

Does Passive Mobilization of Shoulder Region Joints Provide Additional Benefit Over Advice and Exercise Alone for People Who Have Shoulder Pain and Minimal Movement Restriction? A Randomized Controlled Trial

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Background. Passive mobilization of shoulder region joints, often in conjunction with other treatment modalities, is used for the treatment of people with shoulder pain and minimal movement restriction. However, there is only limited evidence supporting the efficacy of this treatment modality.

Objective. The purpose of this study was to determine whether passive mobilization of shoulder region joints adds treatment benefit over exercise and advice alone for people with shoulder pain and minimal movement restriction.

Design. This was a randomized controlled clinical trial with short-, medium- and longer-term follow-up.

Setting. The study was conducted in a metropolitan teaching hospital.

Patients. Ninety-eight patients with shoulder pain of local mechanical origin and minimal shoulder movement restriction were randomly allocated to either a control group (n=51) or an experimental group (n=47).

Intervention. Participants in both groups received advice and exercises designed to restore neuromuscular control at the shoulder. In addition, participants in the experimental group received passive mobilization specifically applied to shoulder region joints.

Measurements. Outcome measurements of shoulder pain and functional impairment, self-rated change in symptoms, and painful shoulder range of motion were obtained at 1, 3, and 6 months after entry into the trial. All data were analyzed using the intention-to-treat principle by repeated-measures analyses of covariance.

Results. No statistically significant differences were detected in any of the outcome measurements between the control and experimental groups at short-, medium-, or longer-term follow-up.

Limitations. Therapists and participants were not blinded to the treatment allocation.

Conclusion. This randomized controlled clinical trial does not provide evidence that the addition of passive mobilization, applied to shoulder region joints, to exercise and advice is more effective than exercise and advice alone in the treatment of people with shoulder pain and minimal movement restriction.



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Shoulder pain is a common complaint, with the prevalence ranging from 20% to 33% in the adult population.¹⁻⁴ It has been reported that shoulder pain is the third most frequent musculoskeletal complaint, after back and knee pain, in the general community.⁴ In 2007, the US Bureau of Labor Statistics reported that injuries to the shoulder in the workforce required the most number of days off work, with a median of 18 days to recuperate. With the exception of the knee and wrist, the shoulder took at least twice the median time to recover compared with all other body parts.⁵ Nocturnal disturbance, the inability to sleep on the affected side, functional disability, and a reduction in the overall quality of life are common complaints resulting from shoulder pain.⁶⁻⁸

Manual therapy in the form of passive joint mobilization is used by physical therapists for the management of pain, including shoulder pain, and often is used in conjunction with other treatment modalities, including exercise therapy.⁹⁻¹¹ For the management of shoulder pain, mobilization techniques are commonly applied to the joints of the shoulder region (glenohumeral, acromioclavicular, and sternoclavicular joints), to the scapula, to the joints of the cervicothoracic vertebral column, and to the ribs. Passive joint mobilization aims to manage shoulder pain by physiological mechanisms (eg, inducing hypoanalgesia)^{12,13} or by mechanical mechanisms (eg, restoring normal biomechanical relationships by addressing related joint stiffness).¹⁴

Clinical trials that have investigated the effectiveness of passive joint mobilization therapy, which included mobilization of the cervicothoracic vertebral column and ribs, for the management of painful shoulder dysfunction indicate that this

form of mobilization therapy is more effective than other therapy modalities. Winters et al¹⁵ demonstrated greater, more rapid decrease in pain in patients with acute and chronic shoulder pain who received manipulation and mobilization of vertebral column, ribs, or shoulder region joints than those who received massage, exercises, and electrotherapy. In addition, patients with chronic shoulder pain demonstrated added treatment benefit (greater decrease in pain intensity and functional limitation) when passive mobilization of vertebral column or shoulder region joints were added to exercises.¹⁶ In the only clinical trial that has investigated mobilization and manipulation therapy specifically applied to the vertebral column and ribs for the management of shoulder pain, patients who received the manual therapy in addition to usual care reported significantly greater overall improvement and decrease in pain.¹⁷

Despite their common use, little evidence is available to support the contribution of passive mobilization applied specifically to shoulder region joints in the management of painful shoulder conditions. Indeed, the results of a recent well-powered randomized controlled trial (RCT) indicate that this form of manual therapy is not more effective than exercises and advice from a physical therapist in the management of the painfully restricted shoulder.¹⁸ These results support the findings of another study of a small sample of participants in which passive mobilizations of shoulder region joints were found to be ineffective in the management of adhesive capsulitis.¹⁹ Only one RCT that examined the effects of passive mobilization of shoulder region joints in patients diagnosed with impingement syndrome showed limited evidence in support of the benefit of this treatment modality.²⁰

Although the evidence indicating no additional benefit of passive mobilizations of shoulder region joints above exercise and advice in painful, restricted shoulder conditions^{18,19} is mounting, little information is available regarding the effectiveness of this modality for the treatment of people with shoulder pain and minimal movement restriction. Therefore, a clear clinical rationale for the use of mobilization therapy applied to shoulder region joints for the management of nonrestricted painful shoulder conditions has not been established. As passive joint mobilization therapy is most commonly used in conjunction with other treatment modalities and with increasing evidence to support the efficacy of exercise therapy in the management of painful shoulder conditions,²¹⁻²⁶ the specific aim of the study was to determine whether low-velocity passive joint mobilization therapy specifically applied to shoulder region joints (glenohumeral, acromioclavicular, and sternoclavicular joints) and passive mobilization of the scapula add benefit over exercise and advice alone in the treatment of people with shoulder pain and minimal movement restriction.

Method

Design Overview

This RCT compared passive mobilization of shoulder region joints, exercise, and advice with exercise and advice alone for the treatment of people with shoulder pain and minimal movement restriction. Prior to



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group allocation, baseline outcome measurements were obtained. Following measurements of pain, functional ability, and painful active range of motion (AROM), participants were randomly allocated to an experimental or control group based on a concealed assignment schedule that had been generated by an investigator who was not involved with recruitment, treatment, or outcome measure assessment in the study. Primary outcome measurements of pain, functional impairment, and self-rated improvement were obtained from participants who were not blinded to treatment group allocation at 1, 3, and 6 months after randomization. Secondary outcome measurements of painful AROM were obtained by a researcher (R.Y.) blinded to group allocation at the same time points.

