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 2: Frozen Shoulder (adhesive capsulitis)  
November 2008

Q: Does physical therapy, including joint mobilization, 
strengthening and stretching exercises, improve outcomes for 
patients with adhesive capsulitis?

To answer this question, we performed a comprehensive 
search of the PubMed database (March, 2008) for 
randomized, controlled trials that addressed this specific 
research question. 1

Five studies met the criteria for inclusion in this review: 
One study evaluated 6 wks of physiotherapy (PT) vs placebo 
therapy among patients who underwent glenohumeral joint 
distention (2); one study compared manipulation under 
anesthesia and home exercise to home exercise alone (1); 
two studies compared intra-articular steroid injections with or 
without 4 wks of PT (3, 5); and one study utilized Ibuprofen 
with or without 3 wks of PT (4). Three studies found that PT 
improved shoulder motion but did not improve functional 
outcomes (e.g., patient rating of pain or disability) (2, 3, 5), 
while two studies found improvements in both (1, 4). The 
outcome questionnaires may not have been adequate to 
detect small functional improvements that likely accompanied 
changes in motion.

A: Despite slight differences in outcomes, all of the studies 
found that changes in motion were most pronounced during 
the initial wks of treatment. While initial improvements in the 
treatment groups tended to level off with time, the placebo 
groups showed slower, but sustained, improvements (2, 3, 5). 
This may reflect the self-limiting nature of adhesive capsulitis, 
and/or the effect of home exercise programs performed by the 
placebo groups in two of these studies (3, 5).

Based on this review, it appears that PT interventions for 
adhesive capsulitis will likely increase shoulder motion and 
may improve pain and disability. Although none of the 
reviewed studies was designed to determine which PT 
intervention was most effective, all programs included 
stretching and strengthening exercises. Although authors 
generally did not include specific examples of the exercises 
used in their studies, we have selected sample exercises from 
VHI PC-Kits that are likely representative of those utilized and 
reflect the studies’ general physical therapy treatment goals 
(Table 2).

Pendulum (circular) exercise from VHI PC-Kits: 
Orthopedic, Shoulder #26

Posterior/inferior glide with flexion below 90° from 
VHI PC-Kits: Orthopedic, Shoulder #19
# Exercise for Rehabilitation and Treatment: 
**Summary of Research**

**Summary 2: Frozen Shoulder (adhesive capsulitis)  November 2008**

## Table 1: Overview of Research Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Overview</th>
<th>Description of Intervention</th>
<th>Results &amp; Conclusions</th>
</tr>
</thead>
</table>
| Kivimäki, 2007 | Hypothesis/Aim: The aim of the study was to compare the effect of manipulation under anesthesia plus home exercises with home exercises only in patients with frozen shoulder. | Subjects in the manipulation group received manipulation under short general anesthesia within 2 wks of randomization. Subjects in both groups received 2 sessions of PT advice and written instructions for a daily home exercise program that included: 1) Pendulum exercises 2) Stretching techniques for the shoulder joint. | Outcome Measures:  1) Shoulder pain intensity 2) Modified Shoulder Disability Questionnaire (SDQ) 3) Working ability 4) Shoulder ROM (measured in degrees except IR which was measured in cm by reaching hand behind back and determining the distance from the inferior angle of the contralateral scapula)  
Results: Range of Motion. Both groups increased ROM throughout the 12 mos with no significant group differences at any time point. In one yr, ROM in the M+HEP group improved from 104° to 157° in flexion, 78° to 161° in abduction, 38cm to 11cm in IR, and 18° to 65° in ER. Similarly, in the HEP group ROM improved from 109° to 154° in flexion, 80° to 154° in abduction, 42cm to 12cm in IR, and 18° to 61° in ER. Functional outcomes. Both groups improved in working ability, pain intensity, and shoulder disability throughout the 12 mos, with no significant group differences present at any time point. Working ability, measured on a scale of 0-10 where 10 represented "work ability at its best" increased in the M+HEP group from 5.0 to 8.3 at 12 months, and in the HEP group from 5.9 to 8.2. Pain intensity, measured on a scale of 0-10 where 0 represented "no pain" deceased from 6.6 to 1.5 and 6.4 to 2.2 in M+HEP and HEP groups, respectively. Shoulder disability, measured on a scale of 0-28 with a higher score indicating more pain during ADLs also decreased during the 12 months, from 22.7 to 6.6 in the M+HEP group and from 21.7 to 6.6 in the HEP group.  
Conclusions: The authors concluded that a HEP was as effective at improving shoulder motion, pain and disability as the same program in combination with manipulation under anesthesia, with the majority of gains occurring in the initial 6 wks. |
The study was to determine whether the addition of PT following joint distention improves shoulder ROM and function, and if PT is cost-effective.

