

# **Development of a functional rehabilitation intervention for post knee arthroplasty patients: Community based Rehabilitation post Knee Arthroplasty (CORKA) trial.**

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## **Abstract**

Knee osteoarthritis is a common cause of disability in older people and knee replacement surgery in the UK is increasing. The CORKA trial is a randomised controlled trial of rehabilitation targeted at patients identified as being at risk of a poor outcome after knee arthroplasty. This paper describes the development and delivery of the CORKA intervention. It was informed by current evidence, relevant guidelines, expert and patient opinion, practical considerations and a pilot study. The intervention is a multicomponent rehabilitation programme with the main component being an exercise programme delivered to participants in their own home. It includes functional task practice, strategies to improve adherence and where appropriate the provision of appropriate aids and equipment.

**Keywords:** Knee arthroplasty; Rehabilitation; Intervention development; Randomised controlled trial; Therapy

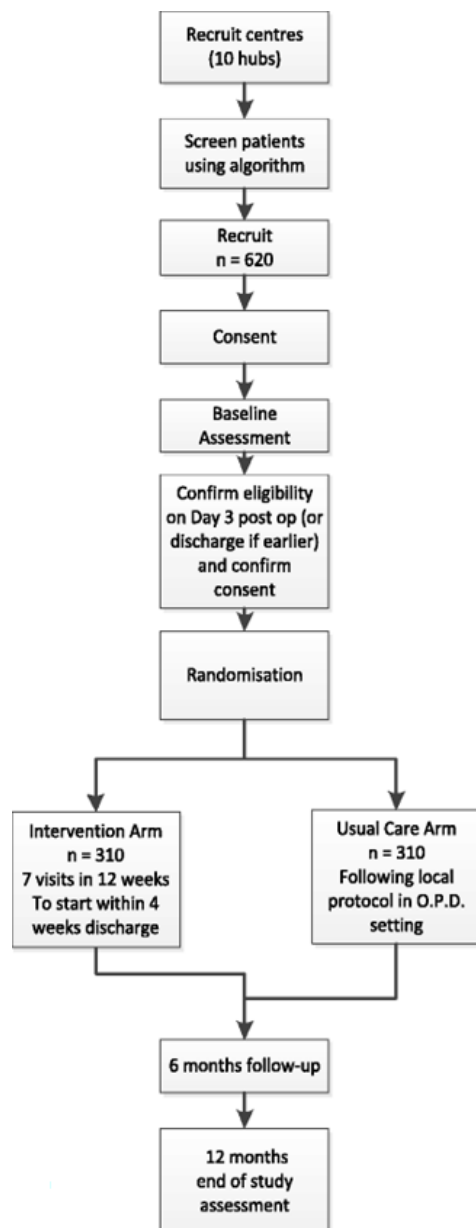
## **Introduction**

Osteoarthritis (OA) is the commonest cause of disability in older people<sup>1</sup> and painful knee OA affects 10% of people in the UK over 55<sup>2</sup>. National outcome data shows a steady increase in patients undergoing knee arthroplasty (KA) increasing by 3.8% in the last year<sup>3</sup>. It is known that outcome following KR is multi-faceted; around 15% of patients do not report a good outcome following KR with on-going pain and mobility problems which reduce their ability to be active after their surgery<sup>4</sup>. There is a strong theoretical underpinning with some evidence from small randomised controlled trials, cohort studies and clinical practice to support an intervention focussed on improving strength, balance and functional activity to optimise post-operative rehabilitation and return to functional activities<sup>5–10</sup>

## **CORKA Trial Overview**

The COMMunity-based Rehabilitation after Knee Arthroplasty (CORKA) trial is a prospective two armed individually randomised controlled trial (RCT), targeted at patients identified as being at risk of poor outcome after KA with blinded outcome assessment at baseline, 6 and 12 months. The primary outcome is function measured by the Lower Limb Functional Disability Index (LLFDI) at 12 months. A full description of the trial has been previously outlined<sup>11</sup>. A flow diagram of the study can be seen in figure1. Recruitment was completed in January 2018 with 620 participants.

