

Supplementary Material

Table 1. Main results and raw data of the included studies.

Study	Outcome/Group	Baseline Mean (SD)	Immediate, Less 1 Week After a Single Session Mean (SD)	Short-Term, 1 to 12 Weeks After Treatment Period Mean (SD)	Mid-Term, 12 to 24 Weeks Mean (SD)
Ibuldu et al. 2004	Pain (VAS, 0-10)				
	G1	5.10 (1.97)		3.71 (2.33) (1wk)	
	G2	5.50 (1.96)		2.05 (1.43) (1wk)	
	G3 (N/A)	5.70 (1.81)		3.65 (2.03) (1wk)	
	PPT (kPa)				
	G1	214.76 (93.16)		246.14 (153.96) (1wk)	
	G2	264.77 (69.62)		391.28 (119.64) (1wk)	
	G3 (N/A)	248.10 (40.20)		240.26 (60.80) (1wk)	
	Cervical Flexion (°)				
	G1	51.24 (7.60)		59.67 (10.52) (1wk)	
	G2	56.10 (10.3)		64.15 (9.25) (1wk)	
	G3 (N/A)	55.60 (10.4)		50.84 (10.25) (1wk)	
	Cervical Extension (°)				
	G1	60.90 (15.26)		72.86 (12.18) (1wk)	
	G2	65.05 (9.39)		81.95 (10.84) (1wk)	
G3 (N/A)	63.90 (14.48)		65.70 (13.93) (1wk)		
Ibuldu et al. 2004	Right Cervical Lateral Flexion (°)				
	G1	34.19 (7.63)		41.71 (10.05) (1wk)	
	G2	34.40 (12.18)		52.65 (10.23) (1wk)	
	G3 (N/A)	37.20 (7.05)		41.45 (10.00) (1wk)	
	Left Cervical Lateral Flexion (°)				
	G1	38.10 (8.46)		49.00 (11.29) (1wk)	
	G2	32.80 (10.88)		53.90 (12.35) (1wk)	
	G3 (N/A)	37.45 (9.42)		44.20 (9.66) (1wk)	
	Cervical Lateral Flexion (mean calculated)				
	G1	36.14 (8.04)		45.35 (10.67) (1wk)	
G2	33.6 (11.53)		53.27 (11.29) (1wk)		

	G3 (N/A)	37.32 (8.23)		44.82 (9.83) (1wk)
	Right Cervical Rotation (°)			
	G1	63.71 (16.27)		78.52 (9.94) (1wk)
	G2	60.00 (14.60)		79.25 (9.98) (1wk)
	G3 (N/A)	62.90 (8.84)		73.05 (11.46) (1wk)
	Left Cervical Rotation (°)			
	G1	69.00 (12.58)		77.90 (9.94) (1wk)
	G2	62.45 (15.80)		80.60 (13.19) (1wk)
	G3 (N/A)	66.85 (10.94)		73.80 (10.74) (1wk)
	Cervical Rotation (calculated mean)			
	G1	63.35 (14.42)		78.21 (9.94) (1wk)
	G2	61.22 (15.2)		79.92 (11.58) (1wk)
	G3 (N/A)	64.87 (9.89)		73.42 (11.1) (1wk)
	Pain (VAS, 0-10)			
	G1	6.7 (1.32)		1.1 (0.93) (2wk)
	G2	7.09 (1.4)		5.76 (1.8) (2wk)
	G3 (N/A)	6.41 (2.07)		5.39 (2.3) (2wk)
	G4 (N/A)	6.95 (1.86)		5.16 (2.2) (2wk)
	Disability (NDI)			
Itoh et al. 2007	G1	13.0 (6.3)		3.1 (3.2) (2wk)
	G2	15.1 (2.7)		12.0 (4.5) (2wk)
	G3 (N/A)	12.0 (3.6)		11.1 (5.09) (2wk)
	G4 (N/A)	12.6 (6.0)		10.9 (6.6) (2wk)
	Pain (NPRS, 0-10)			
	G1	5.59 (4.69-6.50)	3.41 (2.31-4.52) (48h)	
	G2	5.40 (4.48 -6.32)	4.60 (3.62-5.58) (48h)	
Myburgh et al. 2012	PPT (kPa)			
	G1	216.58 (120.27)	186.48 (124.19) (48h)	
	G2	168.76 (72.60)	138.55 (28.42) (48h)	
	Pain (VAS, 0-10)			
Tekin et al. 2012	G1	6.6 (1.3)	4.0 (1.6) (48h)	2.2 (2.0) (4wk)
	G2	6.4 (1.6)	5.4 (1.6) (48h)	5.3 (1.8) (4wk)
	Pain (VAS, 0-10)			
	G1	2.9 (2.8)		1.5 (2.8) (4wk)
	G2	3.6 (2.6)		2.2 (2.6) (4wk)
Rayegani et al. 2014				

	PPT (kPa)	266 (72)	374 (101) (4wk)
	G1	255 (82)	328 (94) (4wk)
	G2		
	Pain (NPRS, 0-10)		
	G1	6.2 (1)	0.9 (0.8) (2wk)
	G2	6.2 (1.3)	1.0 (1.1) (2wk)
	Disability (NPQ)		
	G1	19.1 (6.4)	5.4 (3.1) (2wk)
	G2	17.8 (7.3)	5.0 (3.7) (2wk)
	PPT (kPa)		
	G1	188.1 (39.5)	326.2 (39.0) (2wk)
	G2	188.1 (49.4)	247.3 (49.0) (2wk)
	Cervical Flexion (°)		
	G1	54.1 (7.0)	60.2 (6.6) (2wk)
	G2	54.2 (6.9)	59.8 (6.0) (2wk)
Llamas-Ramos et al. 2014	Cervical Extension (°)		
	G1	60.5 (8.02)	68.0 (8.02) (2wk)
	G2	60.7 (7.5)	68.2 (5.1) (2wk)
	Cervical Lateral Flexion (toward treated side) (°)		
	G1	38.8 (3.6)	43.2 (3.8) (2wk)
	G2	39.9 (5.0)	42.9 (3.7) (2wk)
	Cervical Lateral Flexion (away from treated side) (°)		
	G1	38.6 (3.9)	45.4 (3.6) (2wk)
	G2	38.5 (4.95)	44.9 (4.7) (2wk)
	Cervical Lateral Flexion (mean calculated)		
	G1	38.7 (3.75)	44.3 (3.7) (2wk)
	G2	39.2 (4.95)	44.9 (4.7) (2wk)
	Cervical Rotation (°) (toward treated side)		
Llamas-Ramos et al. 2014	G1	63.5 (5.9)	70.0 (2.4) (2wk)
	G2	64.4 (5.5)	70.0 (3.0) (2wk)

