RESEARCH PAPER

A pre-operative group rehabilitation programme provided limited benefit for people with severe hip and knee osteoarthritis

Jason A. Wallis1,2, Kate E. Webster1, Pazit Levinger3, Cynthia Fong2, and Nicholas F. Taylor1,2

1School of Allied Health, La Trobe University, Melbourne, Australia, 2Physiotherapy Department, Eastern Health, Melbourne, Australia, and 3Institute for Sport, Exercise & Active Living, Victoria University, Melbourne, Australia

Abstract

Purpose: To determine if a pre-operative group rehabilitation programme can improve arthritis self-efficacy for people with severe hip and knee osteoarthritis. Method: Single group, repeated measures design: 4-week baseline phase followed by a 6-week intervention phase of water exercise, and education with self-management strategies. The primary outcome was arthritis self-efficacy. The secondary outcomes were measures of pain (WOMAC), activity limitation (WOMAC), activity performance (30 s chair stand test, 10 m walk test) and health-related quality of life (EuroQol). Results: Twenty participants (10 knee osteoarthritis and 10 hip osteoarthritis) with a mean age of 71 years (SD 7) attended 92% (SD 10%) of the scheduled sessions. All measures demonstrated baseline stability between two time points for measurements at week 1 and measurements at week 4. After the 6-week intervention programme there were no significant improvements for arthritis self-efficacy. There was a 12% increase for fast walking speed (mean increase of 0.14 m/s, 95% CI 0.07, 0.22). There were no significant improvements for other secondary outcomes.

Conclusions: A pre-operative water-based exercise and educational programme did not improve arthritis self-efficacy, self-reported pain and activity limitation, and health-related quality of life for people with hip and knee osteoarthritis who were candidates for joint replacement. While there was a significant increase in one measure of activity performance (walking speed), these findings suggest the current programme may be of little value.

Keywords

Hip, knee, osteoarthritis, pre-operative rehabilitation, self-efficacy

Introduction

People with hip and knee osteoarthritis experience pain, physical impairments such as muscle weakness and reduced joint range of motion that limits daily activities and affects quality of life [1]. Some health services run pre-operative group rehabilitation programmes involving exercise and education with the expectation that these programmes better prepare patients for joint replacement surgery and reduce health service utilisation in the post-operative period. However, it remains uncertain if pre-operative programmes provide sufficient benefit in the post-operative period for health services to continue or adopt these programmes.

A systematic review of 23 randomised controlled trials of pre-operative interventions for people with severe hip and knee osteoarthritis waiting to undergo joint replacement surgery demonstrated low to moderate quality evidence that pre-operative exercise programmes reduce pain for people with hip and knee osteoarthritis before surgery [2]. In addition, most trials did not show benefits after surgery. The only exceptions were two programmes combining exercise and education about post-operative recovery which reported improved immediate post-operative functional recovery after hip replacement with reduced number of days to reach functional goals of walking, stair climbing, using a chair and using a toilet [3,4]. It is possible that improved outcomes from pre-operative programmes involving education and self-management strategies could be the result of enhanced self-efficacy. Self-efficacy may be defined as the confidence a person has in their ability to successfully perform a specific behaviour or task in the future [5]. Therefore, people with severe osteoarthritis who have completed programmes...
involving education and self-management strategies may feel more confident in being able to perform daily tasks despite their condition.

Arthritis self-management programmes are an example of interventions to enhance self-efficacy and were designed for people with mild to moderate effects of arthritis [6,7]. A previous randomised controlled trial of arthritis self-management programme for people with hip and knee osteoarthritis that ran for 6 weeks [8], demonstrated significant improvements in self-efficacy with increased confidence in managing pain at 4 months (effect size 1.63, 95% CI 0.83, 2.43) and 12 months after the intervention (effect size 0.98, 95% CI 0.07, 1.89).

As arthritis self-management programmes were designed for people with mild to moderate effects of arthritis, little is known about the effects of self-management programs, and programmes preparing patients for surgery, on their self-efficacy. No previous studies of pre-operative group rehabilitation programmes investigated this outcome. Therefore, the primary aim of this study was to investigate the effectiveness of a pre-operative exercise and educational programme in improving self-efficacy of patients with severe hip and knee osteoarthritis who were candidates for surgery. It was hypothesised that a pre-operative programme that included self-management strategies would be effective in improving self-efficacy in patients with severe osteoarthritis who were candidates for surgery. The secondary aims were to determine if the programme reduced pain and activity limitation, improved activity performance and improved health-related quality of life.