**Figure 1. CORKA trial flow chart**



## Development of the Intervention

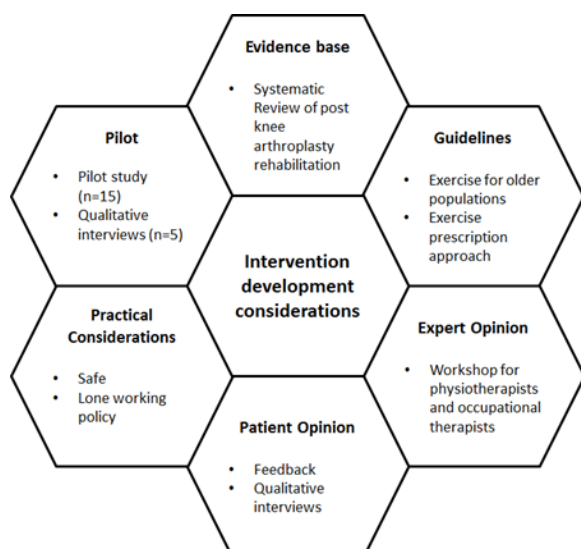
This paper follows the Medical Research Council guidelines for complex interventions<sup>12</sup> and is reported in accordance with the Template for Intervention Description and Replication (TIDiER) checklist<sup>13</sup> and the Consensus on Exercise Reporting Template (CERT)<sup>14</sup>.

The development of the intervention drew from several sources. These included identifying current exercise guidelines, exploring the evidence base on rehabilitation post-arthroplasty and seeking expert and patient opinion. These approaches were discussed and refined at an intervention development day, attended by research staff, physiotherapists and occupational therapists. Factors associated with the design, content, and delivery of the intervention was discussed, and a draft intervention proposed. The intervention was then reviewed, refined, and tested for delivery in a pilot phase in a clinical NHS setting, including patient feedback. The various steps that were taken are outlined below and are represented in figure 2.

## Guidelines

There are currently no exercise guidelines specifically for patients following KA. Therefore exercise guidelines for adults 65 years and older or adults aged 50-64 who have either a chronic condition or functional limitations<sup>15,16</sup> were considered. It is recommend accumulating five sessions of 30 minutes moderate intensity physical activity a week in at least 10 minute bouts<sup>16</sup>.

**Figure 2. Intervention development considerations**



## Evidence base

Prior to the intervention development a systematic search of the literature was conducted on rehabilitation post KA. The relevant papers informing the intervention design are displayed in table 1.

**Table 1 Key papers used in the intervention development**

Author	Design	Conclusion or key considerations	Relevant Intervention component
<b>Su et al 2010<sup>17</sup></b>	Review	Stiffness a frequent complications following TKA	Range of movement exercises
<b>Fitzsimmonds et al 2010<sup>18</sup></b>	Systematic Review	Stiffness is a common problem after TKA	Range of movement exercises
<b>Bhave et al 2005<sup>19</sup></b>	Cohort	Functional limitations can follow knee arthroplasty. A structured programme may be required for some patients.	Range of movement exercises  Functional task practice
<b>Stratford et al 2010<sup>20</sup></b>	Cohort	The greatest improvement in knee ROM took place during first 12 weeks post-arthroplasty	Range of movement exercises
<b>Rowe et al 2000<sup>21</sup></b>	Cohort	It is suggested that 110 degrees of flexion is a suitable goal for knee rehabilitation	Range of movement exercises
<b>Piva et al 2011<sup>22</sup></b>	Cross section	Hip abduction strength can influence physical function post-arthroplasty	Strengthening
<b>Bade and Stevens-Lapsley 2011<sup>23</sup></b>	Cohort	Early high intensity rehabilitation post-TKA can lead to better functional performance	Strengthening
<b>Liao et al 2013<sup>24</sup></b>	RCT	Balance training resulted in a significant change in 10m walk and timed up-and-go test	Balance
<b>Pozzi et al 2013<sup>25</sup></b>	Systematic Review	Optimal physiotherapy should include strengthening and intensive functional exercises	Strengthening  Functional task practice
<b>Stevens et al 2003<sup>26</sup></b>	Cohort	Patients with knee OA have reduced quadriceps strength, and weakness persists after surgery.	Strengthening
<b>Walsh et al 1998<sup>8</sup></b>	Cohort	One year post-TKA physical impairments and functional	Strengthening