Setting and Participants

All patients referred to the outpatient physical therapy department at a large metropolitan government hospital with painful active flexion

or abduction shoulder movements of greater than 1 month's duration and minimal shoulder movement restriction were eligible to participate in this study. In addition, pain, tenderness, or restriction during passive accessory movements at the glenohumeral, acromioclavicular, or sternoclavicular joint or during passive scapular movements was required to be present. Diagnostic classifications systems were not used to select participants for inclusion in this study because they lack reliability and uniformity, thus causing confusion and miscommunication among health care professionals.²⁷⁻³⁵ Participants were excluded if: they were less than 18 years of age; they were unable to understand spoken English; their shoulder symptoms were reproduced during active cervical spine movements or during palpation of cervical or thoracic region joints; they reported paresthesia in the affected upper limb; passive shoulder region joint mobilization was contraindicated; shoulder flexion or abduction range of motion

(ROM) was less than 140 degrees, as determined from digital photographs; shoulder pain was due to an inflammatory or neoplastic disorder; they had had surgery or trauma to the shoulder in the previous 4 weeks; or they reported a feeling of shoulder instability.

Ninety-eight volunteers (47 men and 51 women) were recruited for this study after providing written informed consent. The sample size for this study was calculated using data from the Shoulder Pain and Disability Index (SPADI) questionnaire, one of the primary outcome measures in this trial. Statistical power calculations indicated that a sample size of 98 participants would provide an 80% chance of detecting a minimum change of 15 points in total SPADI score, assuming a standard deviation of 25 points and a maximum 10% loss to follow-up.³⁶

Randomization and Interventions

All patients seen at the participating hospital who were potentially eligible to participate in this study were contacted by telephone. The aims of the study and its procedures were explained, and an appointment was arranged to conduct an interview and physical assessment. At this appointment, the patients were questioned and examined to confirm that they fulfilled all inclusion criteria. Suitable participants then signed a consent form, and baseline outcome measurements of pain, functional impairment, and painful AROM were obtained. Additional demographic information such as participants' age, sex, affected and dominant upper limb, and duration of symptoms were recorded during the interview.

Following initial assessment, participants were randomly allocated to either the control group or the experimental group. Random allocation of participants was per-

The Bottom Line

What do we already know about this topic?

Passive mobilization of shoulder joints has been a common component of physical therapy for people who have shoulder pain. For patients with painful, restricted shoulder function, recent evidence indicates that the addition of this form of manual therapy to exercise and advice from a physical therapist may not improve outcome.

What new information does this study offer?

For patients with shoulder pain without movement restriction, the results of this unblinded clinical trial indicate that the addition of passive mobilization of shoulder joints to exercise and advice from a physical therapist may not improve treatment outcome.

If you're a patient, what might these findings mean for you?

In terms of physical therapy, passive mobilization of the shoulder joints provides no additional benefit over advice and exercise alone.

formed using a previously determined treatment assignment schedule with random numbers generated from the data analysis function in Microsoft Excel.* To ensure concealment, the randomization procedure was carried out by a researcher (K.A.G.) not involved in participant recruitment, treatment, or assessment, and the treatment assignment schedule was stored in consecutively numbered, sealed opaque envelopes.

All participants received treatment in the form of advice and exercises. Physical therapists provided advice on how to avoid or minimize painful shoulder movements during activities of daily living. This advice included: limiting movement to the pain-free ROM; maintaining normal scapulohumeral rhythm within pain-free ROM; using the affected upper limb in a slow, careful manner; using techniques to minimize shoulder pain (eg, during dressing and reaching); and preferentially using the nonaffected upper limb. Exercises were directed toward restoring neuromuscular control mechanisms at the shoulder. This exercise approach has been shown to be effective in previous clinical trials,^{22,23} and all participating therapists were given instructions in the implementation of this treatment approach.

The primary aim of the exercises was to restore normal muscle function in order to regain normal dynamic stability and muscle force couple coordination at the shoulder region, thus leading to restoration of function.³⁷ Stretching exercises to lengthen shortened muscles, exercises to strengthen weakened muscles and to improve muscle coordination, and exercises aimed at restoring normal scapulohumeral rhythm could be included. Motor retraining exercises

were devised and upgraded based on motor learning principles designed to improve motor skills by incrementally increasing the complexity of the exercise tasks. Full range of shoulder movement requires the coordination of a number of muscle force couples. Therefore, less-difficult exercises principally involved muscles within one force couple (eg, isolated rotation exercises for the rotator cuff muscles or scapular depression exercises with the arm by the side). The most difficult exercises involved all shoulder muscle force couples (eg, full-range flexion and abduction exercises requiring coordination of axiohumeral, rotator cuff, and axioscapular muscles).³⁷ The exercises were performed in a pain-free manner to optimize normal muscle function and movement patterns.²² Exercises and advice were tailored by the treating physical therapist to meet the requirements of each participant. The exercise treatment was administered as a daily home-based program and reviewed by the treating therapist 1 or 2 times per week. The purposes of this review were to correct the performance of the exercises if necessary and to increase the intensity and complexity of the exercises as muscle function improved. As motor skill acquisition is a lengthy process that requires regular practice to establish new habituated motor patterns, participants were strongly encouraged to do their exercises on a daily basis at home and to continue them after formal treatment had ceased.³⁷

In addition to this advice and exercise therapy, participants allocated to the experimental group received low-velocity passive joint mobilizations applied to any of the shoulder region joints (ie, glenohumeral, sternoclavicular, and acromioclavicular joints) and passive mobilization of the scapula. Mobilization therapy was aimed at relieving pain and restoring pain-free functional move-

ments.¹⁴ Passive mobilizations could be applied in a sustained or oscillatory manner. As per routine clinical practice, the regions mobilized, as well as the force, direction, and amplitude of the mobilization techniques, were individually determined and progressed by the treating therapist based on each participant's clinical signs and symptoms. The study design required that a minimum of 60% of all treatments provided to participants in the experimental group involved passive shoulder region mobilization in order to ensure an adequate dosage of the mobilization therapy under evaluation.