	Cervical Rotation (°) (away from treated side)	65.8 (5.4)		70.5 (2.4) (2wk)
	G1	66.6 (5.8)		69.6 (2.9) (2wk)
	G2			
	Cervical Rotation (mean calculated)	64.65 (5.65)		70.25 (2.4) (2wk)
	G1	65.5 (5.65)		69.8 (2.95) (2wk)
	G2			
	Pain (VAS, 0-10)			
	G1	6.56 (1.53)		1.34 (1.93) (1wk)
	G2	6.23 (1.26)		3.05 (2.27) (1wk)
Ziaiefar et al. 2014	PPT (kPa)			
	G1	104.041 (39.324)		161.12 (45.69) (1wk)
	G2	106.597 (38.441)		142.19 (43.54) (1wk)
	Pain (NPRS, 0-10)			
	G1	5.7 (1.8)	3.8 (1.9) (10min)	2.0 (1.7) (1wk)
	G2	5.3 (2.0)	5.5 (2.1) (10 min)	4.6 (2.1) (1wk)
	PPT (kPa)			
	G1	224.8 (100.3)	294.0 (69.6) (10 min)	353.7 (92.3) (1wk)
	G2	285.1 (102.4)	282.0 (109.5) (10 min)	296.1 (89.7) (1wk)
Mejuto-Vázquez et al. 2014	Cervical Flexion (°)			
	G1	58.3 (12.2)	68.3 (13.4) (10min)	67.7 (5.0) (1wk)
	G2	51.2 (9.9)	46.2 (9.5) (10min)	50.6 (7.7) (1wk)
	Cervical Extension (°)			
	G1	65.0 (16.2)	78.8 (12.6) (10min)	80.5 (8.4) (1wk)
	G2	61.8 (13.6)	58.1 (16.0) (10min)	60.2 (16.3) (1wk)
	Cervical Lateral Flexion (toward treated side) (°)			
	G1	36.1 (13.4)	48.3 (6.6) (10min)	51.6 (4.3) (1wk)
	G2	38.7 (12.7)	38.1 (10.0) (10min)	41.2 (10.3) (1wk)
	Cervical Lateral Flexion (away from treated side) (°)			
	G1	39.4 (15.1)	51.6 (9.3) (10min)	52.2(6.6) (1wk)
	G2	36.2 (11.5)	37.5 (12.8) (10min)	42.5 (8.5) (1wk)
	Cervical Lateral Flexion (mean calculated)			
	G1	37.75 (14.25)	49.95 (7.95) (10min)	51.9 (5.45) (1wk)
	G2	37.45 (12.10)	37.8 (11.4) (10min)	41.85 (9.4) (1wk)
	Cervical Rotation (°) (toward treated side)			

Mejuto-Vázquez et al. 2014	G1	55.5 (24.1)	66.6 (15.6) (10min)	72.7 (14.1) (1wk)	
	G2	58.1 (15.1)	53.7 (15.0) (10min)	57.5 (7.0) (1wk)	
	Cervical Rotation (°) (away from treated side)				
	G1	58.8 (23.5)	68.3 (15.4) (10min)	74.4 (8.0) (1wk)	
	G2	59.3 (18.2)	55.1 (18.2) (10min)	58.7 (7.9) (1wk)	
	Cervical Rotation (mean calculated)				
	G1	57.15 (23.8)	67.45 (15.5) (10min)	73.55 (11.05) (1wk)	
	G2	58.7 (16.65)	54.4 (16.6) (10min)	58.1 (7.45) (1wk)	
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	Campa-Moran et al. 2015	VAS Pain (0-10)†			
G1		3.38 (1.17)	3.97 (1.77) (10min)	1.33 (1.47) (1wk)	
G2		5.02 (1.77)	3.82 (1.92) (10min)	3.43 (1.47) (1wk)	
G3		4.21 (1.63)	2.98 (1.77) (10min)	0.94 (1.43) (1wk)	
G2 + G3 (n=24)		4.61 (1.71)	3.4 (1.85)	2.18 (1.90)	
Disability (NDI)					
G1		18.0 (5.4)		12.2 (5.66) (1wk)	
G2		17.4 (4.8)		15.2 (5.66) (1wk)	
G3		18.5 (3.2)		10.0 (5.50) (1wk)	
G2 + G3 (n = 24)		17.95 (4.02)		12.6 (6.06)	
PPT (kPa)†					
G1		292.93 (294.18)	295.48 (188.32) (10min)	316.47 (306.75) (1wk)	
G2		228.04 (107.72)	172.17 (129.11) (10min)	249.92 (152.96) (1wk)	
G3		257.18 (133.22)	344.66 (109.37) (10min)	398.23 (51.80) (1wk)	
G2 + G3 (n = 24)		242.61 (119.41)	258.41 (146.47)	324.07 (134.94)	
Cervical Flexion (°)†					
G1		38.04 (3.68)	39.48 (16.07) (10min)	44.78 (7.88) (1wk)	
G2		40 (15.76)	46.45 (19.37) (10min)	41.04 (14.67) (1wk)	
G3		39.63 (13.41)	45.18 (16.77) (10min)	53.41 (10.48) (1wk)	
G2 + G3 (n = 24)		39.81 (14.31)	45.91 (17.73)	47.22 (13.97)	
Cervical Extension (°) †					
G1		43.39 (14.50)	49.96 (16.26) (10min)	50.62 (15.34) (1wk)	
G2	43.41 (27.25)	40.54 (16.26) (10min)	48.64 (4.27) (1wk)		
G3	53.32 (25.15)	55.49 (29.35) (10min)	60.43 (5.19) (1wk)		
G2 + G3 (n = 24)	48.36 (26.12)	48.01 (24.42)	54.53 (7.60)		
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Pain (NPRS, 0-10)					
G1					