		limitations can persist	
<b>Mizner et al 2005<sup>27</sup></b>	Cohort	Quadriceps strengthen is highly correlated with functional performance	Strengthening
<b>Pandy et al 2010<sup>28</sup></b>	Review	Hip and calf musculature play an important role in gait	Strengthening Gait skills
<b>Lee et al 2014<sup>29</sup></b>	Cross section	There is a weak correlation between lower limb strength and the Y-balance test	Strength Balance
<b>Moffet et al 2004<sup>10</sup></b>	RCT	Intensive functional rehabilitation was effective at improving short and midterm functional ability	Strengthening
<b>Coulter et al 2009<sup>30</sup></b>	Cohort	No significant differences in WOMAC between class or one to one physiotherapy after joint replacement surgery (both groups utilised strengthening exercises)	Strengthening
<b>Knoop et al 2011<sup>31</sup></b>	Narrative Review	Knee proprioception is decreased in people with knee OA	Balance
<b>Mandeville et al 2008<sup>32</sup></b>	Cohort	TKR can affect gait stability after surgery	Balance Gait skills
<b>Kearns et al 2008<sup>33</sup></b>	Cohort	From a consecutive series of 1341 TKA patients, 78 (7%) reported falling	Balance
<b>Piva et al 2010<sup>5</sup></b>	Pilot RCT	Feasibility of balance training post-TKA supported by high adherence and low drop out	Balance
<b>McClelland et al 2007<sup>34</sup></b>	Systematic Review	TKA patients have altered gait patterns	Gait skills
<b>Heiberg et al 2010<sup>35</sup></b>	Cohort	Post-TKA patient can experience difficulty with strenuous activities including walking long distances	Gait skill Graduated walking programme
<b>Wiik et al 2013<sup>36</sup></b>	Cohort	Gait parameters after UKR are much closer to normal compared to TKR, but still not as	Gait skills Graduated walking programme

		good as controls	
<b>Turcot et al 2013<sup>37</sup></b>	Cohort	Gait parameters impact satisfaction post-TKA	Gait skills Graduated walking programme
<b>Bruun-Olsen et al 2013<sup>38</sup></b>	RCT	A walking skills programme demonstrated a better 6 minute walk post-TKA	Gait skills Graduated walking programme
<b>Philbin et al 1995<sup>39</sup></b>	Cross section	Patients with end-stage lower extremity OA are severely deconditioned	Graduated walking programme
<b>Ries et al 1996<sup>40</sup></b>	Cohort	Cardiovascular fitness can improve at one year and two years post-TKA	Graduated walking programme
<b>Naylor and Ko 2012<sup>41</sup></b>	Mixed methods study (Nested within a RCT)	Patients post-TKA are able to exercise at moderately hard intensity	Graduated walking programme Strengthening
<b>Harmer et al 2009<sup>42</sup></b>	RCT	Land-based or water-based rehabilitation delivered after TKA, offer similar outcomes	Graduated walking programme
<b>Meier et al 2008<sup>6</sup></b>	Review	Post-TKA quadriceps muscle impairment can contribute to functional limitations	Functional task practice Strengthening
<b>Bade and Stevens-Lapsley 2012<sup>43</sup></b>	Review	Rehabilitation programmes that utilise higher intensity, progressive resistance strengthening demonstrate superior long term strength and functional gains	Functional task practice Strengthening
<b>Noble et al 2005<sup>7</sup></b>	Cross section	TKA patients experience substantial functional impairment	Functional task practice
<b>Bade et al 2010<sup>44</sup></b>	Cohort	Persistent impairments 6 months after TKA suggest more intensive therapeutic approaches may be needed	Functional task practice
<b>Minns Lowe et al 2007<sup>9</sup></b>	Systematic Review	Interventions including functional physiotherapy exercise result in short term benefit post-TKA	Functional task practice