Participants in both groups received 1 or 2 treatment sessions per week for the first month of the trial, followed by additional treatment over the next 4 weeks to a maximum of 12 treatment sessions if deemed necessary by the treating therapist. The physical therapists involved in the trial recorded the number of treatment sessions and the type of mobilization techniques applied for each participant in a logbook. All participants were requested to receive physical therapy treatment only from the involved physical therapy department and to refrain from seeking any other form of therapy while participating in this clinical trial.

Seventeen physical therapists were involved in providing treatment to participants in this clinical trial. Four of these physical therapists had postgraduate qualifications in physical therapy: 1 with a master's degree in physical therapy, 1 with a master's degree in manipulative physiotherapy, and 2 with graduate diplomas in manipulative therapy. The number of years of clinical experience for therapists involved in this study ranged from 2 to 28 (\bar{X} =8.4, SD =7.5). All therapists received instructions regarding all treatment options and clinical trial adherence,

* Microsoft Corporation, One Microsoft Way, Redmond, WA 98052-6399.

and all therapists were involved in treating participants in both the control and experimental treatment groups.

Outcomes and Follow-up

Two primary outcome measures were used in this study. The first primary outcome measure, shoulder pain intensity and functional impairment during the previous week, was assessed using the SPADI questionnaire.³⁶ This self-administered questionnaire consists of 2 sections: the first section of 5 questions relates to pain, and the second section of 8 questions relates to function.³⁶ This questionnaire was chosen because it has been shown to be reliable, valid,^{38,39} and responsive to change³⁹⁻⁴² and has no floor or ceiling effects.⁴⁰ The second primary outcome measure, self-rated change in symptoms, was measured with a 6-point Likert scale. This scale consisted of a horizontal line with 6 points, each with verbal anchors relating to participants' perceived change in symptoms (ie, feeling "much worse," "slightly worse," "the same," "slightly improved," "greatly improved," and "fully recovered").⁴³ Participants were asked to use this scale to indicate their perceived level of change in symptoms since their last assessment. A Likert scale was chosen because it is easy to administer and interpret and it consists of categories labeled with words, which assists individuals to specifically relate to how they feel, thus assisting in defining the change in their symptoms.⁴⁴

Secondary outcome measurements of AROM during shoulder flexion in the sagittal plane and abduction in the coronal plane were assessed using a photographic method shown to be reliable in previous studies of patients with shoulder pain.^{18,22,23} Participants were instructed to perform these movements, and photographs were taken when pain was

initiated and when pain either resolved or when the maximal achievable ROM was reached. Using markers placed on bony landmarks,^{22,23} shoulder joint angles were measured on the photographs. The painful ROM was recorded as the difference between the shoulder angles in the 2 photographs. This method of measuring painful AROM was used because it is quicker to perform than standard goniometry and thus less likely to exacerbate symptoms and influence measurement.^{18,22,23} The intrarater reliability of these AROM measurements was established for the blinded assessor (R.Y.) in this study prior to the commencement of the trial. Intraclass correlation coefficients (2,1) demonstrated excellent intrarater reliability of .92 and .98 for flexion and abduction, respectively.⁴⁵

Participants received between 4 and 8 treatment sessions over a 1-month period. Primary outcome measurements of pain and functional impairment were reassessed, and self-rated change in symptoms was obtained from participants who were not blinded to treatment allocation. Secondary outcome measurements of painful AROM were reassessed by a researcher (R.Y.) who was blinded to treatment allocation. To ensure blinding, participants were instructed to refrain from discussing their treatment with this assessor. Following assessment at 1 month, treatment could continue for a maximum of 12 treatment sessions over a maximum of 8 weeks. Reassessment of all outcome measurements was repeated at 3 and 6 months after baseline measurements.

Data Analysis

All analyses were conducted using an intention-to-treat approach. Missing data (lost to follow-up) were replaced with values obtained by imputation using regression models within each variable and group at all

available time points. For the 2 control group participants who were lost prior to reassessment at 1 month after recruitment and, therefore, did not have a self-rated change in symptoms score, the average of the group was used for their missing scores. A repeated-measures analysis of covariance was used to analyze between-group differences in both primary (SPADI and self-rated improvement) and secondary (painful AROM) outcome measurements at 1, 3, and 6 months following randomization. There was a statistically significant difference in the mean duration of current shoulder symptoms between the experimental and control groups at baseline, and this factor was used as the covariate in the analysis.

Role of the Funding Source

This study was partially funded by a Musculoskeletal Physiotherapy Australia Research Grant from the Physiotherapy Research Foundation awarded in 2005. The Physiotherapy Research Foundation played no role in the design, conduct, or reporting of this study, although regular reports of the progress of this clinical trial were provided.

Results

A total of 230 patients referred to the outpatient physical therapy department for the management of shoulder dysfunction between May 2005 and July 2008 were contacted via telephone regarding potential inclusion in this clinical trial. The flow of participants through the trial is illustrated in Figure 1. Of the 230 patients screened via telephone, 64 were not considered eligible for inclusion in the clinical trial, primarily because they indicated that they had severely restricted shoulder flexion or abduction ROM or because their pain was exacerbated by neck movements suggesting referral from the vertebral column. The remaining 166 patients were invited to attend a physical assessment. Of these