Pecos-Martin et al 2015	G2	5.3 (1.5)	2.6 (1.8) (1wk)	2.1 (1.6) (4wk)	
		5.6 (1.6)	5.3 (1.6) (1wk)	5.1 (1.5) (4wk)	
	Disability (NPQ)				
	G1				
	G2	22.1 (11.4)		9.9 (7.4) (4wk)	
		19.7 (7.9)		19.7 (7.9) (4wk)	
	PPT (kPa)				
	G2	274.58 (49.03)	421.68 (58.83) (1wk)	431.49 (49.03) (4wk)	
	274.58 (58.83)	343.23 (68.64) (1wk)	294.19 (58.83) (4wk)		
Aridici et al. 2016	Pain (VAS, 0-10)				
	G1	7.80 (1.72)		4.58 (1.85) (1wk)	
	G2	7.66 (1.66)		4.20 (2.05) (1wk)	
	Disability (NPDS)				
	G1	66.54 (16.84)		42.74 (20.95) (1wk)	
	G2	66.0 (14.46)		39.56 (19.77) (1wk)	
Segura-Ortí et al. 2016	Pain (VAS, 0-100)				
	G1	36.2 (22.5)		17.7 (14.7) (1wk)	
	G2	46.9 (20.9)		18.6 (10.3) (1wk)	
	G3 (N/A)	34.2 (17.5)		12.3 (9.3) (1wk)	
	PPT (kPa)				
	G1	215.8 (78.5)		245.2 (78.5) (1wk)	
	G2	215.8 (29.4)		245.2 (29.4) (1wk)	
	G3 (N/A)	196.1 (29.4)		225.6 (58.8) (1wk)	
	Disability (NDI)				
	G1	7.2 (3.4)		5.8 (4.2) (1wk)	
	G2	10.2 (7.7)		4.8 (3.1) (1wk)	
G3 (N/A)	8.8 (4.0)		7.0 (3.7) (1wk)		
Hayta et al. 2016	Pain (VAS,0-10)				
	G1	7.1 (1.2)		5.5 (1.2) (4wk)	3.8 (1.1) (12wk)
	G2	7.1 (1.2)		5.7 (1.2) (4wk)	4.2 (1.3) (12wk)
	Disability (NDI)				
	G1	18.4 (7.0)		12.6 (5.6) (4wk)	7.6 (3.7) (12wk)
	G2	19.7 (5.8)		15.9 (5.6) (4wk)	11.1 (5.3) (12wk)
Ziaefar et al. 2016	Pain (NPRS,0-10)				
G1	7.96 (1.52)	7.85 (2.24) [†] (48h)			

	G2	8.26 (1.71)	7.55 (2.17) + (48h)	
	PPT (kPa)			
	G1	104.05 (39.32)	102.57 (47.85) + (48h)	
	G2	106.59 (38.24)	123.17 (42.75) + (48h)	
	Pain (VAS, 0-10)			
	G1	5.00 (1.89)	3.76 (1.70) (72h)	3.05 (1.98) (1wk)
	G2	4.76 (1.72)	2.43 (1.69) (72h)	2.67 (2.30) (1wk)
	G3	4.81 (1.82)	2.48 (1.88) (72h)	2.24 (2.30) (1wk)
Fernández-Carnero et al. 2017	G1 + G2 + G3 (n=63)	4.85 (1.77)	2.88 (1.83) (72h)	2.65 (2.09) (1wk)
	G4	4.81 (1.86)	3.33 (2.45) (72h)	3.52 (2.35) (1wk)
	Disability (NDI)			
	G1	12.76 (7.09)		7.05 (3.51) (1wk)
	G2	12.14 (4.94)		7.14 (4.44) (1wk)
	G3	11.05 (5.01)		7.19 (5.95) (1wk)
	G1 + G2 + G3 (n=63)	11.98 (5.71)		7.12 (4.66) (1wk)
	G4	11.62 (5.94)		8.19 (6.00) (1wk)
	PPT (kPa)			
	G1	176.51 (93.16)	174.55 (110.81) (72h)	183.38 (85.31) (1wk)
	G2	176.51 (59.82)	182.40 (73.54) (72h)	187.30 (108.85) (1wk)
	G3	204.95 (100.02)	236.33 (152.98) (72h)	243.37 (137.29) (1wk)
	G1 + G2 + G3 (n=63)	185.99 (85.80)	197.75 (118.41) (72h)	204.68 (114.07) (1wk)
	G4	178.48 (90.22)	163.77 (85.31) (72h)	181.42 (85.31) (1wk)
Fernández-Carnero et al. 2017	Cervical Flexion (°)			
	G1	48.66 (11.62)	49.06 (10.44) (72h)	47.61 (11.49) (1wk)
	G2	51.44 (7.85)	54.92 (7.82) (72h)	52.65 (8.09) (1wk)
	G3	48.41 (10.66)	49.76 (11.02) (72h)	50.79 (11.03) (1wk)
	G1 + G2 + G3 (n = 63)	49.50 (10.09)	51.24 (10.04) (72h)	50.35 (10.36) (1wk)
	G4	47.87 (12.11)	47.16 (9.09) (72h)	49.20 (10.81) (1wk)
	Cervical Extension (°)			
	G1	58.15 (18.83)	58.03 (13.93) (72h)	62.85 (14.79) (1wk)
	G2	59.25 (13.96)	62.82 (13.07) (72h)	64.12 (12.71) (1wk)
	G3	58.47 (13.18)	58.73 (14.69) (72h)	61.03 (13.55) (1wk)
	G1 + G2 + G3 (n = 63)	58.62 (15.27)	59.85 (13.84) (72h)	62.66 (13.54) (1wk)
	G4	59.52 (16.60)	60.22 (13.97) (72h)	60.06 (14.97) (1wk)
	Lateral Flexion (°)			
	G1	36.11 (8.05)	37.80 (5.35) (72h)	38.57 (6.7) (1wk)
	G2	39.27 (5.16)	53.27 (7.72) (72h)	41.70 (5.58) (1wk)

