.596	†1.438	†0.586	†2.618	†1.383	†0.443	†2.324
Büyükturan et al., 2019	ACL injury (partial)	Active JPSE	29	29	1.265	1.344	0.811	1.982	1.326	0.756	1.896
		International Knee Documentation Committee-2000			16.415	†0.256	†-0.262	†0.794	†0.252	†-0.264	†0.769
Chittrakul et al., 2020	Healthy elderly adults	JPSE	36	36	1.300	2.039	1.517	2.684	2.017	1.447	2.586
		CoP displacement			364.964	1.552	1.061	2.139	1.536	1.001	2.062
Daman et al., 2019	Hypermobility syndrome	Active JPSE	12	12	2.508	1.176	0.373	2.225	1.136	0.269	2.002
		SF-36 - Physical functioning			9.47	†1.197	†0.393	†2.251	†1.156	†0.287	†2.025
Daneshvar et al., 2019	Parkinson's Disease	JPSE	10	10	2.874	0.967	0.092	2.094	0.926	0.000	1.853
		Range of motion knee			12.855	†1.262	†0.382	†2.467	†1.208	†0.249	†2.249
Eymir, Erduran, and Ünver, 2020	Total knee replacement	Active JPSE (day of discharge)	55	58	2.709	0.997	0.620	1.412	0.990	0.599	1.381
		TUG (day of discharge)			26.74	0.430	0.061	0.816	0.427	0.054	0.800
El Shemy, 2018	Cerebral Palsy	Active JPSE	15	15	3.057	1.963	1.191	3.043	1.910	1.039	2.781
		modified TUG			2.876	1.878	1.114	2.938	1.827	0.968	2.686
El-Gohary et al., 2016	Healthy adults	Active JPSE	30	30	1.487	0.874	0.366	1.45	0.863	0.333	1.393
		Stability Index (AP direction)			1.523	1.773	1.224	2.453	1.750	1.152	2.347
El-Gohary et al., 2017	Cerebral Palsy	Passive JPSE	24	24	1.371	0.766	0.200	1.406	0.753	0.167	1.340
		Gross motor function (walking)			4.393	†0.824	†0.257	†1.471	†0.811	†0.221	1.400
		Active JPSE	12	12	1.051	3.331	2.980	5.022	3.215	1.979	4.451

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Hu et al., 2016	Healthy adults	Writing time			6.912	1.071	0.270	2.095	1.034	0.178	1.889
Kumar, Kumar, and Kumar, 2013	Knee osteoarthritis	Active JPSE	22	22	1.961	1.117	0.518	1.833	1.100	0.461	1.732
		Western Ontario and McMaster Universities Osteoarthritis Index			2.971	1.027	0.431	1.731	1.008	0.379	1.637
E. Lee, Cho, and Lee, 2019	Chronic ankle instability	Active JPSE	15	15	N/A	*eta ² =0.14	N/A	N/A	N/A	N/A	N/A
		Stability Index			N/A	*eta ² =0.192	N/A	N/A	N/A	N/A	N/A
Merom et al., 2016	Healthy elderly adults	Active JPSE	147	275	N/A	not sig.	N/A	N/A	N/A	N/A	N/A
		Center of pressure displacement			165.154	†-0.279	†-0.482	†0.078	†0.278	†0.077	†0.479
Salles et al., 2018	Infraspinatus muscle atrophy	Active JPSE	18	18	0.544	2.595	1.822	3.697	2.537	1.651	3.424
		Shoulder external rotation peak torque			6.017	†1.612	†0.929	†2.505	†1.576	†0.824	†2.328
Shiravi et al., 2019	Neck pain	Active JPSE	44	43	0.523	5.736	4.894	6.85	5.686	4.735	6.636
		Isometric scapular upward rotation muscle strength			N/A	not sig.	N/A	N/A	N/A	N/A	N/A
Sohn and Kim, 2015	Healthy adults	Passive JPSE	6	6	N/A	not sig.	N/A	N/A	N/A	N/A	N/A
		Isokinetic knee extension muscle strength†			7.663	†2.505	†1.272	†4.945	†2.313	†0.801	†3.824
Zarei and Norasteh, 2020	Deaf	Active JPSE	10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Single leg stance (eyes closed)			2.155	†1.949	†1.024	†3.367	†1.866	†0.802	†2.931
Somatosensory stimulation Training											
Cho et al., 2015	Knee osteoarthritis	Active JPSE	23	23	4.008	2.670	1.969	3.629	2.624	1.829	3.419
		Pain-free active range of motion			10.847	†1.872	†1.244	†2.684	†1.840	†1.146	†2.533
Fu et al., 2013	ACL reconstruction	Passive JPSE	20	19	N/A	not sig.	N/A	N/A	N/A	N/A	N/A
		Stability Index (AP direction)			1.843	0.873	0.245	1.608	0.856	0.198	1.513
Naderi, Rezvani, and Degens, 2020	Healthy adults	JPSE*	40	40	N/A	0.93	N/A	N/A	N/A	N/A	N/A
		Isokinetic knee extension muscle strength*			N/A	0.66	N/A	N/A	N/A	N/A	N/A
Somatosensory Discrimination Training											
McLean et al., 2017	Hemiplegic Cerebral Palsy	Active JPSE	10	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Goal Attainment Scaling*			N/A	0.79	N/A	N/A	N/A	N/A	N/A
Combined/Multiple System Training											
Akinoğlu et al., 2017	Plantar Fasciitis	Passive JPSE	18	18	1.916	0.819	0.166	1.581	0.801	0.121	1.481
		American Orthopedic Foot and Ankle Society Ankle-Hind foot Score			11.637	†1.308	†0.642	†2.145	†1.279	†0.559	†1.999
		Passive JPSE	20	20	0.985	2.234	1.533	3.189	2.189	1.400	2.979

Alahmari et al., 2020	Ankle Sprain	Knee-to-wall distance (cm)			1.020	†2.942	†2.164	†4.049	†2.883	†1.989	†3.778
Lim, 2019	Stroke	Active JPSE	15	15	2.743	†0.558	†0.016	†1.367	†0.543	†-0.187	†1.272
		Stability Index			0.78	†0.577	†0.141	†1.389	†0.561	†-0.169	†1.292
Wei et al., 2013	ACL relaxation	Passive JPSE	15	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Lysholm Knee Score			7.36	†0.666	†0.039	†1.475	†0.648	†-0.075	†1.372
Meditation											
Chatutain et al., 2019	Healthy elderly adults	Active JPSE	29	29	1.681	1.071	0.549	1.677	1.057	0.506	1.607
		Functional Reach Test			5.064	†2.113	†1.531	†2.857	†2.085	†1.442	†2.727
Cherup et al., 2020	Parkinson's Disease	Joint position sense detection threshold*	18	15	N/A	†0.72	†0.1	†1.4	N/A	N/A	N/A
		Tinetti Score*			3.141	0.77	0.1	1.5	N/A	N/A	N/A
Legend: †Direction of effect size was converted that increment indicates improvement. *effect size reported in study (Cohen's d unless otherwise specified). AP – anterior-posterior; JPSE – Joint position sense error; N/A – data not available; TUG – Timed Up and Go Test.											