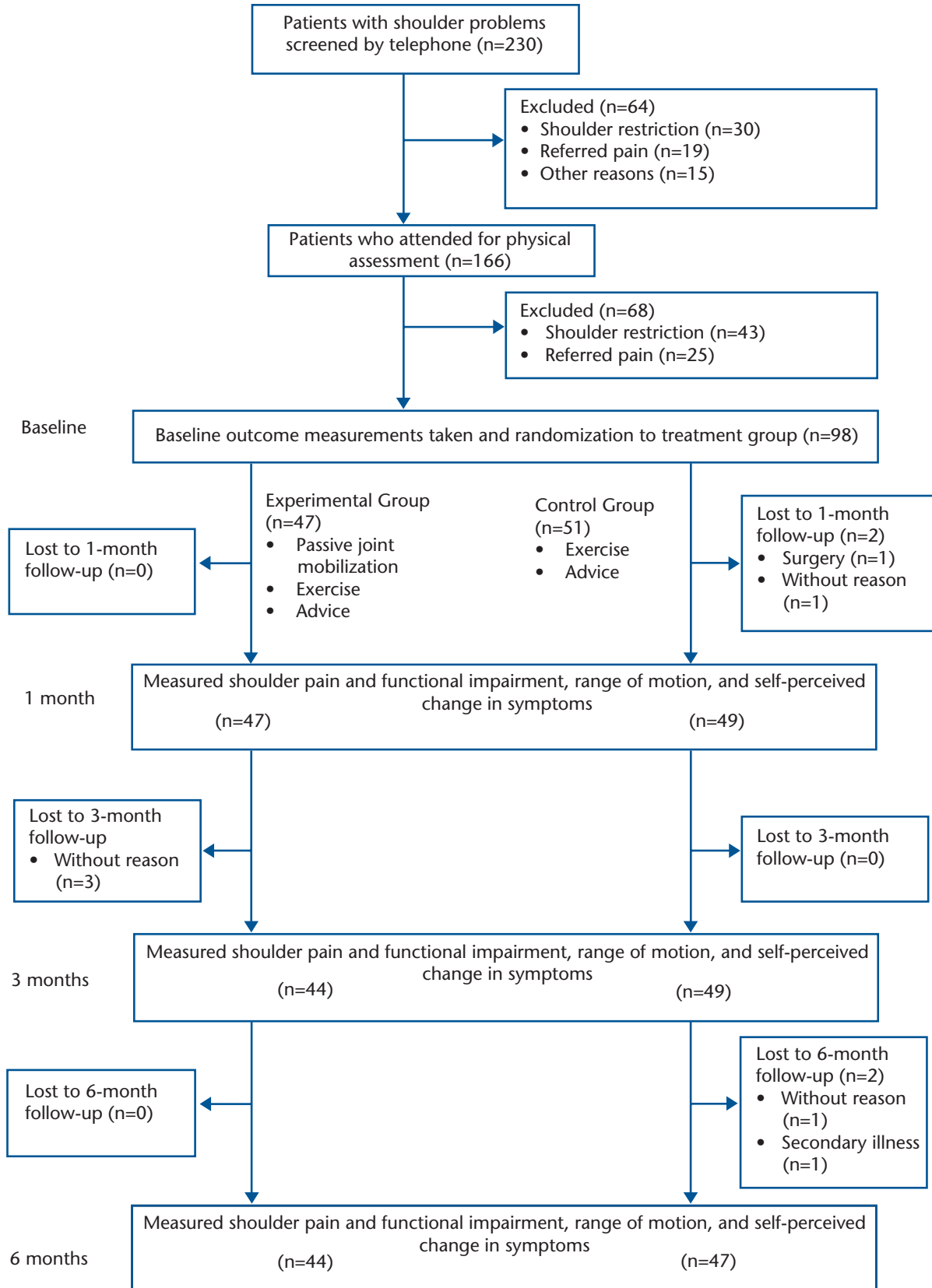


Figure 1. Design and flow of clinical trial participants.

Table 1.
Baseline Characteristics of Participants at Commencement of the Trial^a

Variable	Experimental Group (n=47)	Control Group (n=51)
Age (y), \bar{X} (range)	62 (35–85)	58 (27–81)
Sex, n (male:female)	20:27	27:24
Shoulder affected, n (right:left)	31:16	34:17
Dominant shoulder affected, n (right:left)	41:6	45:6
Duration of symptoms (mo), \bar{X} (SD) [95% CI] ^b	9.7 (12) [6.3 to 13.1]	22 (38) [12.1 to 32.8]
Total SPADI score (%), \bar{X} (SD) [95% CI]	50 (21) [43 to 55]	50 (19) [45 to 55]
SPADI pain score (%), \bar{X} (SD) [95% CI]	56 (21) [50 to 62]	56 (18) [51 to 61]
SPADI disability score (%), \bar{X} (SD) [95% CI]	45 (23) [39 to 52]	46 (22) [40 to 52]
Flexion painful arc (°), \bar{X} (SD) [95% CI]	28 (17) [23 to 33]	31 (20) [25 to 36]
Abduction painful arc (°), \bar{X} (SD) [95% CI]	46 (22) [39 to 52]	50 (23) [43 to 56]

^a 95% CI=95% confidence interval, SPADI=Shoulder Pain and Disability Index questionnaire.
^b Significant differences between the experimental and control groups ($P<.05$).

patients, 68 failed to meet the inclusion criteria. The reasons for exclusion were shoulder flexion or abduction of less than 140 degrees of AROM and shoulder symptoms reproduced during active cervical spine movements or during palpation of cervical or thoracic joints. The remaining 98 patients who met the inclusion criteria accepted the invitation and were recruited for the study.

Baseline characteristics for the total cohort at the commencement of this trial are presented in Table 1. Groups were well matched at baseline, with the only significant difference being a longer duration of symptoms in the control group ($P=.03$). The study population consisted of a young-elderly cohort, with approximately equal numbers of men and women with chronic shoulder pain. At baseline, both groups reported a moderate level of shoulder pain and functional impairment (mean total SPADI score=50% for both groups) and approximately 30 degrees and 50 degrees of painful shoulder flexion and abduction AROM, respectively.