Fernández-Carnero et al. 2017	G3	39.76 (7.95)	40.76 (6.89) (72h)	41.13 (7.55) (1wk)	
	G1 + G2 + G3 (n = 63)	38.38 (8.01)	43.94 (9.45) (72h)	40.46 (6.69) (1wk)	
	G4	38.79 (9.67)	39.58 (9.45) (72h)	40.17 (9.48) (1wk)	
	Cervical Rotation (°)				
	G1	58.44 (11.8)	59.76 (8.69) (72h)	58.83 (9.85) (1wk)	
	G2	62.78 (6.60)	66.36 (6.68) (72h)	66.51 (7.75) (1wk)	
	G3	60.10 (8.83)	62.09 (7.52) (72h)	62.96 (6.71) (1wk)	
	G1 + G2 + G3 (n = 63)	60.44 (9.34)	62.73 (8.03) (72h)	62.76 (8.66) (1wk)	
	G4	59.76 (9.60)	57.25 (12.08) (72h)	58.58 (11.61) (1wk)	
	De Meulemeester et al. 2017	Pain (NPRS, 0-10)			
G1		4.70 (1.81)		3.59 (2.06) (12wk)	
G2		5.86 (1.36)		4.19 (1.97) (12wk)	
Disability (NDI)					
G1		11.00 (5.12)		7.71 (4.66) (4wk)	8.06 (5.08) (12wk)
G2		13.14 (4.60)		10.95 (4.63) (4wk)	9.09 (4.35) (12wk)
PPT (kPa)					
G1		196.2 (72.6)	164.6 (69.7) (10 min)	240.01 (84.5) (4wk)	
G2		162 (59.6)	165.9 (68.7) (10 min)	214.7 (81.8) (4wk)	
Sobhani et al. 2017		Pain (VAS, 0-100)			
	G1	56.1 (19.3)		39.2 (20) (5wk)	
	G2	53.8 (16.0)		33.8 (12.6) (5wk)	
	G3	61.5(18.1)		36.9 (14.9) (5wk)	
	Disability (NDI)				
	G1	21.6 (4.8)		16.7 (3.9) (5wk)	
	G2	24.4 (7.6)		19.6 (6.5) (5wk)	
	G3	26.6 (7.8)		21.4 (6.0) (5wk)	
	Cervical Flexion (°)				
	G1	49.2 (8.8)		55.1 (7.6) (5wk)	
G2	47.7 (11.6)		52.7 (10.8) (5wk)		
G3	46.7 (9.3)		50.6(10.2) (5wk)		
Sobhani et al. 2017	Cervical Extension (°)				
	G1	49.4 (8.0)		53.1 (7.6) (5wk)	
	G2	46.8 (8.7)		51.1 (8.4) (5wk)	
G3	47.6 (10.3)		53.5 (8.8) (5wk)		
Right Cervical Lateral Flexion (°)					
G1	37.6 (6.0)		41.9 (6.3) (5wk)		
G2	35.4 (6.8)		39.5 (6.5) (5wk)		

	G3	35.3 (6.3)		39.9 (6.0) (5wk)	
	Left Cervical Lateral Flexion (°)				
	G1	37.1 (5.5)		39.8 (5.5) (5wk)	
	G2	34.1 (6.4)		37.2 (6.1) (5wk)	
	G3	32.5 (6.1)		35.6 (5.8) (5wk)	
	Cervical Lateral Flexion (mean calculated)				
	G1	37.35 (5.75)		40.85 (5.9) (5wk)	
	G2	34.75 (6.6)		38.35 (6.3) (5wk)	
	G3	33.9 (6.2)		37.75 (5.9) (5wk)	
	Right Cervical Rotation (°)				
Sobhani et al. 2017	G1	75.3 (7.5)		77.8 (7.3) (5wk)	
	G2	75.0 (9.9)		83.3 (8.6) (5wk)	
	G3	73.1 (5.3)		74.4(4.9) (5wk)	
	Left Cervical Rotation (°)				
	G1	75.0 (6.5)		77.5 (6.1) (5wk)	
	G2	74.7 (8.7)		82.3 (6.8) (5wk)	
	G3	72.2 (4.8)		74.5 (5.2) (5wk)	
	Cervical Rotation (°) (mean calculated)				
	G1	75.15 (7)		77.65 (6.7) (5wk)	
	G2	74.85 (9.35)		82.8 (7.7) (5wk)	
	G3	72.65 (5.05)		74.45 (5.05) (5wk)	
	Pain (VAS, 0-10)				
	G1	3.78 (1.18)	2.78 (1.07) (10min)	1.91 (1.00) (1mo)	1.69 (1.03) (12wk)
	G2	3.57 (1.04)	2.93 (0.94) (10min)	1.73 (0.91) (1mo)	1.50 (0.82) (12wk)
	PPT (kPa)				
	G1	198.63 (35.16)	246.03 (46.91) (10min)	317.09 (49.82) (1mo)	320.84 (46.08) (12wk)
	G2	206.90 (34.24)	253.10 (51.26) (10min)	320.13 (61.15) (1mo)	316.97 (52.37) (12wk)
Luan et al. 2019	Disability (NDI)				
	G1	15.31 (2.44)		9.38 (2.46) (1mo)	9.47 (1.87) (12wk)
	G2	15.37 (2.04)		9.57 (1.77) (1mo)	9.07 (1.70) (12wk)
	Pain (VAS, 0-100)				
	G1	36.7 (25.6)		10.75 (3.39, 18.11) (4wk)	
	G2	45.4 (28.1)		16.98 (7.92, 26.60) (4wk)	
	PPT (kPa)				

