

Search Strategy

EMBASE

1. 'low back pain'/exp
2. (low* NEAR/3 ('back pain*' OR 'back ache*' OR 'backache*' OR 'back injur*')):ti,ab
3. ((Lumbal OR lumbar OR lumbosacral OR lumbosacroiliac) NEAR/2 (pain* OR ache* OR syndrome OR strain* OR injur*)):ti,ab
4. (Lumbago OR lumbodynia OR lumbalgia OR lumbalgia):ti,ab
5. #1 OR #2 OR #3 OR #4
6. 'conservative treatment'/exp OR ((conservative* OR nonoperative OR non-operative OR non-surgical OR nonsurgical OR surgical) NEAR/4 (manag* OR treatment* OR option* OR care OR therap*)):ti,ab
7. 'physical medicine'/exp OR 'physiotherapy'/exp OR 'kinesiotherapy'/exp OR 'analgesic agent'/exp OR 'antiinflammatory agent'/exp OR 'nonsteroid antiinflammatory agent'/exp OR 'muscle relaxant agent'/exp OR 'rest'/exp OR 'physical activity'/exp OR 'activity restriction'/exp OR 'spine stabilization'/exp OR 'brace'/de
8. ('progressive mobili?ation' OR physiotherap* OR 'physical therap*' OR 'exercis*' OR 'exercise therap*' OR kinesiotherapy OR 'manual therap*' OR 'therapeutic exercis*' OR 'exercise movement techniques' OR cryotherapy OR analgesic* OR 'anti-inflammatory agent*' OR 'antiinflammatory agent*' OR NSAID OR 'muscle relaxant*' OR rest OR 'activity modification*' OR 'activity restriction*' OR 'spin* stabili?ation' OR 'spin* manipulation' OR bracing OR orthos*):ti,ab
9. 'spine surgery'/exp
10. ((Spine OR spinal) NEAR/3 (surgical OR surgery OR fusion)):ti,ab
11. (Dissectom* OR diskectom* OR laminectom* OR hemilaminectom* OR spondylodesis OR Spondylodeses OR Spondylosyndesis OR 'total disc replacement'):ti,ab

12. #6 OR #7 OR #8 OR #10 OR #11

13. 'athlete'/exp OR 'sport injury'/exp OR 'athletics'/exp OR 'baseball'/exp OR 'cricket (sport)'/exp OR 'cycling'/exp OR 'hockey'/exp OR 'ice hockey'/exp OR 'racquet sport'/exp

14. (Rowing OR rower* OR sculling OR athlet* OR gymnast* OR cricket OR bowler* OR pitcher* OR wrestl* OR hockey OR baseball OR golf OR kayak* OR canoei* OR 'hammer throw*' OR 'martial art*'):ti,ab

15. #13 OR #14 16. #5 AND #12 AND #15

MEDLINE (OVID)

1. Low Back Pain/

2. (low* adj3 (back pain* OR back ache* OR backache* OR back injur*)):ti,ab.

3. ((Lumbal OR lumbar OR lumbosacral OR lumbosacroiliac) adj2 (pain* OR ache* OR syndrome OR strain* OR injur*)):ti,ab.

4. (Lumbago OR lumbodnyia OR lumbalgnesia OR lumbalgia).ti,ab.

5. or/1-4

6. Conservative Treatment/ OR ((conservative* OR nonoperative OR non-operative OR non-surgical OR nonsurgical OR surgical) adj4 (manag* OR treatment* OR option* OR care OR therap*)):ti,ab.

7. "Physical and Rehabilitation Medicine"/ OR exp Physical Therapy Modalities/ OR exp ANALGESICS/ OR exp Anti-Inflammatory Agents/ OR Muscle Relaxants, Central/ OR REST/ OR BRACES/

8. (progressive mobili?ation OR physiotherap* OR physical therap* OR exercis* OR exercise therap* OR kinesiotherapy OR manual therap* OR therapeutic exercis* OR exercise movement techniques OR cryotherapy Or analgesi* OR anti-inflammatory agent* OR antiinflammatory agent* OR NSAID OR muscle relaxant* OR rest OR activity modification* OR activity restriction* OR spin* stabili?ation OR spin* manipulation* OR bracing OR brace* OR orthos*):ti,ab.