Four participants were unable to physically attend the outpatient physical therapy department for

reassessment: 1 at both 1- and 3-month follow-ups, 1 at the 3-month follow-up, and 2 at 3- and 6-month follow-ups. For these participants, data relating to their shoulder pain and functional impairment and self-rated change in symptoms were obtained via telephone. The SPADI has been found to be suitable for administration via telephone.⁴⁶ Therefore, primary outcome measurement data were obtained for 98% (control group=96%, experimental group=100%), 95% (control group=96%, experimental group=94%), and 93% (control group=92%, experimental group=94%) of all participants at the 1-, 3-, and 6-month follow-ups, respectively. Reasons for participant withdrawal are detailed in Figure 1.

Participants in both experimental and control groups received a mean of 9 (SD=5) treatment sessions, ranging from 0 to 24 and 1 to 24 sessions, respectively. Participants in the experimental group received a mean of 7 (range=2-16) treatment sessions involving passive mobilization of shoulder region joints. On average, 67% of the total number of treatment sessions for the experimental group included passive mobilization of shoulder region joints,

thus meeting the minimum dosage requirement (60%) for this study. All but 1 participant in the experimental group received some mobilization therapy. However, 11 experimental group participants had mobilization therapy in less than 60% of their treatment sessions, even though they had up to 9 mobilization treatments. Of the participants who received passive mobilization therapy, 59% received mobilization solely to the glenohumeral joint, 2% solely to the acromioclavicular joint, 2% solely to the scapula, and 35% to a combination of shoulder region joints, including the glenohumeral, acromioclavicular, and sternoclavicular joints.

Group data for all outcome measures at 1, 3, and 6 months following randomization for the experimental and control groups are presented in Table 2 and Figures 2, 3, and 4. Improvement was seen in all outcome measurements in both groups at 1, 3, and 6 months ($P<.001$). Differences in mean total shoulder pain and functional impairment scores (total SPADI scores) between the control and experimental groups at all follow-up periods were small and statistically nonsignificant. At the 1-month follow-up, the experimental

group had 1% (95% CI [confidence interval]=−7% to 9%) less shoulder pain and functional impairment than the control group. The control group had 5% (95% CI=−3% to 12%) and 0% (95% CI=−7% to 7%) less shoulder pain and functional impairment than the experimental group at 3 and 6 months, respectively. Similarly, small and statistically nonsignificant differences in scores for self-rated change in symptoms between the control and experimental groups were demonstrated at all follow-up periods. The control group was 0.2 out of 5 (95% CI=−0.1 to 0.6) better than the experimental group at the 1-month follow-up, and the experimental group was 0.2 out of 5 (95% CI=−0.3 to 0.6) and 0.1 out of 5 (95% CI=−0.2 to 0.5) better than the control group at 3- and 6-month follow-ups, respectively. No adverse effects of any treatment intervention were reported.

Discussion

This is the first adequately powered RCT that has specifically evaluated the effectiveness of passive joint mobilization specifically applied to shoulder region joints for the treatment of people with shoulder pain and minimal movement restriction. Our results demonstrate that the addition of passive mobilization of shoulder region joints to exercise and advice is not more effective than exercise and advice alone in decreasing pain and painful ROM and improving function and self-rated change in symptoms in this cohort, with no significant differences in any of the outcome measurements between the 2 groups at short-, medium-, or longer-term follow-up.

The findings of small, nonsignificant differences in functional impairment and AROM between the groups receiving and not receiving passive mobilizations to shoulder region joints in this study support the findings of the only other clinical

Table 2. Time Course of Primary and Secondary Outcome Measures^a

Variable	1 Month			3 Months			6 Months					
	Experimental Group, \bar{X} (SD)	Control Group, \bar{X} (SD)	Difference, \bar{X} (95% CI)	Effect Size	Experimental Group, \bar{X} (SD)	Control Group, \bar{X} (SD)	Difference, \bar{X} (95% CI)	Effect Size	Experimental Group, \bar{X} (SD)	Control Group, \bar{X} (SD)	Difference, \bar{X} (95% CI)	Effect Size
Total SPADI score (%)	33 (21)	34 (19)	1 (−7 to 9)	−0.05	26 (20)	21 (17)	−5 (−12 to 3)	0.25	15 (18)	14 (17)	0 (−7 to 7)	0.02
SPADI pain score (%)	38 (22)	41 (21)	3 (−6 to 11)	−0.13	29 (22)	27 (20)	−2 (−10 to 7)	0.07	18 (20)	18 (20)	−1 (−8 to 7)	0.02
SPADI disability score (%)	32 (23)	30 (19)	−3 (−11 to 6)	0.13	24 (21)	18 (17)	−6 (−14 to 2)	0.32	13 (18)	12 (16)	0 (−7 to 7)	0.02
Flexion painful arc (°)	14 (23)	19 (19)	5 (−3 to 14)	−0.25	10 (15)	9 (12)	−1 (−7 to 5)	0.08	3 (9)	3 (6)	−1 (−4 to 2)	0.12
Abduction painful arc (°)	28 (24)	36 (25)	8 (−2 to 18)	−0.32	17 (18)	18 (24)	1 (−7 to 9)	−0.06	7 (15)	6 (11)	−1 (−7 to 4)	0.10
Self-rated change in symptoms	4.2 (0.8)	3.9 (0.8)	−0.2 (−0.6 to 0.1)	0.28	4.2 (1.2)	4.4 (1.0)	0.2 (−0.3 to 0.6)	−0.15	4.6 (1.0)	4.8 (0.7)	0.1 (−0.2 to 0.5)	−0.12

^a 95% CI=95% confidence interval. SPADI=Shoulder Pain and Disability Index questionnaire.