Dogan et al. 2019	G1	313.81 (78.45)		382.4 (323.6, 441.2) (4wk)
	G2	294.19 (107.87)		402 (343.2, 451.1) (4wk)
	Cervical Lateral Flexion (°)			
	G1	40 (30-50)		45.8 (43.2, 48.8) (4wk)
	G2	40 (25-50)		46.7 (44.1, 49.4) (4wk)
	Disability (NDI, %)			
G1	32.6 (13.8)		15.3 (10.2, 20.4) (4wk)	
G2	31.2 (11.3)		14.8 (10.25, 18.8) (4wk)	
Manafnezhad et al. 2019	Pain (VAS, 0-10)			
	G1	7.5 (1.7)		3.79 (2.20) (1wk)
	G2	7.3 (1.3)		3.89 (2.16) (1wk)
	Disability (NDI)			
	G1	28.2 (10.2)		15.29 (8.85) (1wk)
	G2	25.6 (11.3)		16.75 (11.69) (1wk)
	PPT (kPa)			
	G1	225.55 (72.56)		338.32 (100.02) ^a (1wk)
	G2	231.43 (94.14)		314.79 (113.75) ^a (1wk)
	Martín-Rodríguez et al, 2019	Pain (VAS, 0-10)		
G1		2.5 (1.86)	2.5 (2.16) (24h)	1.7 (2.16) (4wk)
G2		3.6 (2.20)	3.9 (2.45) (24h)	1.4 (1.53) (4wk)
Disability (NDI)				
G1		17.1 (12.23)		11.9 (9.02) (4wk)
G2		23.2 (13.83)		16.0 (12.85) (4wk)
Cervical Flexion (°)				
G1		55.0 (9.68)	51.9 (11.41) (24h)	54.2 (14.57) (4wk)
G2		55.1 (11.26)	49.4 (9.97) (24h)	52.8 (14.57) (4wk)
Cervical Extension (°)				
G1		63.4 (14.10)	66.8 (12.11) (24h)	63.8 (13.47) (4wk)
G2		59.7 (14.179)	57.1 (9.35) (24h)	58.7 (14.84) (4wk)
Right Cervical Lateral Flexion (°)				
G1		36.8 (6.00)	38.4 (10.89) (24h)	38.6 (7.40) (4wk)
G2		41.0 (11.60)	38.6 (9.42) (24h)	38.5 (7.66) (4wk)
Left Cervical Lateral Flexion (°)				
G1	40.4 (6.53)	41.1 (10.93) (24h)	41.8 (7.93) (4wk)	

	G2	45.7 (9.32)	42.2 (7.28) (24h)	40.3 (8.09) (4wk)
	Cervical Lateral Flexion (mean calculated)			
	G1	38.6 (6.26)	39.75 (10.91) (24h)	40.2 (7.66) (4wk)
	G2	43.35 (10.46)	40.4 (8.35) (24h)	39.4 (7.87) (4wk)
Martín-Rodríguez et al, 2019	Right Cervical Rotation (°)			
	G1	66.3 (9.50)	61.9 (13.79) (24h)	68.9 (9.12) (4wk)
	G2	59.6 (14.32)	63.3 (10.36) (24h)	67.7 (9.25) (4wk)
	Left Cervical Rotation (°)			
	G1	66.2 (12.15)	65.9 (12.74) (24h)	65.6 (9.91) (4wk)
	G2	61.1 (13.08)	65.2 (11.18) (24h)	64.9 (8.31) (4wk)
	Cervical Rotation (mean calculated)			
	G1	66.25 (10.82)	63.9 (13.26) (24h)	67.25 (9.51) (4wk)
	G2	60.35 (13.7)	64.25 (10.77) (24h)	66.3 (8.78) (4wk)
	Pain (VAS, 0-10)			
	G1	6.51 (0.37)		3.3 (0.24) (2wk)
	G2	6.64 (0.82)		4 (0.85) (2wk)
	G3	6.5 (0.78)		2.96 (0.3) (2wk)
Tabatabaiee et al. 2019	PPT (kPa)			
	G1	111.89 (54.91)		185.34 (29.41) (2wk)
	G2	113.26 (54.91)		158.86 (82.37) (2wk)
	G3	112.08 (81.39)		181.61 (35.30) (2wk)
	Ipsilateral Cervical Lateral Flexion (°)			
	G1	37.84 (0.76)		42.68 (0.47) (2wk)
	G2	37.74 (0.73)		40.69 (0.92) (2wk)
	G3	37.76 (0.87)		43.21 (0.42) (2wk)
	Contralateral Lateral Flexion (°)			
	G1	36.67 (0.64)		43.66 (0.49) (2wk)
	G2	36.4 (0.91)		41.54 (0.68) (2wk)
	G3	36.21 (0.84)		43.8 (0.83) (2wk)
	Cervical Lateral Flexion (mean calculated)			
	G1	37.25 (0.7)		43.17 (0.48) (2wk)
Tabatabaiee et al. 2019	G2	37.07 (0.82)		41.11 (0.8) (2wk)
	G3	36.98 (0.85)		43.5 (0.62) (2wk)
	Ipsilateral Cervical Rotation (°)			

	G1	69.37 (0.86)	73.03 (0.8) (2wk)
	G2	69.1 (0.93)	76.39 (0.55) (2wk)
	G3	68.96 (1.09)	76.22 (0.92) (2wk)
	Contralateral Cervical Rotation (°)		
	G1	71.33 (0.74)	75.68 (0.56) (2wk)
	G2	70.58 (0.47)	73.55 (0.90) (2wk)
	G3	71.19 (0.79)	75.44 (0.64) (2wk)
	Cervical Rotation (mean calculated)		
	G1		
	G2	70.35 (0.8)	74.05 (0.68) (2wk)
	G3	69.84 (0.7)	74.97 (0.72) (2wk)
		70.07 (0.94)	75.83 (0.78) (2wk)
	Pain (NPRS, 0-10)		
	G1	6.4 (1.6)	3.1 (2.4) (4wk)
	G2	6.8 (1.6)	2.7 (2.8) (4wk)
	Disability (NDI)		
	G1	13.4 (4.9)	6.9 (4.9) (4wk)
	G2	16.8 (7.9)	5.6 (4.4) (4wk)
	Cervical Flexion (°)		
	G1	68.0 (6.2)	69.1 (3.7) (4wk)
	G2	57.8 (13.9)	63.3 (8.6) (4wk)
Onat et al. 2019	Cervical Extension (°)		
	G1	58.3 (6.9)	59.7 (2.91) (4wk)
	G2	52.2 (9.5)	57.8 (5.4) (4wk)
	Right Cervical Lateral Flexion (°)		
	G1	43.6 (4.2)	45.0 (0.0) (4wk)
	G2	39.0 (7.6)	45.9 (5.6) (4wk)
	Left Cervical Lateral Flexion (°)		
	G1	43.9 (3.6)	45.0 (0.0) (4wk)
	G2	38.8 (7.8)	45.9 (5.6) (4wk)
	Cervical Lateral Flexion (mean calculated)		
	G1	43.75 (7.8)	45 (0.0) (4wk)
	G2	38.9 (7.7)	45.9 (5.6) (4wk)
	Right Cervical Rotation (°)		
	G1	77.5 (10.5)	78.9 (4.6) (4wk)
	G2	65.5 (17.4)	78.1 (6.1) (4wk)
Onat et al. 2019			