9. SPINE/su OR exp DISKECTOMY/ OR LAMINECTOMY/ OR Spinal Fusion/
10. ((Spine OR spinal) adj3 (surgical OR surgery OR fusion)).ti,ab.
11. (Dissectom* OR diskectom* OR laminectom* OR hemilaminectom* OR spondylodesis OR Spondylodeses OR Spondylosyndesis OR total disc replacement).ti,ab
12. or/6-11
13. ATHLETES/ OR Athletic Injuries/ OR BASEBALL/ OR BICYCLING/ OR HOCKEY/ OR Racquet Sports/ OR WRESTLING/
14. (Rowing OR rower* OR sculling OR athlet* OR gymnast* OR cricket OR bowler* OR pitcher* OR wrestl* OR hockey OR baseball OR golf OR kayak* OR canoei* OR hammer throw* OR martial art*).ti,ab.
15. or/13-14
16. and/5,12,15

CINAHL

1. (MH "Low Back Pain")
2. TI (low* N3 ("back pain*" OR "back ache*" OR "backache*" OR "back injur*")) OR AB (low* N3 ("back pain*" OR "back ache*" OR "backache*" OR "back injur*"))
3. TI ((Lumbal OR lumbar OR lumbosacral OR lumbosacroiliac) N2 (pain* OR ache* OR syndrome OR strain* OR injur*)) OR AB ((Lumbal OR lumbar OR lumbosacral OR lumbosacroiliac) N2 (pain* OR ache* OR syndrome OR strain* OR injur*))
4. TI (Lumbago OR lumbodynia OR lumbalgiesia OR lumbalgia) OR AB (Lumbago OR lumbodynia OR lumbalgiesia OR lumbalgia)
5. S1 OR S2 OR S3 OR S4

6. TI ((conservativ* OR nonoperative OR non-operative OR non-surgical OR nonsurgical OR surgical) N4 (manag* OR treatment* OR option* OR care OR therap*)) OR AB ((conservativ* OR nonoperative OR nonoperative OR non-surgical OR nonsurgical OR surgical) N4 (manag* OR treatment* OR option* OR care OR therap*))
7. (MH "Physical Medicine") OR (MH "Physical Therapy+") OR (MH "Analgesics+") OR (MH "Antiinflammatory Agents+") OR (MH "Antiinflammatory Agents, Non-Steroidal+") OR (MH "Muscle Relaxants, Central+") OR (MH "Muscle Relaxation") OR (MH "Exercise+") OR (MH "Physical Activity") OR (MH "Orthoses+") OR (MH "Rest (Iowa NOC)") OR (MH "Massage") OR (MH "Manual Therapy+")
8. TI ("progressive mobili?ation" OR physiotherap* OR "physical therap*" OR exercis* OR "exercise therap*" OR kinesiotherapy OR "manual therap*" OR "therapeutic exercis*" OR "exercise movement technique*" OR cryotherapy Or analgesic* OR "anti-inflammatory agent*" OR "antiinflammatory agent*" OR NSAID OR "muscle relaxant*" OR rest OR "activity modification*" OR "activity restriction*" OR "spin* stabili?ation" OR "spin* manipulation*" OR bracing OR orthos*) OR AB ("progressive mobili?ation" OR physiotherap* OR "physical therap*" OR exercis* OR "exercise therap*" OR kinesiotherapy OR "manual therap*" OR "therapeutic exercis*" OR "exercise movement technique*" OR cryotherapy Or analgesic* OR "anti-inflammatory agent*" OR "antiinflammatory agent*" OR NSAID OR "muscle relaxant*" OR rest OR "activity modification*" OR "activity restriction*" OR "spin* stabili?ation" OR "spin* manipulation*" OR bracing OR orthos*)
9. (MH "Spine/SU") OR (MH "Discectomy") OR (MH "Laminectomy") OR (MH "Laminoplasty") OR (MH "Spinal Fusion")
10. TI ((Spine OR spinal) N3 (surgical OR surgery OR fusion)) OR AB ((Spine OR spinal) N3 (surgical OR surgery OR fusion))
11. TI (Dissectom* OR discectom* OR laminectom* OR hemilaminectom* OR spondylodesis OR Spondylodeses OR Spondylosyndesis OR 'total disc replacement') OR AB (Dissectom* OR discectom* OR laminectom* OR hemilaminectom* OR spondylodesis OR Spondylodeses OR Spondylosyndesis OR "total disc replacement")