Method

Study design

The trial was registered in the Australian New Zealand Clinical Trials Registry [12]. A single group, repeated measures design with a 4-week baseline phase, followed by a 6-week intervention phase was used. A single group, repeated measures design with a multiple baseline is an efficient research design when there is access to a relatively small numbers of participants [9,10]. Establishment of a stable 4-week baseline phase allows any changes in the intervention phase to be attributed to the intervention with more confidence [10]. This trial was approved by the Eastern Health and La Trobe University ethics committees and all participants provided written informed consent.

Participants

Adults with osteoarthritis of the hip or knee were recruited from Eastern Health’s osteoarthritis hip and knee service (OAHKS) and from Eastern Health’s waiting list for joint replacement surgery. Participants were invited to participate if they fulfilled the following inclusion criteria: (1) aged at least 18 years; (2) had a diagnosis of severe osteoarthritis of the hip or knee based on criteria published by Kellgren and Lawrence [11]; (3) lived independently in the community (either at home or in a retirement village); (4) were able to understand English to follow instructions and complete questionnaires; and (5) received medical clearance to participate in water exercise. Participants were excluded if (1) had other severe pathology that would affect participation in the exercise component of the intervention programme; (2) had moderate-to-severe cognitive impairment with a score of less than 7 on the Short Portable Mental Status Questionnaire [12].

Intervention

‘‘Get Fit for Hip and Knee Joint Replacement Programme’’ is a group programme at a rehabilitation hospital in metropolitan Melbourne, Australia (Eastern Health, Peter James Centre) integrating water-based exercise, education and self-management strategies for people who are candidates for hip or knee replacement surgery. The programme was held twice per week for 6 weeks. Each session was 1.75 h long and included education sessions and water exercise. Education sessions were led by allied health professionals including physiotherapists, dieticians and occupational therapists. Exercise sessions were led by an exercise physiologist and assisted by allied health assistants.

The education and self-management component included the following topics: self-management principles; healthy goal setting and action plans; physical activity and osteoarthritis; pacing and activity-rest cycle; food and osteoarthritis; medications and osteoarthritis; reviewing healthy goals; equipment needs before and after joint replacement; and community exercise options (Table 1). The healthy goal setting and reviewing of goals were discussed individually with the exercise physiologist at weeks 1 and 5. In addition, all participants were provided with an educational booklet titled: ‘‘Living with osteoarthritis – a guide for people with osteoarthritis of the hip or knee [13]’’.

The water exercise component contained functional, aerobic, range of motion and muscle training exercises for the lower limbs typically performed at moderate intensity and progressed according to participant capability (Table 1). In addition, all participants were advised to perform home exercises and provided with an

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**Table 1. Get fit for hip and knee joint replacement programme.**

<table>
<thead>
<tr>
<th>Program schedule</th>
<th>Education topic</th>
<th>Educator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Educations sessions (1 h)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 1</td>
<td>Self-management principles, healthy goal setting and action plans.</td>
<td>Exercise physiologist</td>
</tr>
<tr>
<td>Week 2</td>
<td>Physical activity and osteoarthritis.</td>
<td>Exercise physiologist</td>
</tr>
<tr>
<td>Week 3</td>
<td>Pacing and activity-rest cycle.</td>
<td>Occupational therapist</td>
</tr>
<tr>
<td>Week 4</td>
<td>Food and osteoarthritis.</td>
<td>Dietician</td>
</tr>
<tr>
<td>Week 5</td>
<td>Medications and osteoarthritis. Reviewing healthy goals.</td>
<td>Pharmacist and exercise physiologist</td>
</tr>
<tr>
<td>Week 6</td>
<td>Equipment needs before and after joint replacement surgery and Community exercise options.</td>
<td>Physiotherapist</td>
</tr>
</tbody>
</table>

| Water exercises (45 min) | |
|--------------------------| |
| Walking (forwards, backwards, sideways, lunge walking, high knee walking) | |
| Squatting | |
| Hip and knee flexion (performed in standing) | |
| Hip extension (performed in standing and supine) | |
| Hip abduction and adduction (performed in standing and supine) | |
| Cycling (the action of cycling in the water) | |
exercise sheet [13]. On completion of the programme all participants were provided with ongoing exercises to continue at their local pool.