## **Rationale underlying the CORKA intervention**

### **Range of Movement (ROM)**

Following KA surgery there is potential for a loss of both flexion and extension<sup>19,20</sup>. A range of 0-110° is suggested to allow most normal functional activities<sup>21</sup>. It is likely that a significant proportion of any increase in ROM will occur in the initial 12 weeks post-surgery<sup>20</sup> and several studies have included ROM exercises within their post-operative protocols<sup>22-24</sup>. Stiffness can also be a complication<sup>17</sup> and up to 60% of patients undergoing total KA may experience stiffness<sup>18</sup>

### **Strengthening**

It is known that those with knee OA may have decreased quadriceps strength<sup>26</sup>. It is common to find these strength deficit persisting following for a long time following KA<sup>25</sup>. Knee flexor and extensor peak muscle torque has been found to be lower in people one year after KA compared to age matched controls<sup>8</sup>. Muscle strength is an important consideration for this population as strength and functional performance are closely linked. For example, quadriceps strength has been linked with the ability to move from sitting to standing, or stair climbing<sup>27</sup>. Hip abductor strength has been correlated with rising from a chair, climbing stairs, walking and changing direction<sup>22</sup>. In addition hip and calf strength play an important role in gait and balance<sup>28,29</sup>. Previous interventions for this population have included strengthening exercises, with focus on quadriceps, hamstrings, hip abductors and calf muscle groups<sup>10,22,23,30</sup>.

### **Balance**

Knee replacement surgery can affect gait, stability and balance<sup>32</sup>, and falling can be a problem following KA<sup>33</sup>. A pilot study has looked at adding balance training to functional training after KA. Although this was a pilot study and therefore underpowered to detect changes in groups, the authors reported that the balance training group demonstrated high adherence, low drop out and importantly no adverse events<sup>5</sup>. A RCT investigating the effects of functional training with or without balance after KA, found that additional balance training provided significantly better outcomes including 10m walk, Timed Up and Go (TUG), stair climb test and chair rise test<sup>24</sup>.

### **Gait Skills and Aerobic Exercise**

A systematic review of gait analysis post total KA concluded that patients following surgery have altered gait patterns<sup>34</sup>. Problems with walking after KA are common. These include specific gait deficits linked to underlying problems such as pain or reduced ROM and general problems such as decreased walking speed and endurance<sup>8,34,35</sup>. These difficulties may persist at one year post surgery<sup>8</sup>. Unicompartamental knee replacements are more likely to allow a gait pattern closer to normal, but they still demonstrate an altered gait pattern<sup>36</sup>. Gait outcomes contribute to patient satisfaction<sup>37</sup>, making gait an important consideration in post KA rehabilitation. An RCT that compared walking skills with usual physiotherapy, reported short and longer term functional mobility as 'better in the walking skills group'<sup>38</sup>. Walking may also need to be considered from a wider cardiovascular perspective, particularly as it is known that those with end stage OA of the lower limbs are likely to be physically deconditioned<sup>39,40</sup>. This is likely to be exacerbated by reduced mobility immediately post-op. Heart rate response, in addition to other factors affecting exercise performance have been investigated in participants after KA.<sup>41</sup> It was found that moderate intensity exercise was both safe

and tolerable for this population. Other interventions post KA have included aerobic exercise such as cycling on a static bike and treadmill walking<sup>30,42</sup>.