Subjects: 144 adults (number male/female not specified) with adhesive capsulitis, defined as pain and stiffness >=3 mos and restriction of passive motion >=30° in >=2 planes of movement.

Groups:
1) Arthrographic distension + PT (n=74)
2) Arthrographic distention + sham ultrasound (n=70)

Duration: 6 wks of treatment with assessments at 6, 12, and 26 wks

Prior to the trial, all subjects received arthrographic distention of glenohumeral joint with corticosteroid and normal saline. Subjects in the placebo group received sham ultrasound. Subjects in the PT treatment group received 6 wks of treatment (8 visits, 30 min each). PT treatment goals were: Improve glenohumeral joint range of active and passive motion by stretching soft tissue structures around the joint; improve strength, particularly within the newly gained passive range; and regain proprioception and normal shoulder and trunk mechanics. Specific interventions included:
1) Passive and self-executed stretching of muscles passing over the glenohumeral joint
2) C-spine and T-spine mobilization
3) Glenohumeral joint passive accessory glides
4) Glenohumeral joint passive physiologic mobilization including rotation
5) Strength and coordination exercises for rotator cuff and scapular stabilizers
6) Proprioceptive challenge

Subjects in the PT treatment group received a 10 min daily home exercise program to complete at the conclusion of the 6 wks of treatment for the remaining 20 wk study.

Outcome Measures:
1) SPADI (shoulder pain and disability index questionnaire)
2) Pain (overall, night, activity, rest)
3) Short Form 36 Health Survey (general health status)
4) Assessment of Quality of Life
5) Patient Perceived Recovery Scale
6) Active shoulder ROM (measured in degrees except IR which was measured in cm by reaching hand behind back)

Results: Range of Motion. The PT treatment group showed significant improvements in shoulder motion at 6 and 12 wks when compared to the control group (p<0.05). At 12 wks the difference in the changes from baseline between the groups was: Abduction 12.4°; Flexion 9.5°; ER 5.8°; and IR 5.3cm. By 26 wks, the PT treatment group displayed 5-7° more ROM across all planes of motion than the control group, but the difference was no longer significant; except for IR (5.4 cm more in PT group).

Functional outcomes. There were no significant differences between the groups at any time point for the pain or quality of life questionnaires, with the exception of a higher perceived recovery in the PT group at all time points (6, 12, and 26 wks). The authors suggested that there may have been "less potential for additional improvement in these outcomes following the arthrographic joint distension." In addition, the questionnaires may not have been adequate to capture the small changes in function that likely accompanied the increased ROM.

Conclusions: The authors concluded that although PT provided no apparent benefit in terms of pain or quality of life, there was an improved range of motion and patient-perceived recovery with PT treatment.

Hypothesis/Aim:
The aim of the study was to examine the effectiveness of intra-articular steroid treatment and PT, alone and in combination, among patients with adhesive capsulitis.

Subjects: 78 adults (32 male; 46 female) with adhesive capsulitis.

The steroid treatment consisted of 20mg Triamcinolone injected into the anterior and lateral shoulder.

Outcome Measures:
1) Primary outcome -SDQ (shoulder disability questionnaire)
2) Pain at rest scale
3) Global disability scale
4) Passive ER

Results: Range of Motion. The CS+PT group and the PT group showed significant improvement in ROM compared to the placebo group at 6wks. Overall, the
Ryans, 2005 ++

**Hypothesis/Aim:**
The aim of the study was to determine the effectiveness of PT in patients with adhesive capsulitis.

**Subjects:** 119 adults (38 male; 81 female) with adhesive capsulitis, defined as shoulder pain and limitation of passive ROM in all directions that interfered with ADL.

**Groups:**
1) Treatment: Ibuprofen + PT (n=60)
2) Control: Ibuprofen (n=59)

**Duration:** 3 wks of treatment with assessments at 6, 12, and 24 wks.

The Ibuprofen treatment consisted of 400mg 3x/day for 3 wks.