12. S6 OR S7 OR S8 OR S9 OR S10 OR S11

13. (MH "Rowing") OR (MH "Athletes+") OR (MH "Athletic Injuries") OR (MH "Baseball Injuries") OR (MH "Basketball Injuries") OR (MH "Cricket Injuries") OR (MH "Cycling Injuries") OR (MH "Fencing Injuries") OR (MH "Golf Injuries") OR (MH "Gymnastics Injuries") OR (MH "Hockey Injuries") OR (MH "Racquet Sports Injuries") OR (MH "Baseball") OR (MH "Cricket (Sports)") OR (MH "Cycling") OR (MH "Hockey") OR (MH "Racquet Sports")

14. TI (Rowing OR rower* OR sculling OR athlet* OR gymnast* OR cricket OR bowler* OR pitcher* OR wrestl* OR hockey OR baseball OR golf OR kayak* OR canoei* OR "hammer throw*" OR "martial art*") OR AB (Rowing OR rower* OR sculling OR athlet* OR gymnast* OR cricket OR bowler* OR pitcher* OR wrestl* OR hockey OR baseball OR golf OR kayak* OR canoei* OR "hammer throw*" OR "martial art*")

15. S13 OR S14 S5 AND S12 AND S15

Web of Science

TS =(((low* NEAR/3 ("back pain*" OR "back ache*" OR "backache*" OR "back injur*")) OR ((Lumbar OR lumbar OR lumbosacral OR lumbosacroiliac) NEAR/2 (pain* OR ache* OR syndrome OR strain* OR injur*)) OR (Lumbago OR lumbodynia OR lumbalgia OR lumbalgia)) AND (((conservative* OR nonoperative OR non-operative OR non-surgical OR nonsurgical OR surgical) NEAR/4 (manag* OR treatment* OR option* OR care OR therap*)) OR ("progressive mobili?ation" OR physiotherap* OR "physical therap*" OR exercis* OR "exercise therap*" OR kinesiotherapy OR "manual therap*" OR "therapeutic exercis*" OR "exercise movement techniques" OR cryotherapy OR analgesic* OR "anti-inflammatory agent*" OR "antiinflammatory agent*" OR NSAID OR "muscle relaxant*" OR rest OR "activity modification*" OR "activity restriction*" OR "spin* stabili?ation" OR "spin* manipulation" OR bracing OR orthos*)) OR ((Spine OR spinal) NEAR/3 (surgical OR surgery OR fusion)) OR (Dissectom* OR diskectom*

OR laminectom* OR hemilaminectom* OR spondylodesis OR Spondylodeses OR Spondylosyndesis OR "total disc replacement")) AND (Rowing OR rower* OR sculling OR athlet* OR gymnast* OR cricket OR bowler* OR pitcher* OR wrestl* OR hockey OR baseball OR golf OR kayak* OR canoei* OR "hammer throw*" OR "martial art*"))