Outcome measures

All outcome measures were administered by an independent allied health assistant not involved in the implementation of the programme and blinded to previous measures. Outcome measures were taken at weeks 1, 4 and 10, with the measures at weeks 1 and 4 constituting the baseline phase before the start of the intervention, and the week 10 measures taken at the end of the 6-week intervention.

The primary outcome measure was self-efficacy, as measured by the arthritis self-efficacy scale [14]. The arthritis self-efficacy scale has demonstrated high retest reliability in an arthritis population (r > 0.84) [14]. The scale has 20 questions within 3 subscales of pain, function and other symptoms. For example, a question in the pain subscale is “how certain are you that you can decrease your pain quite a bit?” A question in the function subscale is “how certain are you that you can get out of an armless chair quickly without using your arms for support?” A question in the other symptoms subscale is “how certain are you that you can deal with the frustration of arthritis?” All questions are measured on a scale from 1 to 10 with the anchors of “very uncertain” and “very certain” and a higher score indicates higher self-efficacy.

For secondary outcomes, pain and activity limitation were measured using the pain and daily activity subscales of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). The WOMAC has been validated in people with osteoarthritis of the lower limbs [15]. The WOMAC scale has a five item Likert scale (none = 0, mild = 1, moderate = 2, severe = 3, extreme = 4) resulting in a pain score from 0 (best) to 20 (worst), and activity limitation score from 0 (best) to 68 (worst). Activity performance was measured by fast walking speed, using the 10 m walk test and the 30 s chair stand test. For fast walking speed, participants were instructed to walk as quickly as possible over a 14 m walkway, with the time taken to walk the middle 10 m measured. The test has been applied to a wide variety of health conditions and demonstrated evidence of reliability and validity [16,17]. For the 30 s chair stand test, participants rose from a seated position to standing with arms folded across chest as many times as possible in 30 s. The test has demonstrated high levels of inter-rater reliability (r = 0.81) and responsiveness in people with osteoarthritis [18]. Health-related quality of life was measured by the EuroQol (EQ-5D and EQ-VAS) questionnaire [19]. The EQ-VAS measures overall health state on a visual analogue scale. The EQ-5D covers five domains of mobility, self-care, usual activities, pain/discomfort and anxiety/depression. For each domain the participant selects one of three statements that range from no problems to severe problems. The EQ-5D is a standardised instrument for measuring health-related quality of life and providing a single index of utility. It has been used for a range of conditions and changes in the EQ-5D are significantly correlated with changes in condition-specific measures over 3 months [20].

Data analysis

Assuming a one point improvement in the 10 point arthritis self-efficacy scale is clinically significant, based on the fact that one point is approximately equal to one half of the standard deviation [21], and the scale can be measured with reliability of 0.85 and standard deviation of 2.2 [14], a sample size of 14 participants was required for power of 0.80 at an alpha level of 0.05. To account for any dropouts and to give a sufficient sample for other comparisons the aim was to recruit 20 participants.

The assumption of normality was tested with Shapiro–Wilk test for all outcome measures at weeks 1, 4 and 10. Inspection of the data sets suggested that 1/3 did not fulfil the assumption of normality. Results were reported using both parametric and the equivalent non parametric tests, since parametric tests are relatively robust to minor violations, and so that the results can be more easily interpretable by other researchers and those conducting systematic reviews.

To check for baseline stability paired t-tests and the equivalent non-parametric test, Wilcoxon signed ranks test, were applied to measures at week 1 and week 4 to determine if there were systematic changes. To assess the agreement between week 1 and week 4 measures the Intra-class Correlation Coefficient (ICC, 3.1) was applied.

To answer the primary research question of whether the programme led to a clinically significant improvement in arthritis self-efficacy, paired t-tests and Wilcoxon signed ranks test were applied to week 4 and week 10 data. The secondary outcomes were also evaluated by a series of paired t-tests and Wilcoxon signed ranks tests.

