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Original article

A randomized clinical trial of manual therapy for cervico-brachial pain syndrome – a pilot study

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SUMMARY. **Cervico-brachial pain syndrome is an upper quarter pain condition in which mechanosensitive neural tissue is considered a primary feature. A single-blind randomized controlled trial was conducted to determine the clinical effect of two manual therapy interventions. Thirty subjects (20 females and 10 males) were randomly allocated to one of three groups — one of two manual therapy intervention groups or a control group. One manual therapy intervention group consisted of passive techniques aimed at mobilizing neural tissue structures and the cervical spine. The other involved indirect manual therapy techniques with a focus on articular components of the gleno-humeral joint and thoracic spine. The treatment period lasted 8 weeks in total and was combined with a home exercise programme. Following the 8-week baseline period the control group were crossed over into the specific neural tissue manual therapy group. Pain visual analogue scale (VAS), the short-form McGill pain and Northwick Park neck pain questionnaires were completed before, midway and after the treatment period. The findings suggest that both manual physiotherapy interventions combined with home exercises are effective in improving pain intensity, pain quality scores and functional disability levels. A group difference was observed for the VAS scores at 8 weeks with the neural manual therapy technique having a significantly lower score. © 2002 Published by Elsevier Science Ltd.**

INTRODUCTION

Upper quarter pain involves pain perceived in the neck, shoulder, arm, upper back and/or upper chest region with or without associated headache pain (Elvey & Hall 1997). It is a significant problem affecting many individuals (Makela et al. 1991; Bovim et al. 1994; Davis 1994; Elvey & Hall 1997). Certain types of upper quarter pain and dysfunction are thought to be associated with neural tissue disorders. The term cervico-brachial pain syndrome has recently been coined to describe this upper quarter pain in which neural tissue sensitivity to mechanical stimuli is a primary feature (Elvey & Hall 1997). Although the concept of neural tissue dysfunction is not new, the investigation of neural tissue pain disorders has gained popularity in the literature (Elvey 1986; Keneally et al. 1988; Quintner & Cohen 1994; Sweeney & Harms 1996; van der Heide et al. 2001).

Diagnosis of cervico-brachial pain syndrome is based on clinical examination. Few, if any, medical investigative tests are definitive in the diagnosis of cervico-brachial pain syndrorne. Overt neurological deficit is not necessarily present. However, a number of physical signs are assessed to determine involvement of neural tissue. These include: (i) active movement dysfunction; (ii) passive movement dysfunction; (iii) adverse responses to neural tissue provocation tests; (iv) hyperalgesic responses to palpation of nerve trunks; (v) hyperalgesic responses to palpation of related cutaneous tissues and (vi) evidence of a related local area of pathology (Elvey & Hall 1997). Each of these physical signs needs to be consistent with the other clinical signs and the

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symptoms of the patient to reflect a significant neural component in the condition (Elvey 1994).

The difficulties in diagnosis of the specific syndrome are also seen in the description of specific interventions for cervico-brachial pain syndrome. A number of studies have investigated specific treatment of neck and upper limb pain (Koes et al. 1992; Berg et al. 1994; Hurwitz et al. 1996; Sweeney & Harms 1996), yet the diagnostic categories for subject inclusion are often ill-defined or non-specific, making comparisons difficult. The type of treatments investigated in these studies have ranged from neural tissue self-mobilization exercises, to cervical manipulation and strength training routines.

A specific form of treatment for cervico-brachial pain syndrome proposed by Elvey and Hall (1997) is based on hypothesized mechanisms of neural tissue mechanosensitivity. It focuses on passive mobilization of neural tissue structures. Though this treatment approach to cervico-brachial pain syndrome has become increasingly popular in clinical practice, no clinical trial could be found which reported the effect of specific, neural tissue mobilization on this particular condition.