Scopus

TITLE-ABS (((low* W/3 (“back pain*” OR “back ache*” OR “backache*” OR “back injur*”)) OR ((Lumbal OR lumbar OR lumbosacral OR lumbosacroiliac) W/2 (pain* OR ache* OR syndrome OR strain* OR injur*)) OR (Lumbago OR lumbodynia OR lumbalgia OR lumbalgia)) AND (((conservative* OR nonoperative OR non-operative OR non-surgical OR nonsurgical OR surgical) W/4 (manag* OR treatment* OR option* OR care OR therap*)) OR (“progressive mobili?ation” OR physiotherap* OR “physical therap*” OR exercis* OR “exercise therap*” OR kinesiotherapy OR “manual therap*” OR “therapeutic exercis*” OR “exercise movement techniques” OR cryotherapy Or analgesic* OR “anti-inflammatory agent*” OR “antiinflammatory

agent*” OR NSAID OR “muscle relaxant*” OR rest OR “activity modification*” OR “activity restriction*” OR “spin* stabili?ation” OR “spin* manipulation” OR bracing OR orthos*) OR ((Spine OR spinal) W/3 (surgical OR surgery OR fusion)) OR (Dissectom* OR diskectom* OR laminectom* OR hemilaminectom* OR spondylodesis OR Spondylodeses OR Spondylosynthesis OR “total disc replacement”)) AND (Rowing OR rower* OR sculling OR athlet* OR gymnast* OR cricket OR bowler* OR pitcher* OR wrestl* OR hockey OR

baseball OR golf OR kayak* OR canoei* OR “hammer throw*” OR “martial art*”))

Supplementary Table 1- Characteristics of the Included Studies

Author, year of publication	Sport, type of participant	Country	No. of participants (M/F)	Mean participant Age (years) (SD)	Methods
Exercise Interventions					
Antón et al. 2015	Judo; Judo athletes	Spain	N=36; 18M/18F	Training group: 30.9 (3.1); Control Group: 30.2 (2.7), mean: 30.55	Athletes were randomly assigned to either the training group (exercising on a Swiss ball) or the control group (training on a stable surface) for 8 weeks.
Ansari et al. 2020	N/R	India	N=30; M/F N/R	23.33 (3.13)	Athletes were randomly assigned into two groups, retrowalking + conventional exercise ($n = 15$) and conventional exercise ($n = 15$). Pain, flexion range of motion, balance, and muscle fatigability were examined before and after 4 weeks of the intervention. Retrowalk performed on a treadmill at self-paced speed for 15 min/day for 3 days/week for 4 weeks w/conventional exercises for LBP, whereas participants in the control group performed conventional exercises alone for the same duration.
Hides et al. 2012	AFL; Professional football players	Australia	N=46M	22.8 (3.5)	A single-blinded, stepped-wedge design intervention in three blocks, 7-, 8- or 15 weeks in duration, of a motor control program and Pilates exercise. Group 1 underwent 15 weeks of intervention, Group 2 - 8 weeks. Group 3: waitlist control which received the intervention after 15 weeks.
Jackson et al. 2011	Hockey; Recreational hockey players	Canada	N=45M stratified into 1 of 3 groups: middle-age exercise, old-age exercise, control.	Group 1: 52 (2.7) Group 2: 63 (3.1) Group 3: 57 (7.7)	16-week program (3-week familiarization and 13 weeks of testing) and PRT with 5RM testing at baseline and weeks 8 and 12.
Kachanathu et al. 2012	Cricket; Cricketers	Saudi Arabia	N=30M	20.78 (2.08)	Participants randomised into an 8-week core stabilization or conventional exercise program, 45 minutes on 4 days/week. Core program 3 x 5 reps with 5s hold and 10s rest. Conventional exercise used RPE to guide; 83% did a hyperextension programme and 17% a flexion programme.
Kumar et al. 2009	Hockey; Hockey players	India	N=30M	DMST: 24.07 (2.89) Conventional: 23.40 (3.27)	Athletes randomly assigned to DMST or conventional treatment were treated on alternate days for 35 days, 40 min per day.
Seshagiri Rao et al. 2015	Cricket; Competitive cricketers	India	N=60M	Range only: 15-35	4-week exercise program, 4 times/week. 10 reps per exercise. Group 1: Swiss ball exercise (planks, pelvic bridge, back extensions, spine rotation) Group 2: Thera-band exercises (curl up, trunk twist, extension, side bend) Group 3: Floor exercises (arm lift, extension, prone bend).

