**Exercise for Rehabilitation and Treatment: Summary of Research**

*Summarizing research findings to evaluate the effectiveness of exercise for rehabilitation and treatment of orthopedic conditions*

**Summary 18: Hip arthroplasty**  
March 2010

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**Q:** Compared to post-operative rehabilitation only, does the addition of a pre-operative exercise program improve pain and function in individuals undergoing a total hip arthroplasty?

**A:**

To answer this question, we performed a comprehensive search of the PubMed database (August 2009) for randomized, controlled trials and systematic reviews that addressed this specific research question.  

Four studies met the criteria for inclusion in this review, comparing pre- and post-operative exercise to post-operative exercise only (1,3), pre-operative exercise and education to education only (2), and pre- and post-operative exercise to advice only (4).

A 4-wk pre-operative exercise program improved pain and function prior to surgery, as well as improved pain at 4 and 12 wks post-surgery (1). Similarly, a 6 wk pre-operative program found significant changes in function prior to surgery, but no differences remained by 8 or 24 wks post-surgery (2). However, the pre-op exercisers were less likely to be discharged to rehabilitation (2). An 8 wk home based exercise program resulted in significant improvements in function compared to control subjects at discharge and at 3 mos post-surgery, but values were similar by 24 mos (3).

The final study compared both pre- and post-operative exercise to advice only and found that 8 wks of pre-operative exercise resulted in significantly higher walking performance at 3, 12 and 24 wks post-surgery (4).

Based on this review, it can be concluded that inclusion of pre-operative exercise therapy improves pre-operative pain and function for patients with hip osteoarthritis. As expected, when exercise is continued post-surgery the functional improvements also continue. Pre-operative exercise programs that are home based may be ideal for this group due to possible difficulties with mobility. Sample exercises from **VHI PC-Kits** have been provided based on examples from these studies.

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**Quad set from VHI PC-Kits: Geriatric Resource Library-Orthopedic, Total Hip #1**

**One-step stair from VHI PC-Kits: Geriatric Resource Library - Special Conditions, Strength Building #8**
Table 1: Overview of Research Studies

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<thead>
<tr>
<th>Study</th>
<th>Overview</th>
<th>Description of Intervention</th>
<th>Results &amp; Conclusions</th>
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<td>Hypothesis/Aim: To compare the effects of pre- and post-operative exercise to just post-operative exercise among patients with end-stage hip osteoarthritis.</td>
<td>Subjects: 23 adults (9 male; 14 female) meeting the following criteria: diagnosed with end-stage hip osteoarthritis and on the waiting list for THR at the study hospital; and without cognitive impairment, prosthesis in other joints, congenital hip dysplasia, inflammatory arthritis, Parkinson's disease, or sensitive neuropathy. Groups: Subjects were randomly assigned to either: 1. Post-operative only (Control, n=12) 2. Pre- and post-operative (Pre-op, n=11)</td>
<td>Both groups underwent total hip arthroplasty by the same surgeon using the same prosthesis. After surgery, both groups completed a standard 4 wk inpatient rehabilitation program under the supervision of a physical therapist that was identical to the pre-operative program (see below). Control: Subjects completed only post-operative rehabilitation. Pre-operative exercise: One mo prior to surgery, subjects completed a supervised program 5 day/wk for 1 mo prior to surgery. Each session was 1hr and included: 10-15 min of recumbent stationary cycling; stretching of the hamstrings, hip adductors, and hip flexors; strengthening of the hip adductors and quadriceps; postural realignment exercises; and education for post-surgery including movements to avoid, the use of devices, correct posture, lifting and carrying, and ADLs.</td>
<td>Outcome Measures: 1. Western Ontario and McMaster Osteoarthritis Index (WOMAC): The WOMAC measures activities related to functional independence among patients with lower extremity osteoarthritis and consists of 17 items related to function (0=best function; 68=worst function). 2. Harris Hip Score (HHS): The HHS is an observational assessment including pain, walking function, activities of daily living, and ROM (0=maximum disability; 100=no disability). 3. Short Form 36 (SF-36): The SF-36 includes 36 items relating to general health and function, and includes 8 dimensions of health (0=worst; 100=best). 4. Pain: Assessed using a visual analog scale. Results: Pain. The pre-op group demonstrated significantly less pain than the control group at pre-operative assessment (p=0.04), as well as the 4 and 12 wks post-operative assessments (p=0.03). Function. After the pre-operative intervention, the treatment group showed significant improvements compared to the control group in the physical function subscale of the SF-36 (p=0.05). There were no differences between the groups in WOMAC (p=0.6) or the Harris Hip Score (p=0.2). After surgery, both groups showed significant improvements in all outcome measures with no significant differences between the groups at any of the time points. Conclusions: The authors concluded that pre-operative exercise is not effective in reducing impairment after total hip replacement. However, the results reveal that pre-operative exercise improves physical function and pain pre-operatively, as well as reduces pain post-operatively. Limitations of this study include a small sample size and a lack of blinding of the tester to group assignment.</td>
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1) Ferrara, 2008

