A trial into the effectiveness of soft tissue massage in the treatment of shoulder pain

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The purpose of this single blinded randomised controlled trial was to investigate the effects of soft tissue massage on range of motion, reported pain and reported function in patients with shoulder pain. Twenty-nine patients referred to physiotherapy for shoulder pain were randomly assigned to a treatment group that received six treatments of soft tissue massage around the shoulder (n = 15) or to a control group that received no treatment while on the waiting list for two weeks (n = 14). Measurements were taken both before and after the experimental period by a blinded assessor. Active range of motion was measured for flexion, abduction and hand-behind-back movements. Pain was assessed with the Short Form McGill Pain Questionnaire (SFMPQ) and functional ability was assessed with the Patient Specific Functional Disability Measure (PSFDM). The treatment group showed significant improvements in range of motion compared with the control group for abduction (mean 42.2 degrees, 95% CI 24.1 to 60.4 degrees), flexion (mean 22.6 degrees, 95% CI 12.4 to 32.8 degrees) and hand-behind-back (mean 11.0 cm improvement, 95% CI 6.3 to 15.6 cm). Massage reduced pain as reported on the descriptive section of the SFMPQ by a mean of 4.9 points (95% CI 2.5 to 7.2 points) and on the visual analogue scale by an average of 26.5 mm (95% CI 5.3 to 47.6 mm), and it improved reported function on the PSFDM by a mean of 8.6 points (95% CI 4.9 to 12.3 points). We conclude that soft tissue massage around the shoulder is effective in improving range of motion, pain and function in patients with shoulder pain. The mechanisms behind these effects remain unclear. **[van den Dolder PA and Roberts DL (2003): A trial into the effectiveness of soft tissue massage in the treatment of shoulder pain. *Australian Journal of Physiotherapy* 49: 183-188]**

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Introduction

Shoulder pain is one of the most common of all peripheral joint disorders with the point incidence amongst the general population said to be as high as 20% (Pope et al 1997). Often the cause of non-traumatic shoulder pain is thought to be inflammation of the structures around the shoulder due to poor biomechanics with subsequent impingement and inflammation of the affected structures (Bang and Deyle 2000). The most frequent diagnoses for patients with shoulder pain include tendinitis/bursitis, osteoarthritis and cuff tears (Solomon et al 2001). Diagnoses for these patients, however, are not always clear, with some studies reporting significant levels of disagreement between specialists examining the same patient with shoulder pain (Bamji et al 1996, Naredo et al 2002). Authors have hypothesised various mechanisms for the poor biomechanics around the shoulder, including insufficient strength of the rotator cuff, poor motor control of the rotator cuff, poor scapulohumeral rhythm and sub-optimal thoracic/shoulder girdle posture (Host 1995, Smith et al 2002).

Up to 50% of patients who have been diagnosed with shoulder pain are referred to a physiotherapist for treatment (van der Windt et al 1995). Commonly used forms of physiotherapy for shoulder pain include electrotherapy, exercises to strengthen and improve the timing of contractions of the rotator cuff muscles, mobilisation to free up the joint and transverse frictions to decrease "adhesions" in structures around the shoulder (Green et al 1998, Philadelphia Panel 2001). Unfortunately, there is limited evidence either for or against the efficacy for many of these types of treatment (van der Heijden 1997). Exercise therapy aimed at improving the strength and co-ordination of the rotator cuff in patients with non-specific shoulder pain has been shown to bring about moderate improvements in pain-free abduction and flexion range of motion (ROM) and decreased functional impairment but has not been shown to change the patients' self reported pain, strength or hand-behind-back range (Ginn et al 1997). The addition of manual therapy (Maitland type mobilisations) to a program of shoulder exercises has shown positive gains in strength, decrease in pain and improved function compared with exercises alone (Bang and Deyle 2000, Winters et al 1997) but has failed to show any improvement in range (Maricar and Chok 1999). Physiotherapy combining exercise, massage and physical applications has been shown to be less effective than a combination of mobilisation of shoulder, cervical and thoracic spine or steroid injection in reducing reported pain (Winters et al 1997).