### **Functional Exercise**

Functional limitations, persisting beyond the post-operative period, can be experienced by patients after KA<sup>45,43</sup>. A year after surgery patients are likely to be significantly slower when walking and climbing the stairs, in addition to having greater functional impairments on tasks involving kneeling or squatting compared to matched controls<sup>7,8</sup>. Function as measured by the stair climb test, TUG test, 6 minute walk test, and single leg stance has been found to be worse in those post knee replacement, compared to healthy adults at 1, 3 and 6 months post-surgery<sup>44</sup>. In 2007 a systematic review evaluated the effectiveness of exercise after KA. It supported the use of functional physiotherapy exercise interventions to obtain short term benefit<sup>9</sup>. It showed that at 3 to 4 months a small to moderate effect on functional outcome, in addition to a small to moderate effect on quality of life and joint ROM were reported, although no such benefits were found at one year post-operatively. Since this review, further studies have investigated restoration of function post KA<sup>43</sup>, and a further systematic review of exercise post KA conducted in 2013, recommended that physiotherapy should include both strengthening and intensive functional exercises<sup>25</sup>.

### **Workshops**

An initial draft version of the CORKA intervention was compiled on the basis of the guidelines and evidence base described above. The intervention programme, exercise progression strategies and patient materials were reviewed by physiotherapists and occupational therapists in the form of workshops. Following the workshops, feedback was given on all aspects of the intervention, and changes were made to both the intervention and patient materials.

### **Pilot Phase**

Once a final version of the intervention had been developed it was tested in a pilot phase, consisting of 15 participants. After completion of the pilot 3 participants and 2 clinicians were interviewed following treatment, seeking their feedback on the content of the intervention and the mode of delivery. The resulting feedback led to modifications to the patient materials and intervention procedures. The modifications included the need to retake some of the photographs for the exercise sheets to make them 'brighter' and more 'vibrant', in addition to providing a space for comments on the exercise sheets.

### **CORKA Interventions**

The CORKA trial consisted of two intervention arms, usual care and the CORKA intervention. These are described below.

#### **Usual care**

Participants allocated to usual care will receive routine post-operative physiotherapy as offered by the local centre. It is recognised that usual care can vary considerably geographically<sup>46</sup>, however it is likely to include some of the following; written advice on the home exercises given on discharge from hospital, between 1-6 sessions of outpatient physiotherapy, class based exercise sessions or

hydrotherapy and home requirements assessed by an occupational therapist to identify any potential barriers to discharge. To standardise usual care as much as possible, participants will be expected to attend at least one, and no more than six, sessions of usual care.

### **CORKA intervention**

The CORKA intervention is a multicomponent rehabilitation programme. The aim is to improve both the function and participation in activities in those at risk of a poor outcome following KA. The main component of the intervention is an exercise programme delivered to participants in their own home, with the addition of functional task practice, consideration of adherence approaches, and the provision of appropriate aids and equipment. The intervention starts within 4 weeks of surgery and consists of an initial assessment followed by up to 6 subsequent sessions. It is delivered by a mix of qualified staff and rehabilitation assistants. All aspects of this intervention are outlined further below.

#### **Home exercise programme**

The CORKA trial exercise programme consists of groups of possible exercises ordered into specific sections. These sections are 'knee flexion ROM', 'knee extension ROM', 'basic quadriceps strengthening', 'strengthening – quadriceps', 'strengthening – hamstrings', 'strengthening – hip abductors', 'strengthening – calf', 'balance', 'gait skills'. A range of different exercises are included in each section, with the aim of including one exercise from each section, meaning the intervention can be tailored to each individual patient. All exercises can be viewed in appendix 1.