Outcome Measures:
Subjects: 63 adults (27 male; 36 female) meeting the following criteria: scheduled for unilateral primary THA for advanced arthritis; and without inflammatory arthritis, medical condition contraindicating exercise, or bilateral joint replacement.

Groups: Subjects were randomly assigned to either:

1. Control (n=16)
2. Pre-operative exercise (n=20)

Duration: The length of the intervention was 6 wks. Assessments were completed at baseline, post-intervention/pre-surgery, and 8 and 26 wks post-surgery.

Hypothesis/Aim: To determine the effect of pre-operative exercise among patients undergoing total hip replacement.

Subjects: 59 adults (21 male; 38 female) meeting the following criteria: primary or secondary (dysplasia, idiopathic avascular necrosis, and fracture) hip osteoarthritis; undergoing total hip replacement with thrust plate prosthesis; and no prior physical therapy for hip osteoarthritis, chronic pain, or other joint disease, or other joint condition.

Both groups received a pre-operative education booklet including information on preparing the home for post surgery and preparing for surgery. All subjects underwent surgery by one of 7 participating surgeons.

Control: See above.

Pre-operative exercise: Subjects performed water and land based exercise 3x/wk for 6 wks. Each session was 30-60 min and supervised by a physical therapist. During the first 3 wks, subjects performed single-plane motions in the water for the spine, upper and lower extremities. During the second 3 wks, subjects performed stationary cycling or elliptical for 10 min; 2 sets of 8-12 reps of seated rows, chest press, bicep curls, tricep kickbacks, leg press and abdominals; and 2 x 20 sec stretches for the hip, knee and ankles.

Outcome Measures:

1. Harris Hip Score: The HHS is an observational assessment including pain, walking function, activities of daily living, and ROM (0=maximum disability; 100=no disability).

Results: After the 8 wk intervention, the HHS improved significantly in the exercise group (p=0.001). Immediately before surgery, differences in the mean HHS scores were not significant between groups (p=0.13). At discharge (p=0.007) and 3 mos post-operative (p=0.03), the exercise group had a significantly greater HHS compared to the control group. At the 2 yr follow-up, differences were no longer evident as both groups had shown substantial improvement.
Pre-operative exercise: Subjects were evaluated by a physical therapist every 2 wks during the 8 wk intervention. Subjects received home exercises to be performed 3x/day including 10 reps of straight leg raises; stretching of hamstring and hip flexors; and strengthening of the upper extremity.

Conclusion: Although the authors concluded that there was no benefit of pre-operative exercise, this conclusion does not seem to be substantiated by the data. In addition, there were several significant limitations in this study, such as a lack of assurance of exercise compliance. Patients were asked to perform exercises at home, but frequency and intensity did not appear to be monitored. In addition, patients with primary or secondary osteoarthritis were included, and it was not indicated as to whether they were allocated equally between the groups. A significant difference in the mean age between the groups (exercise=46, control=57, p=0.01), indicates that perhaps there were more patients with secondary osteoarthritis in the exercise group.