Trigger points and tender, taut bands in muscles have been recognised for centuries dating back to the time of Hippocrates (Kostopoulos and Rizopoulos 2001). Trigger points are characterised by local tenderness on palpation and by pain on contraction of the muscle. Inter-rater reliability for identification of trigger points and taut bands has been shown to be quite high (Gerwin et al 1997). Common sites for trigger points around the shoulder have been documented (Kostopoulos and Rizopoulos 2001, Travell and Simons 1983) and include all of the rotator cuff, latissimus dorsi, teres major, deltoids and the pectoral muscles. Treatment of these tender areas of muscles by soft tissue manipulation has been proposed by several authors to improve the viscoelastic properties of the muscle and thus in turn improve the biomechanics of shoulder motion, resulting in less pain and improved function (Cohen and Gibbons 1998, Hunter 1998). A randomised, controlled trial was therefore undertaken to assess the efficacy of this technique in treatment of pain around the shoulder.

Methods

Subjects All patients between the ages of 18 and 80 who were referred to Concord Repatriation General Hospital in Sydney for management of shoulder pain over a four month period, and who were able to understand spoken English, were eligible to participate in this study. The study was approved by the Human Ethics Committee at Concord Repatriation General Hospital.

Subjects were excluded from the study if their shoulder pain was due to trauma within the previous four weeks, reproduced on combined cervical extension, ipsilateral rotation and side flexion with overpressure, due to a neoplastic disorder, or of an acute inflammatory nature. Subjects were also excluded if there was no palpable tenderness over the posterior aspect of the shoulder or over the anterior portion of the deltoid muscle or the pectoralis major muscle. For the purpose of this study it was determined that in standard practice, patients without tenderness to the shoulder upon palpation would not usually have treatment directed towards soft tissue massage of the shoulder. These patients were therefore excluded from the study.

Procedure Upon the initial interview, subjects underwent a standard musculoskeletal assessment of the shoulder (Magee 1992) to determine their eligibility for the study. If the subject was deemed eligible, written consent was obtained for his or her participation in the study and the assessor proceeded to collect the required baseline data of range of movement, pain intensity and functional disability.

Pain intensity was measured using the SFMPQ (Melzack 1987). This comprises three sections. The first section consists of a list of 15 words commonly used to describe pain. The first 11 are sensory descriptive words whilst the final four are affective descriptive terms such as "sickening" and "punishing". Each word is rated on a four-point intensity scale from "none" to "severe". The sensory and the affective sections of the questionnaire were summed for this study resulting in one score out of 15 for this section. The second measure of the SFMPQ is a 100 mm visual analogue scale (VAS) labelled "no pain" at one end and "worst pain ever experienced" at the other. The patient was instructed to mark on the line the average level of pain that they experienced over the last 24 hours. This was then measured in millimetres from the "no pain" end of the line. The final part of the pain intensity measure was a present pain index (PPI) on which the patient was asked to mark his or her level of pain at that particular moment on an integer scale from one to five with one representing no pain and five severe pain.

Functional disability was determined using a PSFDM (Stratford et al 1985). The patient was asked to nominate three functional activities that were limited due to pain. These were then rated on a 0 to 10 scale with zero equalling unable to perform the activity and 10 being no limit at all.

Active range of movement into flexion and abduction were measured from photographs taken whilst the subjects were standing. Markers were placed on the tip of the acromion, the lateral angle of the 12th rib, the lateral epicondyle of the elbow and the spinous process of T1 and T7. The subjects was then instructed to move the arm into either shoulder flexion or abduction with the thumb pointing up as far as he or she could (as limited by either pain, weakness or resistance to movement). Photographs were taken at the end of ROM perpendicular to the plane of movement at the level of the shoulder. The flexion angle was calculated as the angle formed by the bisection of two lines drawn between the tip of the acromion and lateral epicondyle of the elbow, and the tip of the acromion and 12th rib. Abduction range was calculated as the angle formed by the bisection of two lines between the T1 and T7 spinous process and the tip of the acromion and lateral epicondyle of the elbow. Ginn et al (1997) found that this measurement technique had high levels of test-retest reliability, with intra-class correlation coefficients of 0.90 for abduction and 0.88 for flexion.

Hand-behind-back was measured as the distance from the mid-line level of the posterior superior iliac spine (PSIS) to the tip of the thumb and documented in millimetres above the PSIS (a positive measure) or below the PSIS (a negative measure).