#### **Functional task practice**

During the participants initial assessment the physiotherapist will focus on tasks that are identified as being problematic. The exercise programme will then be tailored to the individuals' needs and goals. In addition to this other specific tasks will be practiced. If necessary, techniques such as breaking down the task and identifying specific components will be used as part of a practical problem solving approach. These tasks can also be demonstrated and practiced within treatment sessions. To reinforce the importance of task practice written advice will be included in the participants exercise diary. Participants will be asked to follow the advice given when carrying out the task in their daily life. Tasks can then be reviewed, progressed or changed at subsequent sessions.

#### **Graduated walking programme**

The most practical and relevant way to include moderate intensity aerobic exercise within the intervention, and to improve walking endurance is through a graduated walking programme. It is clear that participants will demonstrate a wide range of mobility levels at baseline. Therefore the aim of the graduated walking programme is to increase participants walking time or distance. At session 3 of the intervention participants will be asked about their walking, in relation to time or distance they are currently able to manage, they will then be asked to increase this time or distance gradually, considering any pain and swelling. This will be reviewed at subsequent sessions.



## Prescription and Progression

Prescription and progression of exercises will be linked to treatment algorithms and decision aids. These are described and outlined in Table 2. RPE refers to Rating of Perceived Exertion scale<sup>47</sup>, an 11 point scale where participants can rate how hard they feel they are working.

Table 2. Prescription and progression of exercise

Exercise type	Reps and Sets	Decrease intensity/difficulty	Maintain intensity/difficulty	Increase intensity/difficulty
<b>Strengthening exercises</b>	6-12 Reps	RPE $\geq$ 5	RPE 3-4	RPE $<$ 3
	2-3 Sets	Unable to complete 6 repetitions of exercise with good form	Able to complete 6-12 repetitions with good form	Can complete more than 12 repetitions with good form
	5 Sec hold (if required)	Increase in pain lasting longer than 2 hours post exercise		
		Significant increase in swelling		
<b>Balance exercises</b>	3 Reps	Participant at risk of falling	Exercise challenging for participants but not putting them at risk of falling	Exercise is not challenging for participant
	2-3 Sets	Pain lasting longer than 2 hours post exercise		
	30 Second hold	A significant increase in swelling		
<b>Range of movement exercises</b>	10-15 Reps	Participant or therapist feel exercise isn't being performed correctly	Participant and therapists happy exercise is being performed correctly	Participant or therapist feel exercise isn't being performed correctly
	Sets			
	If stretch selected 3-5 Reps with 30-60 Sec hold			
<b>Gait skills</b>	Reps and sets as required based on assessment of the patient and exercise selected	Exercise too challenging for participant, putting participant at risk of falling	Exercise challenging for participants but not putting them at risk of falling	Exercise is not challenging for participant
<b>Walking</b>	Recommendation to gradually increase walking distance/time from session 3 onwards	RPE $\geq$ 5	RPE 3-4	RPE $<$ 3
		Pain lasting longer than 2 hours post exercise		
		A significant increase in swelling		
<b>Task practice</b>	To practice 1 to 3 tasks as required during daily life	Task practice too challenging for participant, putting participant at risk of falling	Task practice challenging for participants but not putting them at risk of falling	Task practice is not challenging for participant

### **Exercise duration and frequency**

It is envisaged that the exercise programme will take between 15-25 minutes to complete. Participants will be advised that they can perform this as one block or spread throughout the day. They will be asked to perform their exercises daily, although we recognise this may not be possible for everyone.

### **Modifications**

Therapists and rehabilitation assistants will be encouraged to use their clinical reasoning skills when delivering the intervention. If staff members feel that it is unsafe or not appropriate to give a participant an exercise from a particular section of the intervention, then they will be advised not to. If they feel a participant needs additional exercise(s) from a particular section in the intervention, e.g. to encourage flexion in a stiff knee, then they will be advised to do this. Staff members will be asked to record any modifications they make on treatment logs that will be sent back to the central trial team.