Biomechanical Modifications

Nigg et al. 2009	Golf; Golfers (<15 handicap)	Canada	N=37M; Control group: 20M intervention group: 17M	N/R	The intervention group wore unstable sandals used during golf swings in a laboratory setting for 6 weeks. Golf performance, balance and LBP were assessed at baseline and at 6 weeks.
Salai et al. 1999	Cycling; Cycling club members	Israel	N= 10 for preliminary fluoroscopic assessment; N=80; 50M/30F for interview; N=40 for LBP intervention	17-72	After preliminary fluoroscopy was performed on 10 healthy cyclists to determine pelvic-lumbar spine angles on bicycle seats, 40 recreational cyclists with LBP had their seats adjusted to an anterior angle of inclination of 10-15 degrees for 6 months.

Manual Therapy

Feng et al. 2016	N/R	China	N/R	N/R	Massage with thermal magnetic therapy for 2-4 weeks.
Hanrahan et al. 2005	N/R; Collegiate athletes	USA	N=19M	20.3	Joint mobilizations were administered to the experimental group. Control group was placed prone for the equivalent time.
Joseph et al. 2017	Weightlifting; Elite weightlifters	Thailand	N=16F	20.44 (3.14)	Participants were allocated to 1 of 2 groups first. 3 sessions of intervention with a 24-hour interval between each session. After 4 weeks of washout, participants were allocated to the other intervention. Intervention 1 was LPST, intervention 2 was SMT.
Kamali et al. 2017	Soccer, basketball, volleyball; College players	Iran	N=42, 21M/21F	SMT group: 25.14 (3.66) SMT + KT group: 27.17 (6.04)	Participants randomized into 2 groups, SMT and SMT plus KT. SMT carried out once, when tape applied it was for 24 hrs. Tested before and immediately, 1 day, 1 week, and 1 month after the interventions.
Kong et al. 2012	Shooting/ Archery; Shooting and archery athletes	China	N=110 athletes. Control group: 28M/27F. Experimental group: 29M/26F.	Control group: 21.18 (3.77) Experimental group: 19.95 (3.57)	Participants were randomized to an experimental group with Chinese massage combined with herbal ointment or control group with placebo ointment. Participants received 2 30-minute massages per week for 4 weeks.

AFL Australian Football League, CSA cross-sectional area, DMST Dynamic Muscular Stabilisation techniques, KT kinesio taping, LBP low back pain, LPST lumbopelvic stabilization training, M/F: male/female, MF multifidus, MRI magnetic resonance imaging, N/R not reported, NSLBP non-specific low back pain, ODI Oswestry Disability Index, PED/TA radiofrequency thermal annuloplasty using percutaneous endoscopic discectomy, PRT periodised resistance training, PT Physiotherapy, reps repetitions, RPE rating of perceived exertion, s seconds, (SD) standard deviation, SF-36 36-item Short Form Survey, SM soft tissue massage, SMT sport massage therapy, VAS visual analogue scale.