Results

Participants

Twenty participants (11 men, 9 women) with a mean age of 71 years (SD 7), body mass index of 31 (SD 5) completed the programme; 10 had severe knee osteoarthritis and 10 had severe hip osteoarthritis (participant characteristics displayed in Table 2). Osteoarthritis was classified as grade III or IV on the Kellgren Lawrence Scale for 19 participants, and as ‘‘severe’’ according to magnetic resonance imaging (MRI) report for one participant. Five participants were recruited directly from the Eastern Health’s waiting list for joint replacement surgery and 15 were recruited from Eastern Health’s screening clinic (Osteoarthritis Hip and Knee Service). Of the 15 recruited from the screening clinic all were awaiting an appointment with the consultant orthopaedic surgeon to be wait-listed for surgery. Sixteen participants had co-morbidities, of whom 10 participants had multiple co-morbidities; four participants did not have co-morbidities. The most common co-morbidities were hypertension (n = 8), cardiac disease (n = 3) and type 2 diabetes (n = 3). The participants attended a mean of 11 sessions (minimum 7, maximum 12) out of the 12 scheduled sessions (92%). Three participants of the 23 that enrolled in the study declined to participate after week 1, prior to commencement of the programme and were excluded from the analysis (Figure 1). No adverse events were reported during the programme.

Baseline stability

Outcomes at weeks 1 and 4 demonstrated baseline stability for most measures, with no systematic change between outcomes (p > 0.05) and moderate-to-high agreement across the baseline period with ICC values ranging from 0.53 to 0.88 (displayed in Table 3). There was a small systematic change observed in the chair stand test on the non-parametric test but agreement between week 1 and 4 scores for this test was moderately high (ICC = 0.78).

Primary outcome: arthritis self-efficacy

For the primary outcome, there were no significant changes during the intervention phase from weeks 4 to 10 for arthritis self-efficacy subscales of pain, function and other symptoms (primary outcomes displayed in Table 4).
surgery may not be as open to self-management principles with severe osteoarthritis who are considering joint replacement as performance mastery, modelling, interpretation of symptoms focus on the mechanisms required to enhance self-efficacy such over a 6-week period there may not have been sufficient efficacy was not supported.

Therefore, the hypothesis that a key benefit of a pre-operative rehabilitation programme, combining water-based exercise and education for our experimental group with severe hip and knee osteoarthritis who were candidates for joint replacement surgery, did not demonstrate any benefit to arthritis self-efficacy. The findings of the study demonstrated that a 6-week pre-operative rehabilitation programme, combining water-based exercise and education for our experimental group with severe hip and knee osteoarthritis who were candidates for joint replacement surgery, did not demonstrate any benefit to arthritis self-efficacy. Therefore, the hypothesis that a key benefit of a pre-operative programme for people with severe osteoarthritis would be improved self-efficacy was not supported.

While the programme incorporated self-management principles over a 6-week period there may not have been sufficient focus on the mechanisms required to enhance self-efficacy such as performance mastery, modelling, interpretation of symptoms and social persuasion [6]. Another possibility is that people with severe osteoarthritis who are considering joint replacement surgery may not be as open to self-management principles compared with people with mild to moderate osteoarthritis. Current evidence only demonstrates enhanced self-efficacy in people with less severe osteoarthritis that have not committed to surgery.

For the secondary outcomes, there were no significant improvements over the intervention period for the secondary outcomes of pain and activity (WOMAC, 30-s chair stand test), for health-related quality of life (EQ-5D) and overall health state (EQ-VAS; Table 4). There was a significant increase in fast walking speed over the intervention period of 12.2% (mean increase 0.14 m/s, 95% CI 0.07, 0.22; secondary outcomes displayed in Table 5).

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**Discussion**

The findings of the study demonstrated that a 6-week pre-operative rehabilitation programme, combining water-based exercise and education for our experimental group with severe hip and knee osteoarthritis who were candidates for joint replacement surgery, did not demonstrate any benefit to arthritis self-efficacy. Therefore, the hypothesis that a key benefit of a pre-operative programme for people with osteoarthritis would be improved self-efficacy was not supported.

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Acknowledgements

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or expectation effects. Second, the sample size was relatively small which may increase the risk of a type 2 error. However, the study was adequately powered to detect a clinically significant difference in the primary outcome. Third, the intervention was performed at a single clinical site, with a single cultural and linguistic group, which limits the study’s generalisability.

Conclusion

A pre-operative water-based exercise and educational programme did not demonstrate any benefit to arthritis self-efficacy, self-reported pain and activity limitation and health-related quality of life for people with severe hip or knee osteoarthritis who were candidates for joint replacement surgery. While there was a significant increase in their fast walking speed, these findings suggest the current programme may be of little value.

Declaration of interest

The authors report no declarations of interest.

References