Table 1. Characteristics of included trials

Trial	Participants			Intervention		Outcome measures
Year, author	Eligible population	Adjunct treatment + exercise	Exercise	Adjunct treatment + exercise	Exercise	
Biophysical agents						
Jing et al.[1] 2024	Patients	Age (y) = 20.90 ± 2.70 F/M (%) = 22%/78% BMI = NR	Age (y) = 21.60 ± 3.80 F/M (%) = 36%/64% BMI = NR	Neuromuscular electrical stimulation + exercise (n=18)	Exercise (n=14)	Pain (VAS) Function (AKPS)
Albornoz-Cabello et al.[2] 2023	Patients	Age (y) = 42.30 ± 15.52 F/M (%) = 41%/59% BMI = 27.10 ± 3.98	Age (y) = 51.00 ± 10.89 F/M (%) = 62%/38% BMI = 28.60 ± 4.32	Monopolar dielectric diathermy (n=29)	Exercise (n=27)	Pain (VAS) Function (AKPS)
Mv et al.[3] 2023	Patients	Age (y) = 28.80 ± 1.00[#] F/M (%) = NR BMI = 26.30 ± 0.8[#]	Age (y) = 29.20 ± 1.20[#] F/M (%) = NR BMI = 26.70 ± 0.8[#]	Neuromuscular electrical stimulation + exercise (n=31)	Exercise (n=30)	Pain (VAS) Function (AKPS)
Qayyum et al.[4] 2022	Patients	Age (y) = 27.94 ± 6.36 F/M (%) = 54%/46% BMI = NR	Age (y) = 27.45 ± 7.16 F/M (%) = 39%/61% BMI =NR	High power laser therapy + exercise (n=33)	Exercise (n=33)	Pain (VAS)
Rodrigues et al.[5] 2022	Patients	Age (y) = 21.70 ± 3.40 F/M (%) = 100%/0% BMI = NR	Age (y) = 24.10 ± 3.90 F/M (%) = 100%/0% BMI = NR	Anodal transcranial direct current stimulation + exercise (n=14)	Sham anodal transcranial direct current stimulation + exercise (n=14)	Pain (VAS)
Albornoz-Cabello et al.[6] 2020	Patients	Age (y) = 48.00 ± 15.60 F/M (%) = NR BMI = 28.30 ± 5.26	Age (y) = 52.00 ± 10.33 F/M (%) = NR BMI = 28.20 ± 4.74	Monopolar dielectric diathermy (n=42)	Exercise (n=42)	Pain (VAS) Function (AKPS)

Celik et al.[7] 2020	Patients	Age (y) = 39.10 ± 9.10 F/M (%) = 64%/36% BMI = NR	Age (y) = 41.50 ± 12.70 F/M (%) = 46%/54% BMI = NR	Neuromuscular electrical stimulation + exercise (n=14)	Exercise (n=13)	Function (AKPS)
Talbot et al.[8] 2020	Army recruits	Age (y) = 26.50 ± 6.10 F/M (%) = 24%/76% BMI = NR	Age (y) = 26.80 ± 6.60 F/M (%) = 24%/76% BMI = NR	Neuromuscular electrical stimulation + exercise (n=33)	Exercise (n=34)	Pain (VAS)
Glaviano et al.[9] 2019	Patients	Age (y) = 23.80 ± 5.60 F/M (%) =73%/27% BMI = NR	Age (y) = 23.00 ± 3.70 F/M (%) = 80%/20% BMI = NR	Patterned electrical neuromuscular stimulation + exercise (n=11)	Sham patterned electrical neuromuscular stimulation + exercise (n=10)	Pain (VAS) Function (AKPS)
Nouri et al.[10] 2019	Patients	Age (y) = 35.29 ± 3.27 F/M (%) = 70%/30% BMI = 23.52 ± 3.99	Age (y) = 31.43 ± 6.72 F/M (%) = 70%/30% BMI = 23.26 ± 2.84	Higher power laser + exercise (n=20)	Sham laser + exercise (n=20)	Pain (VAS) Function (AKPS)
Iammarrone et al.[11] 2016	Patients	Age (y) = 21.00 ± 7.00 F/M (%) = 77%/23% BMI = NR	Age (y) = 24.00 ± 8.00 F/M (%) = 71%/29% BMI = NR	Pulsed electromagnetic fields + exercise (n=13)	Exercise (n=17)	Pain (VAS)
Bily et al.[12] 2008	Patients	Age (y) = 27.00 ± 7.70 F/M (%) = 53%/47% BMI = NR	Age (y) = 23.70 ± 5.50 F/M (%) = 74%/26% BMI = NR	Electric muscle stimulation + exercise (n=19)	Exercise (n=19)	Pain (VAS) Function (AKPS)
Akarcali et al.[13] 2002	Patients	Age (y) = 41.60 ± 9.58 F/M (%) = NR BMI = NR	Age (y) = 36.30 ± 9.59 F/M (%) = NR BMI = NR	High voltage electric stimulation + exercise (n=20)	Exercise (n=20)	Pain (VAS)
Taping						
Lee et al.[14] 2023	Patients	Age (y) = 27.50 ± 5.40 F/M (%) = 75%/25%	Age (y) = 27.30 ± 7.40 F/M (%) = 84%/16%	Kinesio taping + exercise (n=20)	Exercise (n=19)	Function (AKPS)