### **Information**

In addition to the exercise programme participants will be given an information booklet, which comprises of information about pain and swelling, wound management, scar massage, expected symptoms, slips trips and falls, walking, driving, kneeling, stairs, exercise advice, returning to work, and returning to sports or leisure activities.

### **Adherence**

Several adherence strategies are built into the intervention. These included goal setting, an exercise diary, and a behavioural contract. Goal setting includes discussion with the participants and therapists about goals that are important to the individual. These goals will be recorded in the relevant section in the participant materials, alongside a plan to practice undertaking tasks related to the goal, to follow their tailored exercise programme, and to keep a record of their exercises in the exercise diary. Goals can be reviewed in subsequent sessions as required. In relation to goals the participant material contains a behavioural contract. Participants will be asked when they will undertake their exercise programme, where they will perform their exercise programme, and who can help them achieve their goal. The therapist and participant can then sign this form. Furthermore participants will be given an exercise diary where they can record the exercise they have undertaken daily.

### **Skill mix**

This intervention will be undertaken using both qualified therapists and rehabilitation assistants. At the initial appointment the therapist and assistant will undertake the assessment. Subsequent sessions will be undertaken by the rehabilitation assistant only, with the qualified staff member visiting for an additional session mid-way through the intervention. All therapists will be either UK registered physiotherapists or occupational therapists. NHS banding will range from 5-7 for qualified therapists and 3-4 for therapy assistants

### **Training**

All staff delivering the CORKA intervention will receive training. This will consist of a 2-3 hour training session, including instructions on how to treat participants according to the trial protocol, how to select and progress exercise in line with the protocol, and how to complete trial paperwork. No elements of the intervention are beyond the scope of normal practice for those who will deliver the intervention. Staff members will be provided with a therapist manual which outlines the intervention in detail and included a guide for each session.

### **Safety and Serious Adverse Events**

At all sites staff members will be encouraged to consider the safety of the participant and themselves. A significant consideration in a trial such as CORKA, is that staff will be working alone. Therefore all staff members will be asked to follow the lone working policy of their own organisation and encouraged to report anything they felt constitutes an adverse event or serious adverse event. In order to make this process less burdensome they will be encouraged to contact the central team in Oxford to discuss any questions or concerns.

### **Intervention Fidelity**

Fidelity of the intervention will be monitored by visits from the research physiotherapists on the CORKA trial team to observe the intervention sessions. A pre-defined form will be used to check all aspects of the intervention, as outlined in the protocol.

### **Conclusion**

This paper has outlined the development, and content of a multi-component functional rehabilitation intervention for participants at risk of a poor outcome after KA. The effectiveness of this intervention compared to usual care will be reported at the end of the CORKA trial.

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## Appendix 1. CORKA intervention exercises






Exercise	Level	Purpose	Functional relevance
Hip and knee flexion 	1A	Lower limb range of movement	Walking, stair climbing, kneeling
Passive knee flexion 	1B	Lower limb range of movement	Walking, stair climbing, sitting and standing up from a chair, kneeling
Active assisted knee flexion 	1C	Lower limb range of movement	Walking, stair climbing, sitting and standing up from a chair, kneeling
Hold-relax knee flexion 	1D	Lower limb range of movement	Walking, stair climbing, sitting and standing up from a chair, kneeling
Active Knee flexion 	1E	Lower limb range of movement	Walking, stair climbing, sitting and standing up from a chair, kneeling
Hip and knee flexion with overpressure 	1F	Lower limb range of movement	Walking, stair climbing, kneeling