**PT treatment consisted of 3 hospital-based sessions/wk for 3 wks. Standardized treatment included:**
1) Short wave diathermy for 20 min
2) Mobilization and passive glenohumeral joint stretching exercises to patient tolerance

The treatment group was also instructed in-home exercise to perform on 4 days/wk without hospital-based sessions:
1) Pulley exercises (active assisted) for 5 min
2) Hot pack for 20 min followed by active non-assisted exercises using a towel and a wall for 5 min

All subjects received advice on

**Outcome Measures:**
1) Primary outcome - Rating of pain and disability on 5-point Likert Scale. "Successful treatment" was defined as either "disappearance of shoulder complaints" or "some pain or limitation but does not interfere with everyday life"
2) SPADI (shoulder pain and disability index)
3) Abduction, ER, and IR
4) Satisfaction with treatment on 4-point Likert Scale
5) Adverse reactions to treatment

**Results:**
Range of Motion. After 3 wks, the treatment group had significantly greater improvements in abduction (7.2°, p=0.005) and internal rotation (3.3°, p=0.04) compared to control group. There was no significant effect with external rotation (3.0°, p=0.09). Functional outcomes. The treatment group had significantly higher SPADI scores (p=0.002) and greater satisfaction with treatment (p<0.001). In terms of the primary outcome measure, the subject rating of pain and disability, a greater percentage of the treatment group had "successful treatment" at 3 wks (35%, p=0.04) and 6 wks (61.4%, p=0.05) compared to the control group (3 wks, 18.6%; 6 wks, 42.3%). By 12 wks, the differences were not significant, and by 24 wks, 82.4% of the control group and 80.4% of the treatment group indicated they had "successful

---

Pajareya, 2004 +++

**Hypothesis/Aim:**
The aim of the study was to determine the effectiveness of PT in patients with adhesive capsulitis.

**Subjects:** 119 adults (38 male; 81 female) with adhesive capsulitis, defined as painful shoulder for >4 wks and <6 mo, with shoulder ABD and ER 25% less than opposite shoulder.

**Groups:**
1) Corticosteroid + PT (CS+PT; n=20)
2) Corticosteroid (CS; n=19)
3) Placebo + PT (PT; n=20)
4) Placebo (n=19)

**Duration:** 4 wks of treatment with assessments at 6 and 16 wks

PT treatment consisted of 8 sessions over 4 wks. Standardized treatment included:
1) Proprioceptive neuromuscular facilitation
2) Maitland mobilizations
3) Standardized interferential modality
4) Active exercise therapy with exercise equipment

All subjects, including those in the CS and placebo groups, were instructed in a home exercise program. No details regarding this home exercise program were provided.

**Effect of PT increased ER by 8.3° compared to no PT (p=0.02). The CS group did not have a significant effect on ROM. By 16 wks there were no significant differences between groups.**

**Functional outcomes. The CS+PT group showed significant improvement in SDQ and the visual analog scale of global disability compared to the placebo group. However, the CS+PT groups were not significantly different than the placebo group in either of these measures. After 16 wks, there were no differences between the groups in any of the measures.**

Conclusions: The reason for the short-term nature of the significant results is unclear, but the authors suggest it may be related to subjects dropping out prior to the 16wk followup (21 subjects dropped out, primarily from the CS and placebo groups). Overall, the authors conclude that a combination of injection and physiotherapy may be beneficial because the gains were apparent in both shoulder motion and functional outcomes compared to only one area when either treatment was used in isolation.
Duration: 3 wks of treatment with assessments at 3 wks (all outcomes), and 6, 12, and 24 wks (primary outcome only)

Hypothesis/Aim: The aim of the study was to compare the efficacy of an intra-articular steroid injection with PT, alone and in combination, among patients with adhesive capsulitis who were also taught a home exercise program.

Subjects: 93 adults (38 male; 55 female) with adhesive capsulitis, defined as painful shoulder for <1 yr; SPADI score >=30; and active and passive glenohumeral joint motion 25% less than opposite shoulder or normal values in at least two directions.