	Left Cervical Rotation (°)			
	G1	76.3 (11.3)		79.1 (3.7) (4wk)
	G2	65.5 (17.1)		78.1 (6.1) (4wk)
	Cervical Rotation (mean calculated)			
	G1	76.9 (10.9)		79 (4.15) (4wk)
	G2	65.5 (17.25)		78.1 (6.1) (4wk)
	Pain (VAS, 0-10)			
	G1	6.56 (1.63)		2.4 (1.74) (12wk)
	G2	6.23 (1.26)		3.33 (2.22) (12wk)
ZiaEIFar et al. 2019	Disability (NPQ)			
	G1	2.65 (9.9)		13.17 (11.5) (1wk)
	G2	33 (7.09)		21.39 (12.36) (1wk)
				12.4 (8.6) (12wk)
				19.32 (12.20) (12wk)
	Pain (NPRS, 0-10)			
	G1	6.8 (1.7)		2.6 (2.2) (3wk)
	G2	7.2 (1.6)		3.4 (2.1) (3wk)
Sukareechai et al. 2019	PPT (kPa)			
	G1	537.48 (142.14)		644.09 (128.81) (3wk)
	G2	519.71 (177.68)		657.41 (168.79) (3wk)
	Pain (NPRS,0-10)			
	G1	5.5 (1.4)	4.7 (2.1) (24h)	3.4 (2.2) (4wk)
	G2	5.7 (1.7)	5.1 (1.9) (24h)	4.8 (2.1) (4wk)
Arias-Buría et al. 2020	Disability (NDI)			
	G1	21.7 (2.2)		16 (2.0) (4wk)
	G2	20.0 (2.1)		16.0 (1.9) (4wk)
	Pain (VAS, 0-10)			
	G1	5.79 (1.89)		2.38 (1.85) (4wk)
	G2 (N/A)	5.52 (1.80)		1.17 (1.12) (4wk)
	G3	5.26 (1.46)		3.85 (2.38) (4wk)
				3.91 (2.50) (12wk)
Valiente Castrillo et al. 2020	Disability (NDI)			
	G1	17.45 (4.94)		12.00 (5.68) (4wk)
	G2 (N/A)	15.80 (4.62)		7.19 (6.56) (4wk)
	G3	16.78 (5.32)		13.21 (7.26) (4wk)
				11.0 (6.06) (12wk)
				7.57 (5.33) (12wk)
				13.78 (8.78) (12wk)
	Pain (VAS, 0-10)			
	G1	5.01 (1.52)	2.28 (1.58) (48h)	2.26 (1.55) (1wk)
	G2	4.56 (1.73)	2.04 (1.69) (48h)	1.71 (1.29) (1wk)
	Disability (NDI)			

	G1	19.64 (7.32)		13.09 (7.45), (1wk)
	G2	22.09 (9.75)		12.27 (8.20) (1wk)
	PPT (kPa)			
	G1	194.17 (54.91)	266.73 (45.09) (48h)	264.77 (50.99) (1wk)
	G2	206.80 (50.99)	376.57 (42.16) (48h)	409.91 (45.11) (1wk)
	Cervical Flexion (°)			
	G1	44.83 (9.85)	48.36 (9.31) (48h)	47.27 (8.41) (1wk)
	G2	44.59 (11.25)	54.73 (6.39) (48h)	51.27 (7.59) (1wk)
García-de-Miguel et al. 2020	Cervical Extension (°)			
	G1	50.72 (9.72)	57.32 (7.49) (48h)	58.05 (7.95) (1wk)
	G2	52.81 (13.90)	56.64 (11.37) (48h)	57.68 (11.26) (1wk)
	Cervical Rotation (°)			
	G1	55.19 (13.62)	67.18 (11.00) (48h)	66.32 (9.81) (1wk)
	G2	60.53 (12.48)	70.95 (8.52) (48h)	70.11 (8.42) (1wk)
	Cervical Lateral Flexion (°)			
	G1	36.44 (5.56)	40.09 (5.30) (48h)	40.70 (4.68) (1wk)
	G2	37.97 (4.36)	41.04 (5.08) (48h)	41.38 (5.56) (1wk)

BDI; Beck Depression Inventory; PCS: Pain Catastrophism Scale; VAS: Visual Analogue Scale; GDS-SF: Korean version of geriatric depression scales; wk.: Weeks; ROM: Range of Motion; PPT: Pressure Pain Threshold; NDI: Neck Disability Index; NPRS: Numeric Pain Rating Scale; NPQ: Northwick Park Neck Pain Questionnaire; NPDS: Neck Pain and Disability Score.* Converted to mean and standard deviation values from median and interquartile range