Upon completion of the initial assessment, the subject was randomly allocated to either the treatment group or control group. Randomisation was performed by selection of a sealed envelope from a container of identical envelopes, inside which were instructions regarding which group the patient was to be allocated to. A third person, who arranged all necessary follow-up appointments, opened each envelope. This ensured concealment of allocation to both patients and assessor. Blinding of the patients to allocation was not possible.

Subjects allocated to the control group remained on the waiting list for two weeks, while the treatment group commenced treatment immediately. Treatment consisted of six treatments of soft tissue massage around the shoulder over a two-week period. This was performed as seen fit by the treating therapist. The areas addressed with the massage

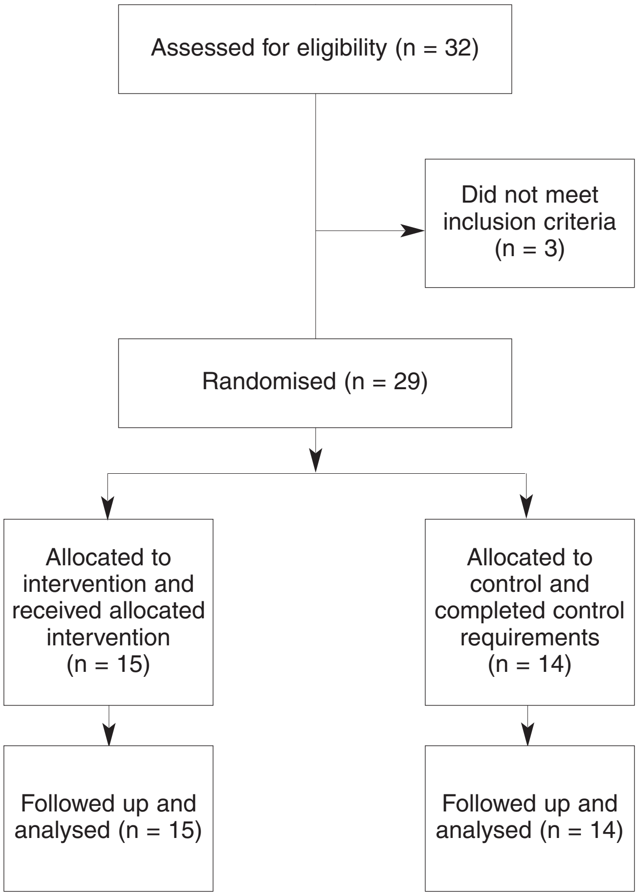

Figure 1. Flowchart of progress of subjects through the study.

included the lateral border of the scapula, in full shoulder flexion; posterior deltoid, at end of range horizontal flexion; anterior deltoid, at end of range hand-behind-back; and pectoralis major, in the stretch position. Each treatment took between 15 and 20 minutes. No other forms of treatment such as advice or exercise were given to the patient during the trial period. Analysis of data was conducted on an intention to treat basis.

Immediately after the completion of treatment, or following the two weeks on the waiting list for the control group, the assessor once again interviewed the subjects. All measurements were repeated. Subjects were shown their responses to the initial questionnaires for comparison immediately prior to filling them out again. This has been shown to improve the reliability of responses (Guyatt et al 1985). Lastly, subjects were asked to fill out their satisfaction with treatment, rated by the words “very satisfied”, “somewhat satisfied”, “somewhat dissatisfied” or “very dissatisfied”. If the subject was in the waiting list group, this sheet was left blank.

Two-tailed independent sample *t*-tests were used to calculate 95% confidence intervals for between-group comparisons on range of motion scores as well as the PSFDM scores and the descriptive and VAS sections of the SFMPQ. Ninety-five per cent confidence intervals for between-group differences in the median scores in the PPI section of the SFMPQ were calculated using the algorithm described by Armitage and Berry (1994).

Table 1. Subject characteristics at entry to trial.

	Treatment group (n = 15)	Control group (n = 14)
Mean age (SD) in years	63.1 (9.9)	65.9 (9.2)
Males:Females	11:4	9:5
Median chronicity of shoulder complaint (*IQR*) in weeks	26 (13-26)	30 (23-91)

Table 2. Medical diagnoses stated on referral for subjects in trial.