Outcome Measures:

1. 25 m walk test: Subjects were asked to walk at a comfortable pace (walking aid permitted if required) for 25 m on a flat grass surface. Gait parameters were calculated including cadence (steps/min), stride length, and gait speed.

2. 2) 6 min walk test (at 12 and 24 wks only): Subjects were asked to walk at the fastest speed possible (walking aid permitted) around a 100 m flat surface, while remaining comfortable. The total distance walked in 6 min was determined.

Results: Before surgery, there were no significant differences between the groups in cadence, stride length, or gait speed during the 25 m walk test. However, 3 wks after surgery, the control group showed decreased values while the exercise group maintained or increased, resulting in a significant difference between group differences in cadence (p<0.01), stride length (p<0.05) and gait speed (p<0.01). At 12 and 24 wks post-surgery, cadence and gait speed remained significantly higher in the exercise group (p<0.05). The average gait speed for adults aged 60-74 is about 1.35 m/sec. The exercise group had achieved this walking speed by the wk 12 testing session (exercise=1.49, control=1.3), yet the control group did not reach this level until wk 24 (exercise=1.57, control=1.36).

The 6 min walk test was not conducted pre-surgery because of patient discomfort. At wk 24, the walk distance in the exercise group was significantly further than the control group (529.7m vs 485.1m, p<0.05).

Conclusions: The authors concluded that peri-operative exercise programs are well tolerated and result in an improved rate of ambulatory function after
Assessments were completed at baseline (8 wks pre-surgery), and 1, 3, 12 and 24 wks post-surgery. total hip arthroplasty. Subjects that exercised before and after total hip arthroplasty achieved a normal walking speed 3 mos before subjects that did not exercise. A limitation of this study was that the tester was not blinded to group assignment.

### Table 2: Additional Exercises from VHI Exercise Kits

The exercises included in this newsletter are intended only as a sampling of exercises from the different VHI exercise collections that might be relevant to the topic discussed. Their inclusion in this newsletter does not represent any rehabilitation protocol or any suggested exercise progression that could be used with patients. Using the order of the exercises to create a rehabilitation program for patients is inappropriate and could result in serious injury.

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Table 2: Additional Exercises from VHI Exercise Kits (cont.)

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References


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1 PubMed database was used to identify peer-reviewed research publications that addressed the specific clinical question
(population, diagnosis, treatment, and outcome). For inclusion, studies must be a randomized controlled trial (RCTs) and published in English. A maximum of 10 RCTs were reviewed, with strength of design and publication year determining which studies to include.

2 No study footnotes needed.

3 Statistical definitions: 1) *P*-value (*p*) denotes the level of significance, where *p*<0.05 indicates a statistically significant result. 2) 95% *Confidence Interval* (95% CI): a range that contains the true population estimate 95% of the time. A smaller range indicates an estimate that is more precise. 3) *Relative Risk* (RR) is a ratio of proportions (ProportionTreatment / ProportionControl). RR less than 1.0 indicates the treatment group has a decreased risk of developing the condition/disease compared to the control group, while RR greater than 1.0 indicates the treatment group has an increased risk. 4) *Incidence Risk Ratio* (IRR) is the ratio of two incidence rates; the incidence rate among the treatment group divided by the incidence rate in the control group. IRR gives a relative measure of the effect of a given treatment with values less than 1.0 favoring the treatment. 5) *Hazard Ratio* (HR) is the relative likelihood of experiencing a particular event; an HR of 0.5 indicates that one group has half the risk of the other group. HR is broadly equivalent to RR, but is useful when the risk is not constant with respect to time as it uses information collected at different times. 6) *Odds Ratio* (OR) is the odds of an event happening in the treatment group expressed as a proportion of the odds of an event happening in the control group and can be interpreted similar to the RR. 7) *Likelihood Ratio* (LR) is the likelihood that a given test result would be expected in a patient with the target disorder compared to the likelihood that the same result would be expected in a patient without that disorder. The LR is used to assess how good a diagnostic test is and to help in selecting an appropriate diagnostic test(s) or sequence of tests.