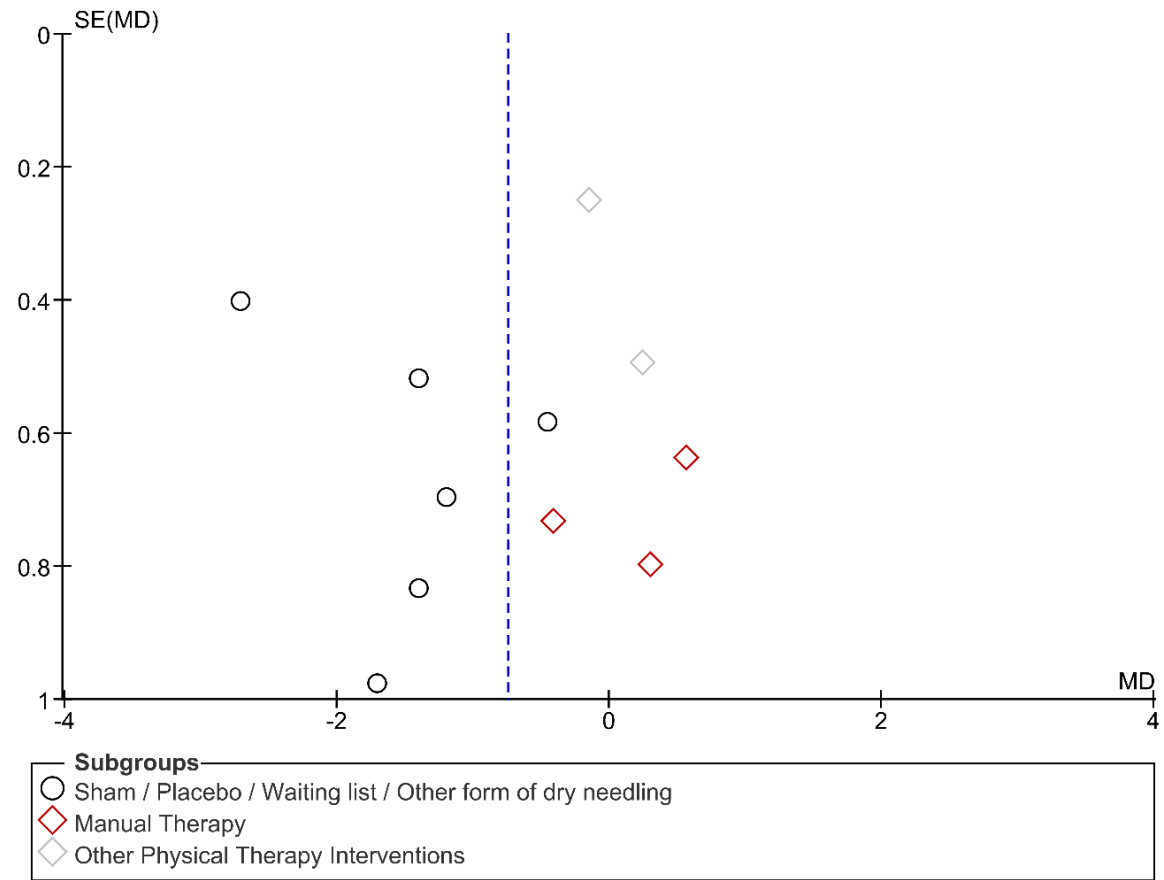


Figure 1. Funnel Plot of the trials ($n = 11$) investigating the immediate effects of dry needling on pain intensity. The funnel plot showed small asymmetry not associated to potential publication bias. SE:Standard error; MD: Mean difference.

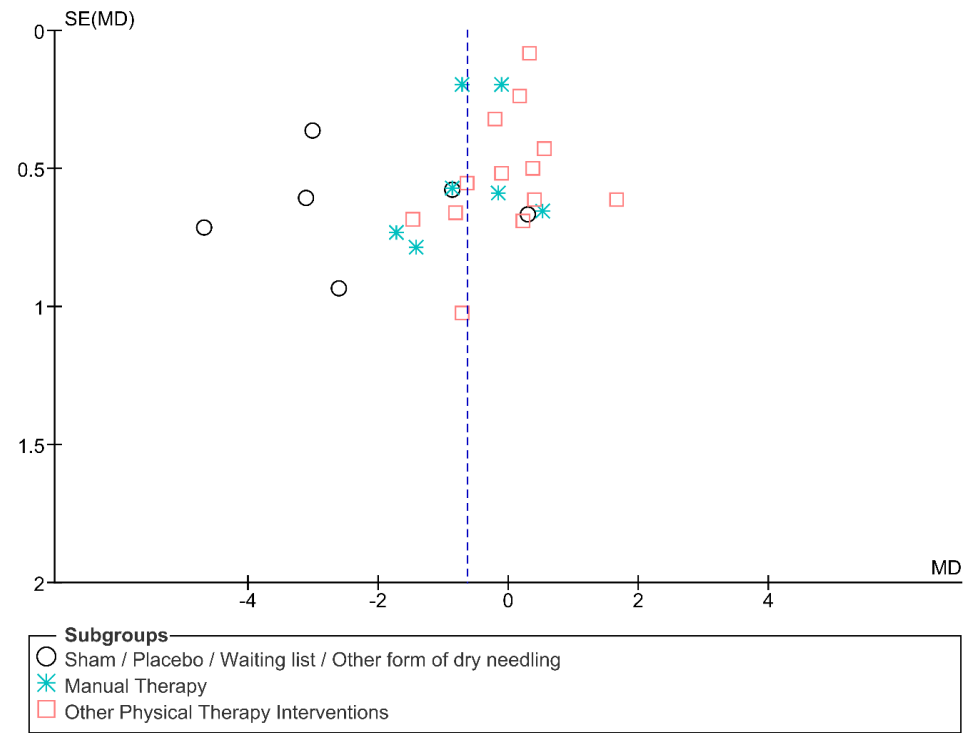


Figure 2. Funnel Plot of the trials ($n=25$) investigating the short-term effects of dry needling on pain intensity. The funnel plot showed small asymmetry not associated to potential publication bias. SE:Standard error; MD: Mean difference.