	Treatment group (n = 15)	Control group (n = 14)
Impingement	4	4
Supraspinatus/RC tear	4	3
Shoulder pain	2	5
Supraspinatus tendinitis	2	0
Biceps tendinitis	1	1
Soft tissue injury	1	0
Degenerative arthritis	0	1
RC tendonitis	1	0

RC, rotator cuff.

Results

Twenty-nine patients (mean age 64.4) were admitted into the study. The characteristics of the two groups are shown in Table 1 and a flow chart of the progress of the subjects though the trial is shown in Figure 1. Random allocation generated groups that were comparable in terms of age, reported functional disability, chronicity of their condition and ROM.

The medical diagnosis with which patients were referred for physiotherapy is listed in Table 2. There were a wide variety of diagnoses that were presented with the most prevalent being impingement, rotator cuff tear and unspecified shoulder pain.

There were no significant improvements in any of the variables for the control group between initial assessment and follow-up (Table 3). The treatment group showed significantly greater improvements in all variables compared with the control group as shown in Table 4.

Table 3. Changes in variables (means and SDs) for the two groups over the experimental period.

	Treatment group (n = 15)		Control group (n = 14)	
	Pre	Post	Pre	Post
Patient Specific Functional Disability score	9.5 (4.6)	17.6 (8.0)	10.9 (5.5)	10.4 (5.6)
Descriptive SFMPQ score	10.9 (6.3)	5.9 (6.3)	12.7 (8.3)	12.6 (8.8)
SFMPQ VAS scores	58.4 (22.7)	31.8 (26.4)	53.9 (21.6)	53.8 (26.3)
PPI scores	1.7 (1.0)	1.1 (1.0)	1.4 (1.5)	1.6 (1.2)
Abduction ROM in degrees	102.2 (28.8)	135.6 (24.1)	100.1 (36.2)	91.2 (28.6)
Flexion ROM in degrees	114.4 (24.2)	129.5 (18.5)	110.86 (23.0)	103.4 (23.1)
Hand behind back ROM in cm above line between PSISs	12.2 (11.2)	19.9 (10.2)	11.4 (13.6)	8.1 (16.2)

ROM, range of motion. PSIS, posterior superior iliac spine.

The difference in median changes between the two groups in the PPI section of the SFMPQ was -1 (95% CI -1 to 0).

There was no significant correlation between any of the improvements gained and the length of time that the patient had experienced the symptoms.

Eight out of the 15 treatment subjects rated their satisfaction with treatment as "very satisfied", with an additional five indicating that they were "somewhat satisfied" with treatment. The remaining two subjects indicated that they were "very dissatisfied" with treatment.

Discussion

This randomised, controlled trial demonstrates that subjects who received specific massage to the shoulder demonstrated significantly greater improvement in range of motion, decreased reported pain and improved self rated functional scores compared with subjects who were on the waiting list for a two-week period. The magnitude of the improvement in range in the experimental group over the waiting list group was considerable, with treatment resulting in a mean improvements of 22.6 degrees in flexion (95% CI 12.4 to 32.8), 42.2 degrees in abduction (95% CI 24.1 to 60.4) and with patients being able to reach a mean of 11 cm (95% CI 6.3 to 15.6) further up the back. These improvements compare well with those reported in Ginn et al (1997), with their trial of exercises aimed at restoring normal function to the rotator cuff muscles. They found a mean improvement of 22 degrees in pain free abduction ROM and a mean improvement of 16 degrees flexion ROM in the experimental group and reported no significant change with hand-behind-back scores with treatment. In addition, the results in our study were achieved in half the time of those in the study by Ginn et al (1997), with the results of treatment in this study being perceived as satisfactory by a majority of the experimental group subjects.

All patients referred to the physiotherapy department with shoulder pain that fell into our inclusion categories, regardless of diagnosis, were entered into our trial. The fact that these patients improved with such a wide range of diagnoses points to the potential generalisability of the effects of this massage in patients with shoulder pain of local mechanical origin. It may also indicate a common denominator with many patients with shoulder pain, namely the presence of trigger points and taut bands within the muscle surrounding the shoulder. There obviously needs to be further study to determine the longer term effects of this type of treatment and to identify which particular conditions may best benefit from this type of massage.