Supplementary Table 2- Summary of Findings

Author, year of publication	Sport	Intervention Group	Control Group	Outcome Measures	Follow-up Period	Findings with Outcome Measure (SD)
Exercise Interventions						
Antón et al. 2015	Judo	Training on a Swiss ball Press-up, contralateral single-leg hold, bridging	Training on a stable surface (press-up,	1) RMDQ	8 weeks	1) Significant decrease in RMDQ after treatment in both groups compared with before treatment (p<0.001), no significant differences among groups. Intervention: RMDQ Pre 11.3 (5.9) and post 4.9 (3)

		1st week: one set of 5 reps for each movement 3 times/week. The following 7 weeks: 3 sets of 10 reps, 5 times/week.	contralateral single-leg hold, bridging)			Control: RMDQ Pre 10.1 (4.1) and post 3.2 (3)
Ansari et al. 2020	N/R	Retrowalking and conventional exercise 15 mins retrowalking on treadmill 3 days/week	Conventional exercise: 2 sets of 12 reps, each position maintained for 10 s, and 1 min rest between sets. No external load/resistance was provided.	1) ODI 2) Pain- NRS 3) ROM 4) Y balance test 5) Sorenson's test hold time	4 weeks	1) N/R 2) Significant differences were observed between the groups after intervention period of 4 weeks ($p = 0.003$) with retrowalking + conventional exercise group showing greater decline in pain than conventional exercise only group [retrowalking, pre-to-post: 5 (2-7) to 1 (0-6), Control, pre-to-post: 5 (2-7) to 3 (1-5)]. 3, 4, 5) Improvement in all measures but no additional improvements in these outcome measures after addition of retrowalking to conventional exercise program
Hides et al. 2012	AFL	Group 1: 15-week motor control training and 7 weeks Pilates 2 days/week. Group 2: 8-week motor control training, 14 weeks Pilates 2 days/week	Group 3: 7-week motor control training and 15 weeks Pilates 2 days/week.	1) MRI of CSA and symmetry of MF, QL, and psoas muscles 2) Trunk CSA 3) Player availability for competition	15, 23 and/or 30 weeks; end of season	1) The MF CSA increased across time ($F = 7.7, p < 0.0001$), but there were no effects found for muscle asymmetry or LBP ($p > 0.05$); QL and psoas muscle CSA showed no change for interaction between intervention group and time ($p < 0.05$). 2) Groups 1 and 2 combined vs Group 3 showed a greater increase in trunk CSA associated with drawing-in of the abdominal wall ($F = 4.9, p = 0.03$). 3) During the playing season, players in groups 1 and 2 who received the intervention by time 2 missed fewer games than players in group 3 ($F = 3.4, p = 0.04$).
Jackson et al. 2011	Hockey	1) Middle age exercise 2) Old age exercise Periodised Resistance Training (PRT) for 16 weeks 4 days/week	Allowed to continue their recreational activity	1) Strength- 5RM 2) Pain- VAS 3) Disability- ODI, 4) SF-36	8 and 12 weeks	1) The ME and OE increased 5RM in all exercises (bench press, leg press and lat pulldown) ($p < 0.05$) from baseline to week 8, baseline to week 12, and week 8 to week 12. 2, 3, 4) Exercise reduced pain in the ME and OE groups ($p < 0.05$) in VAS, ODI, and SF-36 compared to control. There was no difference between week 8 and 12.
Kachanathu et al. 2012	Cricket	Cores Spinal stabilization (Group A) sessions lasting 45min, focus on core muscle co-contraction, 4 days/week	Conventional exercises (Group B) physiotherapy strengthening exercises 4 days a week. 8 weeks	1) VAS 2) OLBPDQ	8 weeks	1) Group A and Group B showed improvement in VAS score (2.20 ± 0.67 and 1.33 ± 0.72 respectively), $p = 0.002$ 2) Group A and Group B improvement in OLBPDQ score (3.38 ± 1.19 and 1.18 ± 0.65 respectively), $p = 0.000$. Greater improvements were observed in a core program compared to conventional exercise.
Kumar et al. 2009	Hockey	Dynamic muscular stabilization techniques (DMST). Treated by the same physiotherapist with the same intensity and capacity on alternate day for 35 days. The duration of each individual treatment session was 40 minutes	Conventional techniques: Ultrasound, SWD, and lumbar strengthening exercises. Treated by the same PT with the same intensity and capacity on alternate days for 35 days. The duration of each individual treatment session was 40 minutes	1) VAS 2) 5 minutes of walking (m) 3) Stair climbing (number/min) 4) Stand ups (number/min).	Day 35	1) Pain improved 2.1 times more with DMST than with conventional treatment. With time (days), walking, standups, climbing, and pain improved (correlation) significantly ($p < 0.01$) higher in DMST ($r = 0.83$ to 0.92) than in conventional treatment ($r = 0.40$ to 0.75), and their rate of improvement were also significantly ($p < 0.01$) higher in DMST than in conventional treatment. 2) Metres covered in walking improved 4.7 times more with DMST. 3) Number of steps per minute improved 1.4 times more with DMST. 4) Stand-ups improved 2 times more with DMST.