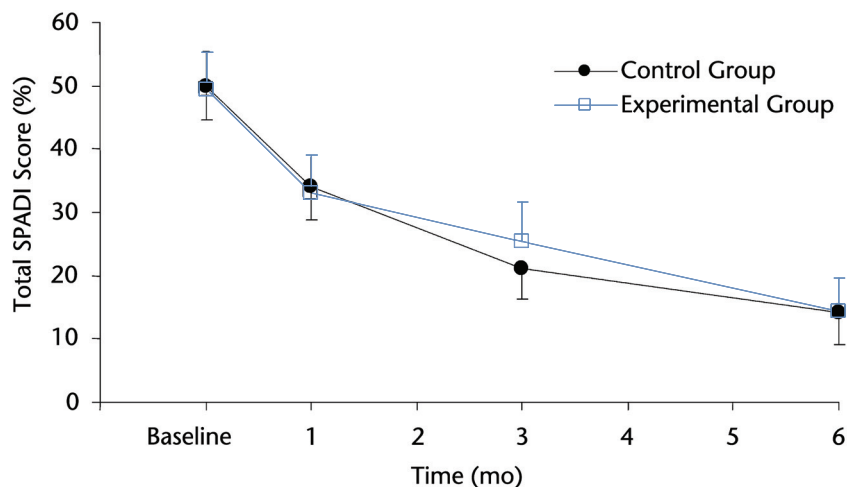


Figure 2. Mean (95% confidence interval) Shoulder Pain and Disability Index (SPADI) questionnaire scores (%) for shoulder pain and functional impairment for the control and experimental groups at entry into the trial (baseline) and at 1-, 3-, and 6-month follow-ups.

trial that specifically evaluated the effectiveness of this modality for the treatment of people with shoulder impingement syndrome.²⁰ However, although Conroy and Hayes²⁰ found passive mobilization of shoulder region joints to be effective in decreasing the maximum pain level reported over a 24-hour period and during an impingement test in this cohort in the short term, the current study found no differences in pain levels measured on the SPADI questionnaire in the short, medium, or longer term. The current well-

powered, longer-term study confirms and extends the majority of findings of this smaller short-term study (ie, that passive mobilizations applied to shoulder region joints do not add clinical benefit in the management of painful shoulder dysfunction).

The results of the current study also strongly support the findings of previous RCTs investigating the effectiveness of passive mobilizations specifically applied to shoulder region joints for the management of painful,

restricted shoulder dysfunction.^{18,19} Similar to the current study, these studies found no significant differences in pain,^{18,19} functional impairment,¹⁸ self-rated change in symptoms,¹⁸ or AROM^{18,19} between a group that received passive mobilizations and a group that did not receive passive mobilizations at short-term follow-up^{18,19} or longer-term follow-up.¹⁸ The results of the current and other relevant RCTs, therefore, indicate that passive joint mobilizations specifically applied to shoulder region joints for the management of shoulder pain of local mechanical origin without instability do not provide additional clinical benefit above exercise and advice alone.

Systematic reviews of clinical trials investigating mobilization therapy have concluded that there is limited evidence to support the effectiveness of passive joint mobilization therapy for the management of shoulder pain.^{11,47,48} Of the 3 available clinical trials included in these reviews,^{15,16,20} the majority investigated mobilizations directed at vertebral column or rib joints, as well as shoulder region joints.^{15,16} With the addition of more-recent evidence from clinical trials conducted since these reviews were performed, this

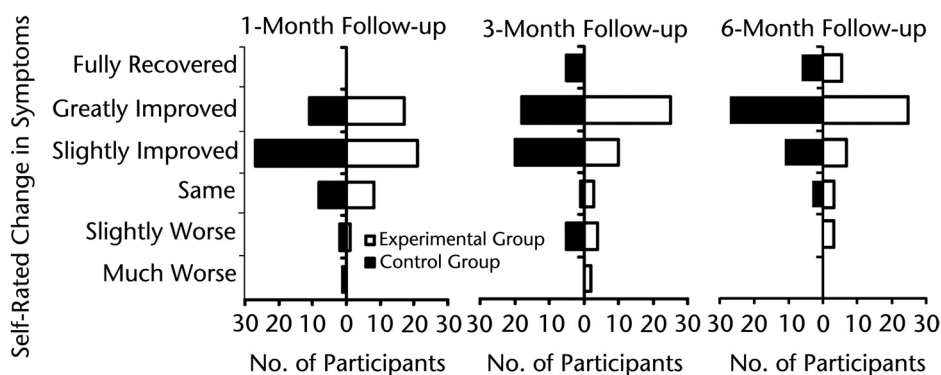


Figure 3. Scores for self-rated change in symptoms for the control (shaded) and experimental (unshaded) groups at 1-, 3-, and 6-month follow-ups.

conclusion can be further refined. The results of the current study and of the study by Chen et al¹⁸ considering the effectiveness of passive mobilization specifically applied to shoulder region joints provide strong evidence that passive mobilization of shoulder region joints does not add clinical benefit in the treatment of people who have shoulder pain with and without movement restriction. In addition, Bergman et al¹⁷ provided evidence that mobilization or manipulation therapy specifically applied to the vertebral column and ribs is more effective than usual care in the management of shoulder pain. It would appear, therefore, that the conclusion that patients with painful shoulder dysfunction gain clinical benefit from the application of mobilization therapy only applies to passive joint mobilization of the vertebral column or rib joints.

The design of the current study included several features to minimize bias, thus enhancing the internal validity of results obtained and strengthening the conclusions that can be drawn from this study. Participants were allocated to 1 of 2 treatment groups using a predetermined random and concealed allocation process. An exercise approach of proven efficacy was implemented as the control treatment.^{22,23} Passive mobilization therapy was isolated to the shoulder region joints in order to evaluate the contribution of this specific component of the common group of treatment modalities used by physical therapists to treat people with shoulder pain. Participants in both groups were provided with the same mean number of treatments and thus the same amount of participant-therapist contact time. Short-, medium-, and longer-term reassessments were conducted. The number of participants unavailable for reassessment was low at all follow-up periods, thus preserving the successful randomization

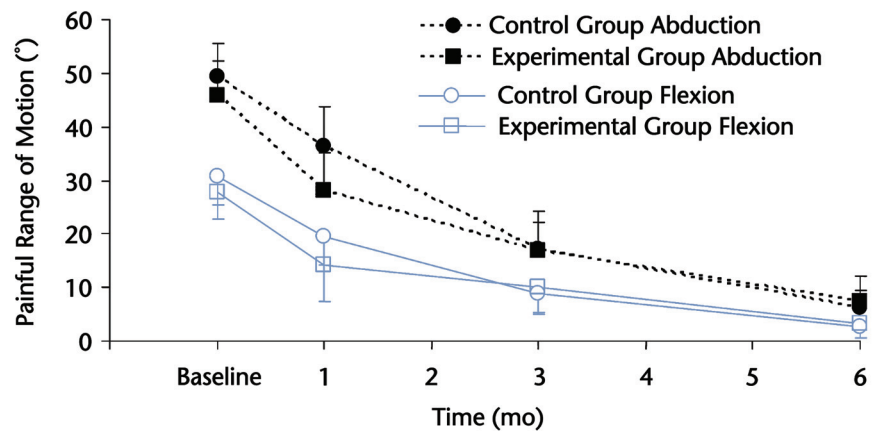


Figure 4.