Massage has been shown to be an effective treatment in other regions of the body. A recent Cochrane systematic review of studies on the effects of massage in patients with low back pain concluded that massage is beneficial in improving both symptoms and function for patients with sub-acute and chronic low back pain (Furlan et al 2002). These beneficial effects were long lasting with some studies demonstrating gains for one year following treatment. The addition of exercises and education to the massage further improved these gains. Further studies on the effects of massage on symptomatic shoulders could add exercises to see if this bestows additional benefit to the patient. Winters et al (1997) showed that a combination of exercise, massage and physical applications was less successful in reducing shoulder pain than either steroid injection or mobilisation of the joints of the shoulder complex and cervical and thoracic spine. However, specific details of what exercises and massage carried out in this study were not provided by Winters et al, making it difficult to directly compare their results with our study.

Because of the nature of the treatment in this study, it was not possible to blind therapists and patients. One of the possible limitations of this study was that the control group were only placed on a waiting list, rather than receiving an inert sham type treatment. This means that these results could be explained at least in part by a placebo or Hawthorne effect. One recent systematic review which

Table 4. Results of independent samples *t*-tests (n = 29).

Variable	Mean difference between groups	*p*	95% confidence interval
Patient Specific Functional Scale*	8.6	< 0.001	4.9 to 12.3
Descriptive SFMPQ**	-4.9	< 0.001	-7.2 to -2.5
SFMPQ VAS**	-26.5 mm	0.02	-47.6 to -5.3
Abduction ROM**	42.2 degrees	< 0.001	24.1 to 60.4
Flexion ROM*	22.6 degrees	< 0.001	12.4 to 32.8
Hand behind back ROM*	11.0 cm above line between PSISs	< 0.001	6.3 to 15.6

*, positive result is beneficial. **, negative result is beneficial. ROM, range of motion. PSIS, posterior superior iliac spine.

pooled the effect sizes of placebo treatments involved in treating pain versus no treatment (Hrobjartsson and Gotzsche 2001) concluded that, on average, only 6.5 mm out of a 100 mm VAS could be accounted for by a placebo effect. This is significantly smaller than the mean improvement of 26.5 mm found in this study.

Little scientific evidence exists to fully explain the morphological and functional effects of massage that could improve shoulder pain of local mechanical origin. Myofascial trigger points are thought to be due to sensitised nerve fibres associated with excessive release of neurotransmitters in abnormal endplates, which in turn results in spontaneous electromyographic (EMG) activity within that part of the muscle (Fricton et al 1985, Hong and Simons 1998). Soft tissue massage is thought to decrease this EMG activity although the mechanism remains unclear (Grosshandler et al 1985, Hunter 1998). Gam et al (1998) looked at the effects of massage and exercise versus no treatment in a group of patients with chronic neck and shoulder pain and found that the massage and exercise group showed significantly fewer and less intense myofascial trigger points compared with the control group.

Studies on rats with enzyme-induced tendon damage have shown that soft tissue massage resulted in increased fibroblast proliferation compared with the control group (Davidson et al 1997). The massage group also showed greater improvement in gait parameters compared with the control group following treatment. It was hypothesised that increased fibroblast activity might improve the formation and maturation of collagen during wound healing. Although not easily transferable, these results might point to some effect that the massage might be having on collagen in the fascia or tendons of these muscles. Heavier massage (monitored by a pressure transducer) applied to rats with induced tendon injuries has also been shown to result in greater healing than either light or moderate massage (Gehlsen et al 1998). This again is difficult to readily translate to humans but may show that firmer massage may be more effective than lighter massage.

Cadaveric studies where the posterior part of the glenohumeral capsule has been operatively tightened have shown that this results in increased anterior translation of the humeral head with cross body movements and significant superior translation of the humeral head during flexion (Harryman et al 1990). A potential hypothesis is that soft tissue massage may decrease posterior restriction through its effect on either muscle or collagen, thus allowing the ball and socket to operate in a more "normal" anatomical alignment. This in turn might reduce the opportunity for impingement of sensitive structures around the shoulder during movements.

There is clearly a need for further research into the mechanisms behind the effectiveness of massage in the treatment of shoulder pain of local mechanical origin.

Conclusion

This randomised, controlled trial has shown that soft tissue massage around the shoulder in subjects with shoulder pain of local mechanical origin produces significantly greater improvements in pain, function and range of motion than does no treatment over a two-week period. These results highlight the importance of assessing and treating muscle dysfunction in patients with painful shoulders.

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