Groups:
1) Corticosteroid + PT (CS+PT; n=21)
2) Corticosteroid (CS; n=23)
3) Placebo + PT (PT; n=21)
4) Placebo

Steroid treatment consisted of 40mg Triamcinolone injected into the shoulder joint space under fluoroscopic guidance. PT treatment consisted of 12 one-hr sessions for 4 wks (3 sessions/wk). PT followed two strategies depending on the classification of acute or chronic capsulitis. PT for acute capsulitis was designed to relieve pain, maintain or improve ROM, and restore function. Specific treatments included:
1) TENS followed by mobilization
2) Active ROM exercises
3) Ice

PT for chronic capsulitis was designed to improve ROM and muscle strength and restore function. Specific treatment included:
1) Ultrasound followed by mobilization
2) Active and auto-assisted ROM
3) Isometric strengthening exercises
4) Ice

All subjects, including those in the CS and placebo groups, were instructed in a 10 min home exercise program to be done twice daily for 3 mos. The home exercise program included active and auto-assisted ROM exercises in flexion, abduction, external rotation, and internal rotation.

Outcome Measures:
1) Primary outcome SPADI (shoulder pain and disability index questionnaire)
2) Short Form 36 Health Survey (general health status)
3) Active and Passive ROM (sum of movement in flexion, abduction, and ER in degrees); and IR (measured in cm by reaching hand behind back)

Results: Range of Motion. Compared to all other groups, the CS+PT group showed a significantly greater sum of active ROM, sum of passive ROM, and IR at 6 wks; greater passive flexion and IR at 3 mos; and greater passive flexion at 6 mos. The CS group showed some significant changes in ROM measures compared to the placebo group at 6 wks (active ROM, passive ROM, ER), 3 mos (active ROM, passive ROM, ER, abduction), and 6 mos (active ROM). The PT group had significantly greater passive flexion at 3 mos. By 12 mos, there were no longer any significant differences between any of the groups in any of the ROM measures.

Functional outcomes. The CS+PT group and the CS group showed significant improvement in the SPADI total score compared to the PT group and the placebo group at 6 wks (active ROM, passive ROM, ER), 3 mos (active ROM, passive ROM, ER, abduction), and 6 mos (active ROM). The PT group did not differ from the placebo group in these measures. There were no differences between any groups in the SPADI score at 6 or 12 mos. There were also no differences in the SF-36 questionnaire between any of the groups at any time point.

Conclusions: The authors concluded that a corticosteroid injection combined with a home exercise program was effective in improving shoulder pain and disability in patients with adhesive capsulitis, and that the addition of supervised PT to corticosteroid treatment provided faster improvements in ROM.

http://www.vhikits.com/newsletter/?issue=2
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.

<table>
<thead>
<tr>
<th>Level: Beginning-Intermediate</th>
<th>Level: Beginning-Intermediate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kit</td>
<td>Tab</td>
</tr>
<tr>
<td>Assisted Exercise</td>
<td>Shoulder</td>
</tr>
</tbody>
</table>

Level: Beginning-Intermediate

<table>
<thead>
<tr>
<th>Kit</th>
<th>Tab</th>
<th>Exercise #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopedic</td>
<td>Shoulder</td>
<td>73</td>
</tr>
</tbody>
</table>

Level: Beginning-Intermediate

<table>
<thead>
<tr>
<th>Kit</th>
<th>Tab</th>
<th>Exercise #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopedic</td>
<td>Shoulder</td>
<td>32</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Level: Intermediate-Advanced</th>
<th>Level: Intermediate-Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kit</td>
<td>Tab</td>
</tr>
<tr>
<td>Foam Roller</td>
<td>All Fours</td>
</tr>
</tbody>
</table>

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

[Diagram of exercises]

http://www.vhikits.com/newsletter/?issue=2
Exercise for Rehabilitation and Treatment: Summary of Research
Summary 2: Frozen Shoulder (adhesive capsulitis) November 2008

Disclaimer

Warning! This newsletter is intended to be viewed only by licensed medical professionals, in accordance with the Terms of Use Agreement. Do not employ any treatment or technique set forth in the newsletter before consulting your doctor or other appropriate licensed medical professional; by violating these instructions, you hereby release and discharge VHI from all claims, demands, damages, costs, expenses, injuries, and causes of action arising from any act or occurrence relating to the use of the information set forth in this Newsletter.

References


Animations were created as part of a Phase I SBIR grant from the National Institutes of Health (NIH)
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.

Intervention had a statistically significant effect (+++); intervention had a statistically significant effect on some, but not all, outcome measures (++); intervention had a positive effect or clinical effect but was not statistically significant (+); intervention did not show an effect (-).

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 (Proportion Treatment / Proportion Control). 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.