

## Supplementary Table 2

*General Characteristics of Studies*

Study	Objective	Downs and Black Score	Participants	Duration	Exercise Parameters	Outcome Measures	Results
Berschin et al., 2014	Investigate the effectiveness of WBV exercise in ACLR rehabilitation compared with a standard protocol	21 - Good	29/11 (m/f) 27.5yo (mean) 86.6 days from injury to surgery 1-week post-op	2 sessions per week, 10 weeks	Weeks 2-5: 2-4 x 12-20 reps & 2-3 x 15-30 reps at 50-60% 1RM Weeks 6-11: 2-4 x 8-12 at & 2-4 x 15-20 reps at 60-80% 1RM	Knee flx & ext strength Balance Lysholm scale	No difference in knee joint laxity between groups, within 2mm of contralateral side  Strength deficits improvements similar between groups  WBV superior to standard protocol to improve balance  Lysholm scores improved in both groups, no difference between groups
Bieler et al., 2014	Compare high-intensity resistance training as part of ACLR rehabilitation with low intensity resistance training	25 - Good	31/19(m/f). 29.2yo (mean) 40.3mo (HRT) & 16.8mo (LRT) from injury to surgery 8 weeks post-op	12 weeks	HI Weeks 8-9: 1 x 20 – 3 x 15 reps, 20RM. Weeks 10 & 11: 1 x 15 - 3 x 12 reps, 15RM Weeks 12-13: 1 x 12 – 3 x 10 reps, 12RM. Weeks 14-20: 1 x 8 – 3 x 8 reps, 8RM  LI Weeks 8-9: 1 x 30 – 2 x 20 reps, 30RM. Weeks 10-20: 1 x 20 – 2 x 20 reps, 20RM	Knee joint laxity Leg extensor power KOOS Lysholm scale Tegner scale Single & triple hop tests	Knee joint laxity did not change from week 7 to 20, no difference between groups  ↑ muscle power HI compared with LI at 14 & 20 weeks  No difference in hop test results  No difference between groups in self-assessed function. Lysholm: 80 both groups Tegner: HI 4, LI 3 KOOS: pre-surgery levels at 20 weeks both groups  No difference in adherence

Study	Objective	Downs and Black Score	Participants	Duration	Exercise Parameters	Outcome Measures	Results
Friedmann-Bette et al., 2018	Investigate the effects of concentric-eccentric overload strength training versus concentric-eccentric strength training on muscular regeneration following ACLR	13 - poor	55m/13f 25yo (mean) 12 weeks post-op	2 sessions per week, 12 weeks	6 x 8 reps, 8RM. 90s rest between sets	Knee ext muscle strength CSA quad femoris Muscle biopsy sampling	<p>MCSA: - 4% ↑ (CON/ECC) - 11% ↑ (CON/ECC+) (no sig. difference) Graft type did not affect MSCA</p> <p>FCSA: ↑ in FCSA for all fiber types after 12 weeks (no difference between groups) Greater type 1 fibers in ST group than in PT</p> <p>↑ in peak torque at both velocities (60<sup>o</sup>s<sup>-1</sup> &amp; 180<sup>o</sup>s<sup>-1</sup>) in both groups (no difference between groups)</p> <p>Type of graft effected peak torque - higher peak torque of semi-ten group</p> <p>Peak torque correlated with MCSA in both training groups</p> <p>↑ in type 1 fibres in CON/ECC+ group</p> <p>Myofibers expressing MHCneo ↑, higher in CON/ECC+ group</p>
Study	Objective	Downs and	Participants	Duration	Exercise	Outcome	Results

		<b>Black Score</b>			<b>Parameters</b>	<b>Measures</b>	
Fukuda et al., 2013	Determine if early start on OKC exercises would promote a clinical improvement without causing laxity post-ACLR	26 - Excellent	29m/16f 25yo (mean) 12mo from injury to surgery 1-2 weeks post-op	3 sessions per week, 25 weeks	3 x 10 reps, 10RM and 3 x 15 reps at 70% of 1RM, and isometrics	Knee flx, ext strength Anterior knee laxity Pain Single and triple hop tests, cross-over hop test Lysholm scale	No difference in laxity between groups  EOKC group had improved quads strength at 19weeks, 25 weeks and 17 months compared with 12 weeks post-op. LOKC groups sig. difference in quads strength only at 17 months compared with 12 weeks post-op  No difference between groups in self-reported function, hop tests and pain
Kang et al., 2012	Investigate the differences in strength and endurance of patients who performed OKC and CKC exercises post-ACLR.	15 - Fair	24m/12f. 29yo (mean). 12 weeks post-op.	3 sessions per week, 12 weeks.	5 x 12 reps at 70% 1RM, 30 seconds rest between sets.	Knee flx, ext strength & endurance Squat strength	OKC group demonstrated greater difference in strength and endurance of extensor muscles  No difference in squat strength ↑
Kiniliki et al., 2014	Assess the functional outcomes of early onset progressive eccentric and concentric training in patients with ACLR	16 - Fair	31m/2f. 33.2yo (mean) 3.1mo from injury to surgery 3 weeks post-op	3 sessions per week, 12 weeks	2-3 sets (2-3mins recovery between) 5% 1RM - 50% 1RM progressed gradually weekly	Knee flx and ext strength Vertical jump Single hop test Lysholm scale ACL-QoL	No difference in isokinetic strength of knee extensors and flexors between study and control group  Vertical jump test, single hop for distance test, Lysholm knee scale, ACL-QoL demonstrated greater improvement in the study group compared with control
<b>Study</b>	<b>Objective</b>	<b>Downs and Black Score</b>	<b>Participants</b>	<b>Duration</b>	<b>Exercise Parameters</b>	<b>Outcome Measures</b>	<b>Results</b>