Seshagiri Rao et al. 2014	Hockey	Core stability exercise programme 4 times/week A) Swiss ball training B) Thera-band training C) floor exercises	Group D) 4 weeks rest	1) ODI 2) Double leg lowering test for core strength	4 weeks	1,2) Significant improvement in ODI and core strength was observed with all groups compared to control group (p<0.0001). The Thera-band training group had better improvement over Swiss ball training and floor exercises.
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Biomechanical Modifications

Nigg et al. 2009	Golf	Wearing an unstable shoe	N/R	1) Motion analysis of swing 2) Timed balance scores, 3) VAS in lab and after playing 18 holes of golf	6 weeks	1) No significant difference between group means for change in performance of any of 10 variables of golf performance analyzed; 2) No significant difference between group means for static and dynamic standing balance times; 3) Significant difference between groups in perceived LBP scores for the in-lab measurement on a VAS (t = -2.02, P = 0.0515). [LBP VAS score decreased by 17.5 mm on a 100mm scale in intervention group and by 3.6 mm in the control group (no significant change)]. Trend of between group difference in a VAS immediately after playing golf (t = -1.95, P = 0.0609)
Salai et al. 1999	Cycling	1) Racing cyclists (N=25). Seats were adjusted to produce an anterior angle of inclination (angle of 10–15°). The decision to use either a 10° or a 15° angle was arbitrary.	2) Mountain cyclists (N=15). Seats were adjusted to produce an anterior angle of inclination (angle of 10–15°). The decision to use either a 10° or a 15° angle was arbitrary.	LBP incidence	6 months	Six months after the 40 cyclists who reported LBP at study start and had seat adjustments, 72% were LBP-free, 20% reported a major reduction in pain occurrence and magnitude, and 7% reported no change.

Manual Therapy

Feng et al. 2016	N/R	Massage with thermal magnetic therapy Frequency N/R	Conventional therapy Frequency N/R	1) VAS 2) Dorsal muscle strength 3) Spinal mobility	2 and 4 weeks	1) Specific data N/R. "Effective rate of the control group was 87.45%, while the treatment group was 96.54%. By comparing the therapeutic effect between the two groups, the therapeutic effect of treatment was significantly better than the control group (p<0.05)." 2) "Both groups improved significantly, and the treatment group achieved more significant effect over the control group" (p<0.05) 3) "No significant evaluation difference existed between groups" (p>0.05)
Hanrahan et al. 2005	N/R	Cryotherapy treatment for 15 minutes, stretching routine. Grade 1 (small-amplitude movements) and 2 (large-amplitude) joint mobilizations (one treatment)	Subject lies prone for the time it took to administer 1 joint mobilization treatment	1) McGill Pain Questionnaire 2) VAS 3) Dynamometry to determine force generation in the erector spinae muscles	24-hour post-treatment	1) MPQ scores decreased from 12 to 10 in the control group and from 11 to 4 in the experimental group (p<0.05) 2) VAS scores during extension decreased from 4.5 to 2.5 in the experimental group and decreased from 4.5 to 4 in the control group. 3) Force increased from 17kg to 21kg in the experimental group and remained unchanged in the control group (19kg)
Joseph et al. 2017	Weightlifting	Group A LPST for 3 days with an interval 24 hours between sessions. SMT for 3	Group B SMT for 3 days with an interval of 24 hours between sessions. LPST for	1) VAS 2) Pain pressure threshold (PPT) 3) Tissue blood flow (TBF)	N/R	1) Reduction of VAS in LPST (5.12±2.47 to 3.18±1.64) vs. SMT (4±1.09 to 2.62±1.31) (p<0.01) 2) Increase in PPT in LPST (472.28±98.64 to 711.69±126.50) vs. SMT (440.64±215.47 to 665.73±255.85) (p<0.01)