Mean (95% confidence interval) painful flexion and abduction active range of motion for the control and experimental groups at entry into the trial (baseline) and at 1-, 3-, and 6-month follow-ups.

achieved at the commencement of the clinical trial. The sample size was large enough to provide adequate power to detect significant differences, and responsive, reliable outcome measures were used. With the exception of duration of symptoms, which was taken into account in the analysis, baseline demographics were similar at the commencement of the trial, and baseline outcome measurements were well matched. Finally, an intention-to-treat analysis was implemented.

In addition, this RCT included features to enhance the external validity of the study and thus enhance the generalizability of the results obtained. All treatments were specifically tailored to the individual participant rather than following a prescribed pattern and, therefore, were more reflective of a typical clinical setting. Seventeen physical therapists with varying clinical experience ranging from 2 to 28 years were involved in providing treatment in this study, and all of these physical therapists provided treatment for participants in both the experimental and control groups.

The conclusion from this clinical trial, that the addition of passive joint mobilizations of shoulder region joints to exercise and advice is not more effective than exercise and advice alone for the treatment of people with shoulder pain and minimal movement restriction, however, does need to be viewed in light of some limitations. The lack of a reliable diagnostic classification system for shoulder pain resulted in a heterogeneous study population in the current study consisting of patients with a mix of mechanical shoulder symptoms, only excluding those with restricted shoulder ROM. It is possible that specific subgroups within this heterogeneous group, if they can be reliably identified, may benefit from mobilization therapy directed at the shoulder region joints. In addition, the lack of evidence to guide therapists in the choice of passive mobilization technique may have resulted in the choice of less-than-optimal mobilization therapy for some participants. Finally, although the loss to follow-up was smaller than that assumed in the calculation of the sample size for the current study, there is the chance that significant

differences between the treatment groups were missed due to type 2 statistical error, and the possibility of bias due to the lack of blinding of the treating therapists and participants cannot be discounted.

Mr Yiasemides and Associate Professor Ginn provided concept/idea/research design and project management. All authors provided writing, data analysis, and consultation (including review of manuscript before submission). Mr Yiasemides provided data collection. Associate Professor Ginn provided fund procurement, facilities/equipment, and institutional liaisons. The authors are grateful to the outpatient physical therapy staff at the Royal Prince Alfred Hospital, Sydney, Australia, for their involvement in this clinical trial.

