

Table 3. Characteristics of included studies, incorporating stair negotiation within their prehabilitation or rehabilitation interventions

Prehabilitation	Groups		Outcome change
Vukomanovic et al. 2008 THR	<p><i>Study group, n = 18</i></p> <p>Prior to surgery, one appointment with physiotherapist and two practical classes with physiotherapist on rehabilitation and how to undertake exercises that form part of rehabilitation program following surgery:</p> <p>Rehabilitation program starting day 1 post-operative:</p> <ul style="list-style-type: none"> • Stair climbing and descent, with aids • bed mobility • standing and walking with crutches 	<p><i>Control group, n = 18</i></p> <p>No education or exercises prior to surgery.</p> <p>Rehabilitation program starting day 1 post-operative:</p> <ul style="list-style-type: none"> • Stair climbing and descent, with aids • bed mobility • standing and walking with crutches 	<p>No differences between groups at discharge for pain, range of motion, Harris and JOA hip scores, and time to taken to walk. Study group negotiated stairs significantly earlier than control group.</p>
Swank et al. 2011 TKR	<p><i>Exercise group, n = 36</i></p> <p>At least three times per week for 4-8 weeks before surgery:</p> <ul style="list-style-type: none"> • Step ups (eight steps each direction, progressing to 20 steps; 76.2 mm step height) • lower-limb thera-band resistance exercises • squats • hip flexion-extension • hip abduction • adduction • ankle plant-dorsiflexion • knee flexion extension 	<p><i>Standard care group, n = 35</i></p> <p>Continue habitual physical activities</p>	<p>When assessed prior to surgery, the exercise group had improved sit-to-stand, stair ascent time, knee extension peak torque (surgical knee) compared to the standard care group.</p>

Rehabilitation (inpatient)	Groups		Outcome change
Bruun-Olsen et al. 2009 TKR	<p><i>Continuous passive motion (CPM) and exercise group, n = 30</i></p> <p>Continuous knee flexion-extension on same day of operation and following day.</p> <p>Plus, post-discharge exercise sessions as per exercise only group including climbing stairs with crutches.</p>	<p><i>Exercise only group, n = 33</i></p> <p>Exercise sessions after discharge with physiotherapist to include:</p> <ul style="list-style-type: none"> walking training (with crutches) and eventually climbing stairs with crutches hip and knee flexion-extension (active and assisted) isometric knee extensions 	<p>No differences between groups for pain, TUG, timed 40 m walking, timed stair climbing at one week or three months following surgery.</p> <p>For whole group, significant 50% reduction in pain score was found at 3 months.</p>
Bruun-Olsen et al. 2013 TKR	<p><i>Walking-skill group n = 29</i></p> <p>12 group sessions (70 mins) over 6-8 weeks, 6 weeks after surgery:</p> <ul style="list-style-type: none"> Climbing stairs at different speeds forward and lateral step training obstacle negotiation corridor walking (40 m) sit-to-standing moving and throwing 	<p><i>Standard care group, n = 28</i></p> <p>12 individual sessions (40 mins) over 6-8 weeks, 6 weeks after surgery:</p> <ul style="list-style-type: none"> seated ROM resistance exercises 	<p>Walking-skill group had greater improvement for 6MWT at 12-14 weeks and 9 months post-intervention.</p> <p>No differences for secondary outcomes, including timed stair climbing and timed stands.</p>
Rehabilitation (after discharge)	Groups		Outcome change
Kramer et al. 2003 TKR	<p><i>Clinic-based rehabilitation, n = 80</i></p> <p>Twice weekly clinic based sessions (each 60 min), from weeks 2 to 12.</p> <p>Home exercises three times daily until 12 weeks follow-up; once daily thereafter, includes stair climbing.</p>	<p><i>Home-based rehabilitation, n = 80</i></p> <p>Telephone call support.</p> <p>Home exercises, three times daily until 12 weeks follow-up; once daily thereafter, includes stair climbing.</p>	<p>No differences between groups for outcomes at 12 and 52 weeks following surgery, including: timed stair negotiation, 6MWT, WOMAC, knee ROM, Knee Society clinical rating score.</p>
Galea et al. 2008	<p><i>Centre-based exercise group n = 11</i></p> <p>8-week supervised exercise program, twice</p>	<p><i>Home-based exercise group, n = 12</i></p> <p>Received an illustrated guide of the Centre-</p>	<p>No group differences found for majority of outcomes after 8 week</p>