		days after 4 weeks of washout.	three days after 4 weeks of washout.			3) Improvement of TBF in LPST (13.78±19.46±3.21) vs. SMT (11.03±2.09 to 24.60±7.99) (p<0.01). The SMT group showed a trend of greater therapeutic benefits when compared to LPST.
Kamali et al. 2017	Soccer, basketball, volleyball	SMT plus KT (one application for 24 hours) one lumbar rotational manipulation followed by 2 kinesio taping stripes from PSIS to T12.	SMT one lumbar rotational manipulation	1) Pain intensity- NRS 2) Functional disability- ODI 3) Trunk endurance of flexors-extensors via McQuade test, and unsupported trunk holding test	1 day, 1 week, 1 month	1) NRS decreased with SMT (39.04±9.16 to 32.85±15.85), SMT plus KT (35.71±9.25 to 27.38±18.13) (p<0.05) 2) ODI decreased with SMT (25.18±12.84 to 20.94±15.45), SMT plus KT (20.94±7.65 to 13.54±9.29) (p<0.05) 3) Trunk endurance increased with SMT (79.87±38.64 to 93.98±36.94), SMT plus KT (74.29±39.82 to 86.51±41.57). (p<0.05) There were no between-group differences.
Kong et al. 2012	Shooting/ Archery	Chinese massage combined with herbal ointment (4 weeks) Two 30-minute sessions weekly for 4 weeks	Simple Massage Therapy Two 30-minute sessions weekly for 4 weeks	1) Chinese Short form McGill pain questionnaire (C-SFMPQ) 2) Local muscle stiffness via myotonometer	1 and 3 months	Experimental group experienced significant improvements in C-SFMPQ and in local muscle stiffness compared with control group (between-group difference in mean change from baseline, -1.24 points, P = 0.005 in sensory scores; -3.14 points, P < 0.001 in affective scores; -4.39 points, P < 0.001 in total scores; -0.64 points, P = 0.002 in VAS; -1.04 points). Difference remained at one month follow up, but it was only significant in affective scores (-2.83 points, P < 0.001) at 3 months follow up. 2) Both groups had significant improvement in local muscle stiffness in a relaxation state than the baseline (p = 0.005).

AFL Australian Football League, CSA cross-sectional area, IO Internal oblique, KT kinesio taping, LBP low back pain, ME middle age exercise group, M/F: male/female, MF multifidus, MPQ McGill Pain Questionnaire, MRI magnetic resonance imaging, N/R not reported, NSLBP non-specific low back pain, NRS Numerical Rating Scale, ODI Oswestry Disability Index, OE Old age exercise group, OLBPDQ Oswestry Low Back Pain Disability Questionnaire, PRT periodised resistance training, QL Quadratus Lumborum, reps repetitions, RM repetition maximum, RMDQ Roland Morris Disability Questionnaire, ROM Range of Motion, RPE rating of perceived exertion, (SD) standard deviation, SF-36 36-item Short Form Survey, SM soft tissue massage, SMT sport massage therapy, VAS Visual Analogue Scale.