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References

- Luime JT, Koes BW, Hendriksen IJ, et al. Prevalence and incidence of shoulder pain in the general population: a systematic review. *Scand J Rheumatol*. 2004;33:73–81.
- McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. *Best Pract Res Clin Rheumatol*. 2007;21:403–425.
- Pope DP, Croft PR, Pritchard CM, Silman AJ. Prevalence of shoulder pain in the community: the influence of case definition. *Ann Rheum Dis*. 1997;56:308–312.
- Urwin M, Symmons D, Allison T, et al. Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis*. 1998;57:649–655.
- US Department of Labor. *Nonfatal Occupational Injuries and Illnesses Requiring Days Away from Work*, 2007. Washington, DC: Bureau of Labor Statistics. Available at: <http://www.bls.gov/iif/oshwc/osh/case/osnr0031.pdf>. Accessed November 5, 2010.
- Chipchase LS, O'Connor DA, Costi JJ, Krishnan J. Shoulder impingement syndrome: preoperative health status. *J Shoulder Elbow Surg*. 2000;9:12–15.
- Ostor AJ, Richards CA, Prevost AT, et al. Diagnosis and relation to general health of shoulder disorders presenting to primary care. *Rheumatology (Oxford)*. 2005;44:800–805.
- Smith KL, Harryman DT Jr, Antoniou J, et al. A prospective, multipractice study of shoulder function and health status in patients with documented rotator cuff tears. *J Shoulder Elbow Surg*. 2000;9:395–402.
- Green S, Buchbinder R, Glazier R, Forbes A. Systematic review of randomised controlled trials of interventions for painful shoulder: selection criteria, outcome assessment, and efficacy. *BMJ*. 1998;316:354–360.
- Green S, Buchbinder R, Hetrick S. Physiotherapy interventions for shoulder pain. *Cochrane Database Syst Rev*. 2003;2:CD004258.
- Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther*. 2004;17:152–164.
- Paungmali A, O'Leary S, Souvlis T, Vicenzino B. Hypoalgesic and sympathoexcitatory effects of mobilization with movement for lateral epicondylagia. *Phys Ther*. 2003;83:374–383.
- Sterling M, Jull G, Wright A. Cervical mobilisation: concurrent effects on pain, sympathetic nervous system activity and motor activity. *Man Ther*. 2001;6:72–81.
- Maitland G. *Maitland's Vertebral Manipulation*. 7th ed. Oxford, United Kingdom: Butterworth-Heinemann; 2005.
- Winters JC, Sobel JS, Groenier KH, et al. Comparison of physiotherapy, manipulation, and corticosteroid injection for treating shoulder complaints in general practice: randomised, single blind study. *BMJ*. 1997;314:1320–1325.
- Bang MD, Deyle GD. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *J Orthop Sports Phys Ther*. 2000;30:126–137.
- Bergman GJ, Winters JC, Groenier KH, et al. Manipulative therapy in addition to usual medical care for patients with shoulder dysfunction and pain: a randomized, controlled trial. *Ann Intern Med*. 2004;141:432–439.
- Chen JF, Ginn KA, Herbert RD. Passive joint mobilisation of shoulder region joints plus advice and exercise does not reduce pain and disability more than advice and exercise alone: a randomised trial. *Aust J Physiother*. 2009;55:17–23.
- Nicholson GG. The effects of passive joint mobilisation on pain and hypomobility associated with adhesive capsulitis of the shoulder. *J Orthop Sports Phys Ther*. 1985;6:238–246.
- Conroy DE, Hayes KW. The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. *J Orthop Sports Phys Ther*. 1998;28:3–14.
- Ainsworth R, Lewis JS. Exercise therapy for the conservative management of full thickness tears of the rotator cuff: a systematic review. *Br J Sports Med*. 2007;41:200–210.
- Ginn KA, Cohen ML. Exercise therapy for shoulder pain aimed at restoring neuromuscular control: a randomised comparative clinical trial. *J Rehabil Med*. 2005;37:115–122.
- Ginn KA, Herbert RD, Khouw W, Lee R. A randomised, controlled clinical trial of a treatment for shoulder pain. *Phys Ther*. 1997;77:802–811.
- Grant HJ, Arthur A, Pichora DR. Evaluation of interventions for rotator cuff pathology: a systematic review. *J Hand Ther*. 2004;17:274–299.
- Kuhn JE. Exercise in the treatment of rotator cuff impingement: a systematic review and a synthesised evidence-based rehabilitation protocol. *J Shoulder Elbow Surg*. 2009;18:138–160.
- Trampas A, Kitsios A. Exercise and manual therapy for the treatment of impingement syndrome of the shoulder: a systematic review. *Phys Ther Rev*. 2006;11:125–142.
- Bamji AN, Erhardt CC, Price TR, Williams PL. The painful shoulder: can consultants agree? *Br J Rheumatol*. 1996;35:1172–1174.
- de Winter AF, Jans MP, Scholten RJ, et al. Diagnostic classification of shoulder disorders: interobserver agreement and determinants of disagreement. *Ann Rheum Dis*. 1999;58:272–277.
- Hanchard NC, Howe TE, Gilbert MM. Diagnosis of shoulder pain by history and selective tissue tension: agreement between assessors. *J Orthop Sports Phys Ther*. 2005;35:147–153.
- Hughes PC, Taylor NF, Green RA. Most clinical tests cannot accurately diagnose rotator cuff pathology: a systematic review. *Aust J Physiother*. 2008;54:159–170.
- Kuhn JE, Dunn WR, Ma B, et al. Interobserver agreement in the classification of rotator cuff tears. *Am J Sports Med*. 2007;35:437–441.
- Liesdek C, van der Windt D, Koes BW, Bouter LM. Soft-tissue disorders of the shoulder: a study of interobserver agreement between general practitioners and physiotherapists and an overview of physiotherapeutic treatment. *Physiotherapy*. 1997;83:12–17.
- Norregaard J, Jacobsen S, Kristensen J. A narrative review on classification of pain conditions of the upper extremities. *Scand J Rehabil Med*. 1998;31:153–164.

- 34 Park HB, Yokota A, Gill HS, et al. Diagnostic accuracy of clinical tests for the different degrees of subacromial impingement syndrome. *J Bone Joint Surg Am*. 2005;87:1446-1455.
- 35 Schellingerhout JM, Verhagen AP, Thomas S, Koes BW. Lack of uniformity in diagnostic labeling of shoulder pain: time for a different approach. *Man Ther*. 2008;13:478-483.
- 36 Roach KE, Budiman-Mak E, Songsiridej N, Lertratanakul Y. Development of a shoulder pain and disability index. *Arthritis Care Res*. 1991;4:143-149.
- 37 Stevans J, Hall KG. Motor skill acquisition strategies for rehabilitation of low back pain. *J Orthop Sports Phys Ther*. 1998;28:165-167.
- 38 MacDermid JC, Solomon P, Prkachin K. The Shoulder Pain and Disability Index demonstrates factor, construct and longitudinal validity. *BMC Musculoskelet Disord*. 2006;10:12.
- 39 Paul A, Lewis M, Shadforth MF, et al. A comparison of four shoulder-specific questionnaires in primary care. *Ann Rheum Dis*. 2004;63:1293-1299.
- 40 Bot SD, Terwee CB, van der Windt DA, et al. Clinimetric evaluation of shoulder disability questionnaires: a systematic review of the literature. *Ann Rheum Dis*. 2004;63:335-341.
- 41 Heald SL, Riddle DL, Lamb RL. The shoulder pain and disability index: the construct validity and responsiveness of a region-specific disability measure. *Phys Ther*. 1997;77:1079-1089.
- 42 Schmitt JS, Fabio RP. Reliable change and minimum important difference (MID) proportions facilitated group responsiveness comparisons using individual threshold criteria. *J Clin Epidemiol*. 2004;57:1008-1018.
- 43 Likert R. A technique for the measurement of attitudes. *Archives of Psychology*. 1932;83:12-17.
- 44 Bolognese JA, Schnitzer TJ, Ehrich EW. Response relationship of VAS and Likert scales in osteoarthritis efficacy measurement. *Osteoarthritis Cartilage*. 2003;11:499-507.
- 45 Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. *Psychol Bull*. 1979;86:420-428.
- 46 Williams JW Jr, Holleman DR Jr, Simel DL. Measuring shoulder function with the shoulder pain and disability index. *J Rheumatol*. 1995;22:727-732.
- 47 Desmeules F, Cote CH, Fremont P. Therapeutic exercise and orthopedic manual therapy for impingement syndrome: a systematic review. *Clin J Sport Med*. 2003;13:176-182.
- 48 Faber E, Kuiper JI, Burdorf A, et al. Treatment of impingement syndrome: a systematic review of the effects on functional limitations and return to work. *J Occup Rehabil*. 2006;16:7-25.