		BMI = 21.90 ± 2.30	BMI = 22.20 ± 1.70			
Şahan et al.[15] 2023	Patients	Age (y) = 25.00 ± 6.23 F/M (%) = 86%/14% BMI = 24.58 ± 3.66	Age (y) = 25.23 ± 10.69 F/M (%) = 62%/38% BMI = 22.01 ± 2.59	Star taping + exercise (n=14)	Exercise (n=13) Sham star taping + exercise (n=12)	Pain (VAS) Function (AKPS)
			Age (y) = 26.91 ± 9.02 F/M (%) = 58%/42% BMI = 24.12 ± 5.26			
Songur et al.[16] 2023	Patients	Age (y) = 31.60 ± 9.50 F/M (%) = 75%/25% BMI = 23.53 ± 3.55	Age (y) = 28.25 ± 7.80 F/M (%) = 75%/25% BMI = 23.48 ± 2.47	McConnell patellar taping + exercise (n=13)	Exercise (n=13)	Pain (VAS) Function (AKPS)
		Age (y) = 28.16 ± 8.40 F/M (%) = 83%/17% BMI = 22.75 ± 3.89		Femoral rotation taping + exercise (n=14)		
Basbug et al.[17] 2022	Sedentary patients	Age (y) = 34.10 ± 8.90 F/M (%) = 100%/0% BMI = 23.90 ± 5.10	Age (y) = 39.00 ± 6.40 F/M (%) = 100%/0% BMI = 23.90 ± 5.30	Kinesio taping + exercise (n=15)	Exercise (n=15)	Pain (VAS)
Arrebola et al.[18] 2020	Patients	Age (y) = 30.38 ± 8.40 F/M (%) = 100%/0% BMI = 24.37 ± 2.60	Age (y) = 30.31 ± 7.91 F/M (%) = 100%/0% BMI = 22.68 ± 2.78	Kinesio taping (patellar medialisation) + exercise (n=13)	Exercise (n=16)	Pain (NPRS) Function (AKPS)
		Age (y) = 27.86 ± 9.38 F/M (%) = 100%/0% BMI = 23.37 ± 3.60		Kinesio taping (lateral rotation of the femur		

				and tibia) + exercise (n=14)		
Ghourbanpour et al.[19] 2018	Patients	Age (y) = 33.85 ± 10.29 F/M (%) = NR BMI = 24.70 ± 6.76	Age (y) = 37.15 ± 12.45 F/M (%) = NR BMI = 28.90 ± 4.99	McConnell patellar taping + exercise (n=15)	Exercise (n=15)	Pain (VAS) Function (KOOS-ADL)
Günay et al.[20] 2017	Patients	Age (y) = 36.00 ± 7.95 F/M (%) = 69%/31% BMI = 25.60 ± 2.64	Age (y) = 31.00 ± 6.70 F/M (%) = 38%/62% BMI = 25.20 ± 3.90	Kinesio taping + exercise (n=16)	Exercise (n=13)	Pain (VAS) Function (AKPS)
			Age (y) = 30.80 ± 8.54 F/M (%) = 50%/50% BMI = 24.20 ± 3.30		Sham Kinesiotaping + exercise (n=14)	
Akbaş et al.[21] 2011	Patients	Age (y) = 41.00 ± 11.26 F/M (%) = 100%/0% BMI = 25.17 ± 4.80	Age (y) = 44.88 ± 7.75 F/M (%) = 100%/0% BMI = 28.64 ± 5.77	Kinesio taping + exercise (n=15)	Exercise (n=16)	Pain (VAS) Function (AKPS)
Mousavi et al.[22] 2011	Male students	Age (y) = NR F/M = 0%/100% BMI = NR	Age (y) = NR F/M = 0%/100% BMI = NR	Kinesio taping + exercise (n=10)	Exercise (n=11)	Pain (VAS)
Whittingham et al.[23] 2004	Arm recruits	Age (y) = 18.80 ± 1.30 F/M (%) = 20%/80% BMI = NR	Age (y) = 18.70 ± 1.40 F/M (%) = 20%/80% BMI = NR	McConnell patellar taping + exercise (n=10)	Exercise (n=10)	Pain (VAS) Function (FIQ)
			Age (y) = 18.60 ± 1.10 F/M (%) = 20%/80% BMI = NR		Sham taping + exercise (n=10)	