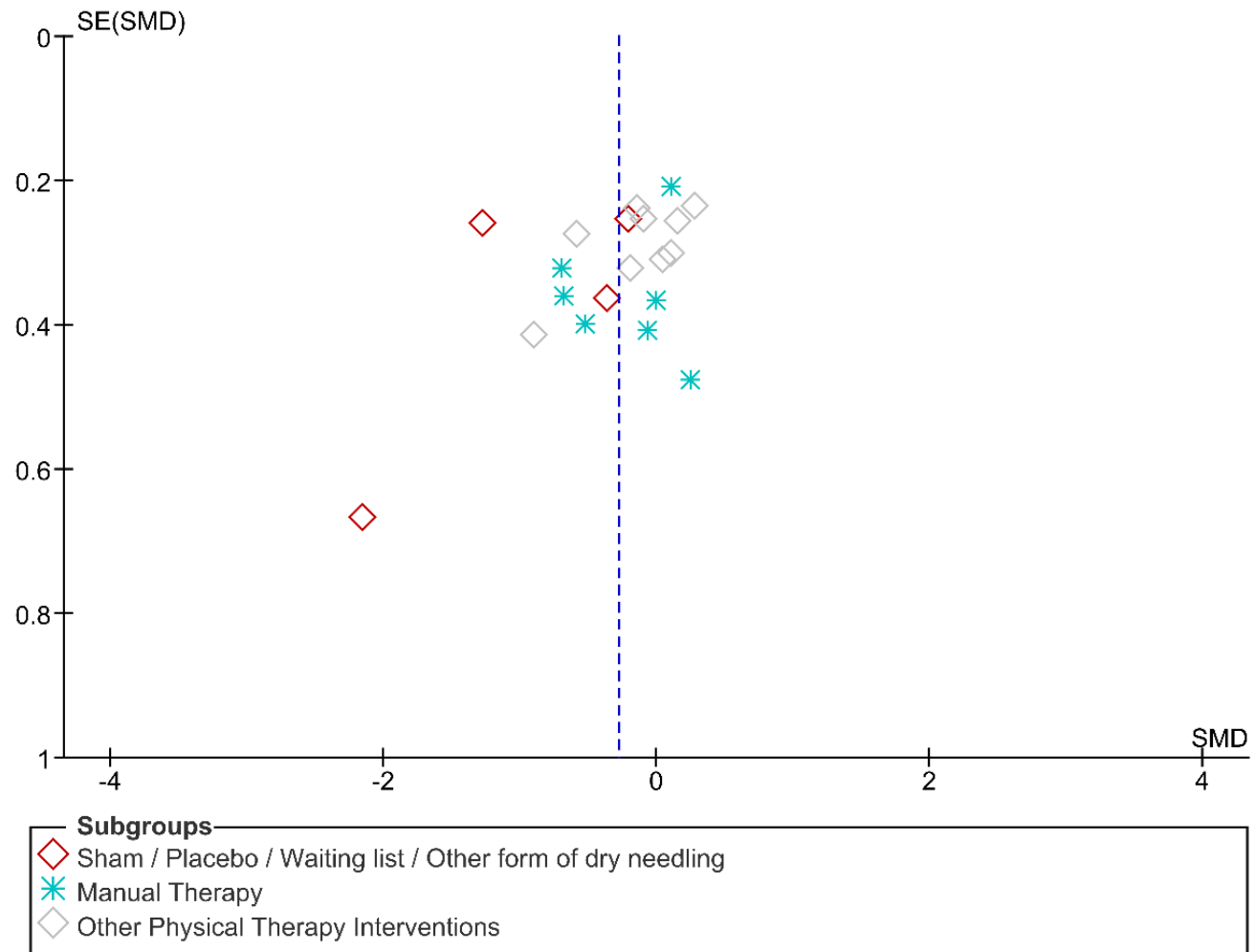


Figure 3. Funnel Plot of the trials ($n = 20$) investigating the short-term effects of dry needling on pain-related disability. The funnel plot showed asymmetry due to the study by Itoh et al 2007, therefore, it was associated to potential publication bias. The exclusion of this study would tend to a symmetric funnel plot. SE:Standard error; SMD: Standard mean difference.

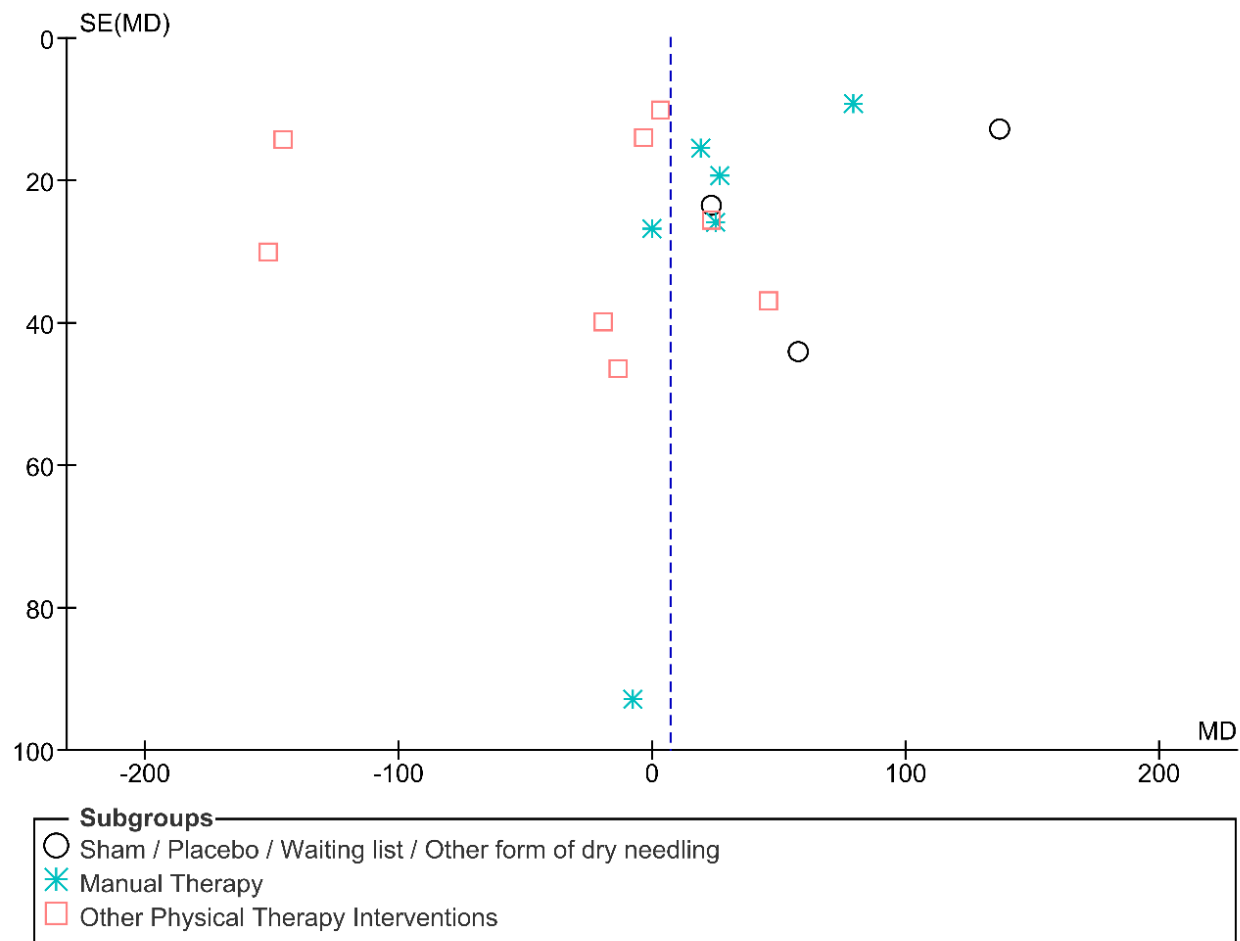


Figure 4. Funnel Plot of the trials ($n = 17$) investigating the short-term effects of dry needling on pressure pain thresholds. The funnel plot showed small asymmetry not associated to potential publication bias. SE:Standard error; MD: Mean difference.

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