Lepley et al., 2015	Determine if a combination of NMES and eccentric exercise would be effective at improving quadriceps muscle strength in patients following ACLR	15 - Fair	23m/13f. 21.6yo (mean) 78.6 days from injury to surgery 6 weeks post-op	2 sessions weekly, 6 weeks	4 x 10 reps, 60% 1RM, 2 min rests between sets	Quads activation and strength	<p>No difference in quads strength and activation between NMES + ECC and ECC only groups at RTP</p> <p>Strength deficits and QAF in NMES only group at RTP compared with healthy controls</p> <p>Healthy controls stronger than SR group at RTP</p> <p>NMES + ECC and ECC only groups had ↑ quads activation at RTP compared with SR and N only groups</p> <p>NMES + ECC and ECC only demonstrated greater strength gains compared with NMES only and SR groups</p> <p>ECC only ↑ quads strength compared with standard rehab at RTP</p> <p>Changes in quads strength related to increased quads activation</p> <p>No difference in quads strength and activation between healthy controls and NMES + ECC and ECC only at RTP</p>
Study	Objective	Downs and Black Score	Participants	Duration	Exercise Parameters	Outcome Measures	Results

Perry et al., 2005	Compare the effects of a CKC versus an OKC training regimen on knee joint laxity and function post ACLR	20 - Good	37m/12f 33yo (mean) CKC group - 811 days from injury to surgery OKC group - 1340 days from injury to surgery 8 weeks post-op	2 sessions per week, 6 weeks	Wk 1-3: 3 x 20 reps, 20RM Wk 4-6: 3 x 6 reps 6RM	Knee joint laxity Single, vertical, cross-over hop tests. Hughston clinic questionnaire ROM Knee circumference	No difference in knee laxity between groups  No difference in self-reported function or functional hop tests between groups
Risberg et al., 2007	Determine the effect of an NT program vs a strength program on knee function following ACLR	22 - Good	47m/27f 28.4yo (mean) Injury occurred less than 3 years before surgery 2 weeks post-op	2-3 sessions per week, 6 months	Phase 3: 3 x 12-15 reps progressing to 3 x 8-12 reps at 50-80% 1RM Phase 4: 3 x 6-8 reps	Cincinatti Knee Score SF36 VAS pain and knee function Knee flx, ext strength Balance Proprioception Single, triple hop test, stair hop test	91% adherence in ST group. 71% adherent in NT group (80% or > attendance)  No difference in knee joint laxity between groups at 6 months  No difference between the groups for any outcome measurements at 3 months  No difference in muscle strength variables  Decline in quads strength and hop tests from pre-op period to 6 months post-op
<b>Study</b>	<b>Objective</b>	<b>Downs and Black Score</b>	<b>Participants</b>	<b>Duration</b>	<b>Exercise Parameters</b>	<b>Outcome Measures</b>	<b>Results</b>

Santos et al., 2018	Correlate possible gains in knee extensor and flexor torque generated by isokinetic training with hop tests post-ACLR	14 - poor	16n 2-5 years post-op	2 sessions per week, 12 weeks	3 x 10 reps, 10RM, 3-minute rest between sets	Knee ext and flx strength Single, triple, crossover, figure 8 hop tests	Knee ext strength deficit in affected leg at pre-training  Knee ext strength deficits remained post-training  ↑ in knee flx strength post-training compared with knee ext  SH, TH and F8 tests ↑ compared with pre-training  Moderate correlation between knee ext strength and single hop for AL, strong correlation for NAL  Moderate correlation between knee flx strength and SH
Welling et al. 2019	Compare results of a RT protocol for soccer players after ACLR with healthy controls	15 – fair	38m 24.2yo (mean) 2 weeks post-op	2.6 sessions (mean) per week, 10 months	Phase 2: 2 x 15-25 reps (<50% 1RM) Phase 3: 2-4 x 8-10 reps (60-80% 1RM) & 2 x 15-25 reps (<50% 1RM) Phase 4: 5 x 3 reps (>80% 1RM) & 2 x 15-25 reps (<50% 1RM)	Peak quads and hamstring strength	4 months post-ACLR quads strength weaker than control  7 months post-ACLR no difference in quads or hamstring strength compared to control  10 months post-ACLR hamstring strength greater than control  10 months post-ACLR 65.8% passed quads & 76.3% passed hamstring LSI>90%

Abbreviation:  $os^{-1}$ , degrees per second; %, percent; +, and; >, greater than; ACL-QoL, anterior cruciate ligament quality of life; WBV, whole body vibration; Sig., Significant; RCT, randomised controlled trial; m, male; f, female; yo, years old; flx, flexor; ext, extensor; RT, resistance training; HI, high intensity; LI, low intensity; ↑, increased/improved; CON, concentric; ECC, eccentric; ECC+, eccentric overload; CSA, cross-sectional area; MCSA, muscle cross-sectional area; FCSA, fascicle cross-

sectional area; PT, patellar tendon graft; ST, semitendinosis tendon graft; mm, millimetres; MHCneo, neonatal myosin heavy-chain (measure of muscle regeneration/remodelling); NMES, neuromuscular electrical stimulation; OKC, open kinetic chain; CKC, closed kinetic chain; EOKC/LOKC, early/late start open kinetic chain; NMES, neuromuscular electrical stimulation; RTP, return to play; SR, standard rehabilitation; Pre-op, pre-operative; Post-op, post-operative; QAF, quadriceps activation failure; ROM, range of movement; NT, neuromuscular training; s, seconds; ST, strength training; AL, affected limb; NAL, non-affected limb; Reps, repetitions; SH, single hop; TH, triple hop; F8, figure 8 hop