Tunay et al.[24] 2003	Patients	Age (y) = 32.65 ± 6.22 F/M (%) = NR BMI = 23.05 ± 2.67	Age (y) = 28.00 ± 8.54 F/M (%) = NR BMI = 21.69 ± 1.96	Patellar taping + exercise (n=20)	Exercise (n=20)	Pain (VAS)
Clark et al.[25] 2000	Patients	Age (y) = 26.00 ± 7.40 F/M (%) = 50%/50% BMI = 24.80 ± 5.70	Age (y) = 29.50 ± 6.20 F/M (%) = 40%/60% BMI = 24.90 ± 4.20	Taping + exercise (n=20)	Exercise (n=20)	Pain (VAS) Function (WOMAC)
Whole body vibration						
Wu et al.[26] 2022	Patients	Age (y) = 27.50 ± 0.00 F/M (%) = 44%/56% BMI = 22.20 ± 0.00	Age (y) = 27.30 ± 0.00 F/M (%) = 50%/50% BMI = 21.70 ± 0.00	Whole body vibration + exercise (n=18)	Exercise (n=18)	Pain (VAS) Function (AKPS)
Rasti et al.[27] 2020	Athletes	Age (y) = 25.91 ± 5.16 F/M (%) = 0%/100% BMI = 24.01 ± 0.78	Age (y) = 24.16 ± 5.21 F/M (%) = 0%/100% BMI = 24.31 ± 0.00	Whole body vibration + exercise (n=12)	Exercise (n=12)	Pain (NRS)
Yañez-Álvarez et al.[28] 2020	Patients	Age (y) = 48.00 ± 13.00 F/M (%) = 56%/44% BMI = 27.80 ± 3.80	Age (y) = 52.00 ± 10.70 F/M (%) = 48%/52% BMI = 28.50 ± 4.70	Whole body vibration + exercise (n=25)	Exercise (n=25)	Pain (VAS) Function (AKPS)
Corum et al.[29] 2018	Patients	Age (y) = 32.70 ± 7.30 F/M (%) = 100%/0% BMI = 24.20 ± 4.20	Age (y) = 33.70 ± 7.70 F/M (%) = 100%/0% BMI = 23.50 ± 3.10	Whole body vibration + exercise (n=18)	Exercise (n=16)	Pain (VAS) Function (AKPS)
Dry needling						
Ma et al.[30] 2020	Patients	Age (y) = 22.48 ± 2.40 F/M (%) = 48%/52% BMI = 22.68 ± 2.69	Age (y) = 25.14 ± 6.02 F/M (%) = 56%/44% BMI = 21.84 ± 3.32	Dry needling + exercise (n=25)	Sham needling + exercise (n=23)	Pain (VAS) Function (AKPS)

Zarei et al.[31] 2020	Athletes	Age (y) = 22.25 ± 3.25 F/M (%) = 100%/0% BMI = NR	Age (y) = 25.65 ± 8.49 F/M (%) = 100%/0% BMI = NR	Dry needling + exercise (n=20)	Exercise (n=20)	Pain (NPRS) Function (AKPS)
Sutlive et al.[32] 2018	Arm recruits	Age (y) = 30.30 ± 5.50 F/M (%) = 43%/57% BMI = 26.40 ± 4.40	Age (y) = 31.10 ± 5.10 F/M (%) = 33%/67% BMI = 26.80 ± 3.20	Dry needling + exercise (n=30)	Sham needling + exercise (n=30)	Pain (NPRS) Function (AKPS)
Knee brace						
Petersen et al.[33] 2016	Patients	Age (y) = 28.00 ± 9.40 F/M (%) = 66%/34% BMI = 23.00 ± 1.50	Age (y) = 28.00 ± 8.10 F/M (%) = 79%/21% BMI = 23.00 ± 1.30	Patellar brace + exercise (n=78)	Exercise (n=78)	Pain (NAS) Function (AKPS)
Denton et al.[34] 2005	Patients	Age (y) = 33.50 ± 8.80 F/M (%) = 100%/0% BMI = NR	Age (y) = 31.50 ± 9.80 F/M (%) = 100%/0% BMI = NR	Knee brace + exercise (n=17)	Exercise (n=17)	Pain (VPS) Function (AKPS)
Lun et al.[35] 2005	Patients	Age (y) = 35.00 ± 11.00 F/M (%) = NR BMI = NR	Age (y) = 35.00 ± 11.00 F/M (%) = NR BMI = NR	Patellar bracing + exercise (n=32)	Exercise (n=34)	Pain (VAS) Function (KFS)
Manual therapy						
Anwar et al.[36] 2022	Patients	Age (y) = NR F/M (%) = NR BMI = NR	Age (y) = NR F/M (%) = NR BMI = NR	Pain release phenomenon technique + exercise (n=NR)	Exercise (n= NR)	Pain (VAS) Function (LEFS)
Fatimah et al.[37] 2021	Patients	Age (y) = 29.88 ± 3.06 F/M (%) = 77%/23% BMI = NR	Age (y) = 29.38 ± 3.45 F/M (%) = 73%/27% BMI = NR	Tibiofemoral mobilisation + exercise (n=26)	Exercise (n=26)	Pain (NPRS)