Rehabilitation (after discharge)	Groups	Outcome change	
THR	<p>weekly, 45 mins, 8 weeks after surgery, includes:</p> <ul style="list-style-type: none"> • Climbing and descending three steps for 5 mins, progressive for speed and repetitions • figure-of-eight walk • sit-to-stand • active single-leg stance • hip abduction • heel raise and lateral stepping • advice given on progression 	<p>based exercises, and carried out 8 week exercise program at home unsupervised, eight weeks after surgery. No advice on progression. Includes climbing and descending three steps for 5 mins.</p>	<p>program. QoL, stair negotiation, TUG and 6MWT improved in both groups.</p>
Lesch et al. 2010	<i>Case report – 49 year old</i>		<p>17 days following surgery, recovered normal gait pattern, unaided stair negotiation, improved Harris hip score</p>
THR	<p>Seven home-based sessions (45 to 60 min each) over 17 days, including:</p> <ul style="list-style-type: none"> • Reciprocal stair climbing (placing only one foot on each step) • proprioceptive neuromuscular facilitation • squats • lateral stepping • single-limb balance • Carioca and ADL practice 		
Harmer et al. 2009	<i>Land-based intervention group, n = 49</i>	<i>Water-based intervention group, n = 50</i>	<p>Water-based group improved more than land-based between 8 and 26 weeks for stair-climbing power, WOMAC stiffness and function, but clinically insignificant.</p>
TKR	<p>Twice-weekly, supervised sessions (60 mins each), for 6 weeks, 2 weeks after surgery</p> <ul style="list-style-type: none"> • Stair climbing (five-step stair and stationery stepper machine) • stationary cycling • treadmill walking • static balance 	<p>Twice-weekly, supervised sessions (60 mins each), for 6 weeks, 2 weeks after surgery</p> <ul style="list-style-type: none"> • walking (forward-backward) • lateral stepping • jogging • step-ups • jumping • kicking 	<p>Significant improvements observed in both groups at 8 weeks in all outcomes (including 6MWT, stair climbing</p>

Rehabilitation (after discharge)	Groups		Outcome change
	<ul style="list-style-type: none"> • sit-to-standing • knee ROM exercises <p>Also instructed to perform home-based activities, including ROM exercises and walking.</p>	<ul style="list-style-type: none"> • lunges • squats • knee ROM • upper-limb exercises 	power, WOMAC, pain, ROM), further improvements for all outcomes at 26 weeks except for WOMAC pain.
Kauppila et al. 2010 TKR	<p><i>Multimodal intervention group, n = 44</i> Ten days supervised training, 2-4 months post-surgery:</p> <ul style="list-style-type: none"> • isometric and dynamic strength exercises • aqua-aerobics • stretching and Nordic walking • relaxation strategies <p>Plus standard physiotherapy care, as per control group, including stair climbing</p>	<p><i>Control group, n = 42</i> Standard physiotherapy care, on ward and at home:</p> <ul style="list-style-type: none"> • pre-op exercises • Stair climbing • transfers • gait training • unaided walking • lower-limb mobility and strength • functional exercise on discharge • supervised outpatient exercise at 2 months. 	<p>No differences found between groups for any outcome measures at 2, 6 and 12 months follow ups. Both groups improved WOMAC scores, times for 15 m walk, stair ascent and descent, and isometric knee strength.</p> <p>Improvements plateaued at 6 month.</p>
Liao et al. 2015 TKR	<p><i>Additional balance rehabilitation group, n = 65</i></p> <p>Eight weeks of functional rehabilitation training within 2 months of discharge (including stair climbing, thirty repetitions between weeks 6 and 8) plus: progressive proprioceptive and balance training, involving:</p> <ul style="list-style-type: none"> • tandem walking • cross-over stepping • foam-balance exercises. 	<p><i>Functional rehabilitation group, n = 65</i></p> <p>Eight weeks of functional rehabilitation, within 2 months of discharge: three, one-to-one supervised sessions per week:</p> <ul style="list-style-type: none"> • warm up • muscle strengthening exercises • functional-task oriented exercises (including stair climbing, thirty repetitions between weeks 6 and 8) 	Both groups had improvements in balance and mobility however the balance rehabilitation group patients exhibited significantly greater improvements than the functional rehabilitation groups at 8 weeks and 32 weeks follow up.

Rehabilitation
(after discharge)

Groups

Outcome change

Note: Activities for daily living, ADL; Assessment of Quality of Life, AQL; Japanese Orthopaedic Association, JOA; knee injury and osteoarthritis outcome score, KOOS; range of motion, ROM; timed up-and-go test, TUG; visual analogue scale, VAS; Western Ontario and McMaster University Osteoarthritis Index, WOMAC; 6 min walk test, 6MWT.