The heterogeneity of the cervico-brachial pain syndrome combined with the different focus of manual therapy techniques makes it difficult to interpret the evidence as to the efficacy of specific manual therapy for specific chronic neck problems. Various forms of manual therapy have been used in clinical trials of physiotherapy, yet few if any have used a convincing non-specific manual therapy or placebo (Vernon et al. 1990; Cassidy et al. 1992b). To obtain a high level of evidence the need to control for non-specific effects place trials of manual therapy in a position that uses pseudo-treatments such as detuned ultrasound. The validity of such intervention needs to be questioned when most participants in chronic pain syndromes are likely to have had some form of manual therapy prior to entry into the study.

The purpose of this study was to examine two active manual therapy interventions for cervico-brachial pain syndrome. The first manual therapy technique parallels the diagnostic philosophy by targeting the neural tissues and second manual therapy technique focuses on the joints of the shoulder and thoracic spine.

METHODS

Subjects

Subjects were recruited from printed media and radio advertisements. Approximately 220 individuals responded to the advertisements, of these a sample of convenience of 160 respondents were initially screened by a telephone interview by a therapist (BN). Forty subjects were excluded and 120 were asked to attend a physical examination. The physical examination was performed by two manipulative physiotherapists expert in the clinical definitions of cervico-brachial pain syndrome as proposed by Elvey and Hall (1997).

Subjects were included into the study if they fulfilled the following criteria:

(i) aged 18–75 years having experienced cervicobrachial pain for greater than 3 months,
(ii) adequate knowledge of English to participate in a subjective examination and to answer questionnaires,
(iii) evidence of upper quarter neural tissue mechanosensitivity on physical examination as described by Elvey (1997),
(iv) provided informed consent and were able to attend the clinics for treatment and assessments.

Subjects were excluded if they had

(i) contraindications to manual physiotherapy techniques (Grieve 1988),
(ii) specific pathology due to trauma of the shoulder girdle complex, arm or hand on the affected side,
(iii) cervical myelopathy,
(iv) cervical spine surgery within the last 6 months,
(v) received manipulative/manual physiotherapy within the previous 3 months,
(vi) been involved in compensation and/or litigation associated with neck and/or upper limb pain.
(vii) planned imminent treatment: for example, injections, surgery.

Thirty subjects were recruited in total.

Research design

The research design was a single-blind randomized, three-armed controlled clinical trial with two active treatments and one cross over group. An examiner, blinded to group allocation, performed the baseline and outcome measurements. Prior to the initial assessment subjects were assigned to one of three groups using a block randomization to ensure each group had 10 subjects.

Testing was performed at 4-week intervals. For the 8-week intervention period this involved three test occasions, before, midway through the treatment (4 weeks) and at the end of treatment (8 weeks). The control group were assessed on two additional occasions during the 2 months before the initial intervention.

During the assessments, in addition to neurological, nerve provocation assessments and range of motion assessments, the subjects completed three questionnaires. The latter questionnaires are the focus of this manuscript. The first questionnaire was the short-form McGill Pain Questionnaire (SF-MGP) (Melzack 1987), the Northwick Park Questionnaire (NPQ) (Leak et al. 1994) and a visual analogue scale for pain over the past week (VAS) (Melzack 1987).

Protocol

Subjects were randomly assigned to one of three groups for a period of 8 weeks. The control group did not receive any intervention for 8 weeks then they were allocated to the specific neural treatment (NT) group as a crossover protocol.

Direct and indirect treatment approaches

Therapists for each intervention group were directed to use a selection of treatment choices that either directly or indirectly targeted the neural structures associated with the cervico-brachial pain syndrome. Both interventions had a manual therapy component with a home exercise programme. The first manual therapy treatment, with a local focus, used predominantly neural tissue techniques and direct mobilization of the cervical spine and caudad cephalad mobilization of the glenohumeral joint. The second intervention incorporated indirect approaches such as thoracic mobilizations and postero-anterior mobilizations of the gleno-humeral joint.

For the purposes of this study the local approach was defined as the neural treatment (NT) and the second the articular treatment (AT). The indirect AT intervention was frequency and duration matched to the NT intervention.