						Function (AKPS)
Telles et al.[38] 2016	Patients	Age (y) = 63.30 ± 12.10 F/M (%) = NR BMI = 27.20 ± 5.10	Age (y) = 61.80 ± 17.30 F/M (%) = NR BMI = 27.70 ± 4.50	Myofascial technique + exercise (n=9)	Exercise (n=9)	Pain (NPRS) Function (LEFS)
Blood flow restriction						
Constantinou et al.[39] 2022	Patients	Age (y) = 25.50 ± 14.00 F/M (%) = 43%/57% BMI = 24.60 ± 3.00	Age (y) = 30.50 ± 16.00 F/M (%) = 47%/53% BMI = 24.70 ± 4.30	Blood flow restriction + exercise (n=30)	Exercise (n=30)	Pain (VAS) Function (AKPS)
Giles et al.[40] 2017	Patients	Age (y) = 28.50 ± 5.20 F/M (%) = 60%/40% BMI = NR	Age (y) = 26.70 ± 5.50 F/M (%) = 49%/51% BMI = NR	Blood flow restriction + exercise (n=40)	Placebo blood flow restriction + exercise (n=39)	Pain (VAS) Function (AKPS)
Electromyography biofeedback						
Qi et al.[41] 2007	Patients	Age (y) = NR F/M (%) = NR BMI = NR	Age (y) = NR F/M (%) = NR BMI = NR	EMG Biofeedback + exercise (n=13)	Exercise (n=13)	Pain (PSS)
Dursun et al.[42] 2001	Patients	Age (y) = 36.90 ± 9.20 F/M (%) = 80%/20% BMI = NR	Age (y) = 36.60 ± 10.60 F/M (%) = 80%/20% BMI = NR	EMG Biofeedback + exercise (n=30)	Exercise (n=30)	Pain (VAS) Function (FIQ)
Internal and external attentional focus						
Aghakeshizadeh et al.[43] 2021	Recreational athletes	Age (y) = 28.60 ± 7.70 F/M (%) = 52%/48% BMI = 23.70 ± 1.90 Age (y) = 29.90 ± 8.00 F/M (%) = 65%/35%	Age (y) = 28.90 ± 6.50 F/M (%) = 54%/46% BMI = 23.70 ± 1.70	Internal focus + exercise (n=23)	Exercise (n=24)	Pain (VAS) Function (AKPS)

		BMI = 23.90 ± 1.30		External focus + exercise (n=23)		
Mindfulness						
Bagheri et al.[44] 2021	Recreational runners	Age (y) = 27.90 ± 7.50 F/M (%) = 100%/0% BMI =23.70 ± 2.30	Age (y) = 28.80 ± 6.80 F/M (%) = 100%/0% BMI = 23.20 ± 2.60	Mindfulness + exercise (n=15)	Exercise (n=14)	Pain (VAS) Function (KOS)
Foot orthoses						
Eng et al.[45] 1993	Adolescents	Age (y) = 14.40 ± 1.10 F/M (%) = 100%/0% BMI = NR	Age (y) = 15.10 ± 1.40 F/M (%) = 100%/0% BMI = NR	Foot orthoses + exercise (n=10)	Placebo foot orthoses + exercise (n=10)	Pain (VAS)

Abbreviation: F, female*; M,* male*; n,* sample size*; BMI,* body mass index; *NR,* not reported; *VAS,* visual analogue scale; *FIQ,* functional index questionnaire; *NPRS,* numerical pain rating scale; *AKPS,* anterior knee pain scale; *WOMAC,* Western Ontario and McMaster Universities; *PSS*, pain severity scale; *EMG,* electromyographic; *NAS,* numerical analogue scale; *NRS,* numerical rating scale, *LEFS,* lower extremity functional scale; [#]: standard error; *KOOS-ADL,* Knee Injury and Osteoarthritis Outcome - Activities of Daily Living; *VPS,* verbal pain scale; *KFS,* knee function scale; *KOS,* knee outcome survey.

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