Knee extension stretch		2A	Lower limb range of movement	Walking, stair climbing, standing up from a chair
Knee extension with overpressure		2B	Lower limb range of movement	Walking, stair climbing, standing up from a chair
Knee extension		2C	Lower limb range of movement	Walking, stair climbing, standing up from a chair, dressing, getting in/out of car
Hamstring stretch		2D	Lower limb range of movement	Walking, stair climbing, dressing
Calf stretch		2E	Lower limb range of movement	Walking, stair climbing, dressing
Static Quadriceps		3A	Lower limb strength	Walking, stair climbing, standing up from a chair
Inner range quadriceps		3B	Lower limb strength	Walking, stair climbing, standing up from a chair

Long arc quadriceps		4A	Lower limb strength	Walking, stair climbing, standing up from a chair
Knee extension with ankle weight		4B	Lower limb strength	Walking, stair climbing, standing up from a chair
Sit to stand using arms		4C	Upper and lower body strength	Walking, stair climbing, standing up from a chair, lifting/carrying household objects, getting in/out of car
Sit to stand without arms		4D	Lower limb and trunk strength	Stair climbing, standing up from a chair, walking, getting in/out of car
Wall slide		4E	Lower limb strength	Stair climbing, standing up from a chair, walking, getting in/out of car, lifting household objects
Mini Squats		4F	Lower limb strength	Stair climbing, standing up from a chair, walking, getting in/out of car, lifting household objects

Single leg dip 	4G	Lower limb strength	Stair climbing, standing up from a chair, walking, lifting household objects
Static hamstrings 	5A	Lower limb strength	Stair climbing, standing up from a chair, walking, lifting household objects
Sliding heel backwards 	5B	Lower limb strength and range of movement	Stair climbing, standing up from a chair, walking, kneeling
Standing hamstring curls 	5C	Lower limb strength	Stair climbing, standing up from a chair, walking, lifting household objects
Active hamstrings 	5D	Lower limb strength	Stair climbing, standing up from a chair, walking, lifting household objects
Standing hamstring curls with ankle weight 	5E	Lower limb strength	Stair climbing, standing up from a chair, walking, lifting household objects
Lunge 	5F	Lower limb strength	Stair climbing, standing up from a chair, walking, lifting household objects

Hip abduction 	6A	Lower limb strength	Walking, dressing, getting into/out of bed
Bridging 	6B	Lower limb strength	Dressing, walking , standing up from a chair
Hip hitching 	6C	Lower limb strength	Walking, dressing, getting into/out of bed
Standing hip abduction 	6D	Lower limb strength	Walking, dressing, getting into/out of bed, standing from a chair
Standing hip abduction with ankle weight 	6E	Lower limb strength	Walking, dressing, getting into/out of bed, standing from a chair
Short lever hip abduction in side lying 	6F	Lower limb strength	Walking, dressing, getting into/out of bed
Long lever hip abduction in side lying 	6G	Lower limb strength	Walking, dressing, getting into/out of bed
Hip abduction in side lying with ankle weight 	6H	Lower limb strength	Walking, dressing, getting into/out of bed

Bilateral calf raise		7A	Lower limb strength	Walking and stair climbing
Single calf raise		7B	Lower limb strength	Walking and stair climbing
Standing feet together		8A	Balance	Falls Prevention
Semi-tandem stance		8B	Balance	Falls prevention
Tandem stance		8C	Balance	Falls Prevention
Single leg stance		8D	Balance	Falls Prevention
Walking on the spot		9A	Walking skills and balance	Walking and falls prevention

Waling forwards and backwards 	9B	Walking skills and balance	Walking a straight path and falls prevention
Side stepping 	9C	Walking skills and balance	Walking, stepping around obstacles, falls prevention
Step ups 	9D	Walking skills and balance	Walking, stepping onto kurbs, stair climbing, falls prevention
Mini lunge step up 	9E	Walking skills and balance	Walking, stepping onto kurbs, stair climbing, falls prevention
Turning 	9F	Walking skills and balance	Walking with aid and falls prevention
Figure of 8 walk 	9G	Walking skills and balance	Walking both straight and curved paths, falls prevention
Tandem walking 	9H	Walking skills and balance	Walking and falls prevention