Neural treatment

The specific NT involved methods of treatment as described by Elvey (1997). This follows a general principle of mobilizing the tissues surrounding the nerves; and in conditions less acute, or where progression of technique is required, mobilizing the neural tissues together with the surrounding soft tissues.

The treating physiotherapist could use any or all of the following interventions at his/her discretion.

Cervical lateral glide
The subject was positioned in supine, the shoulder slightly abducted with a few degrees of medial rotation, and the elbow flexed to approximately 90° such that the hands were resting on the subject's chest or abdomen. The physiotherapist gently supported the shoulder over the acromial region with one hand while holding and supporting the head and neck. The technique involved a gentle controlled lateral glide to the contralateral side of pain in a slow oscillating manner up to a point in range where the first perception of resistance was felt by the therapist (and before the onset of pain). This was determined to be the treatment barrier.

Shoulder girdle oscillation
The subject was positioned prone with the involved arm comfortably supported by the physiotherapist towards a position of hand behind the back. The physiotherapist placed the other hand over the acromial area. The technique involved a gentle oscillation of the shoulder girdle in a caudad cephalad direction. The range of oscillation was governed by the onset of first resistance perceived by the therapist in the caudad direction. This was determined to be the treatment barrier. The technique was progressed by performing the oscillation in gradually increased amounts of hand behind the back position.

Muscle re-education
Contract-relax techniques were performed into shoulder abduction and external rotation. This was progressed from a shoulder position of flexion/adduction towards a position of abduction/external rotation—comparable to a quadrant position (Maitland 1988) in the scapular plane (Elvey & Hall 1997).

Home mobilization
Subjects were taught a series of home mobilization techniques:

(i) Cervical spine side flexion was performed contralateral to the painful side. Up to 10 repetitions were done 1–3 times daily (depending on the irritability of the condition) with the shoulder in a position of abduction, and elbow resting on a table in a flexed position.
(ii) Active movements of shoulder abduction and/or external rotation in the same starting position as above was carried out if appropriate.

Articular treatment

Although the following techniques are generally accepted and utilized as valid manual therapy treatment techniques in clinical practice, they are not aimed at directly mobilizing the anatomical bed onto which the neural tissue lies, or mobilizing the neural tissue together with the surrounding soft tissues. Rather, these techniques are directed at an articular element of dysfunction. Hence, for the purpose of this study, the following techniques (Maitland 1988; Grubbs 1993; Owens-Burkhart 1997) are referred to as the articular therapy (AT). Since these techniques were generalized and not matched to the actual joint dysfunction of the individuals the AT group may be considered to have received an indirect or non-specific intervention.

The treating physiotherapist could use any or all of the following interventions at their discretion.

Glenohumeral mobilization
The subject was positioned supine with the arm comfortably at the side. The physiotherapist held the forearm against his/her side and supported the posterior surface of the head of the humerus. The technique involved a posteroanterior glenohumeral movement. This technique was progressed by performing the posteroanterior glide with the shoulder in gradually increased amounts of shoulder abduction as well as by increasing the grade and number of repetitions of the technique (Maitland 1988; Grubbs 1993; Owens-Burkhart 1997).

Thoracic mobilization
The subject was positioned prone with the arms comfortably at the side. The physiotherapist applied a posteroanterior unilateral vertebral pressure over the transverse processes at T2–T5 on the ipsilateral side of pain. The technique was progressed by increasing the grade; number of repetitions, arm position, and number of thoracic spine levels treated (Maitland 1988).

Home exercise
Subjects were taught a series of home mobilization techniques:

(i) Passive Codman/pendular exercises performed as tolerated (Souza 1994; Owens-Burkhart 1997).
(ii) Active assisted external rotation to the first onset of pain/discomfort (P1) using a wand/cane (subject is supine to help maintain scapular stabilization) (Maitland 1988; Grubbs 1993; Owens-Burkhart 1997).
(iii) *Shoulder stretches:* Pectoralis major stretch at doorway; anterior shoulder stretch with the hands clasped behind the back and arms extended; and posterior shoulder stretch (horizontal adduction at 90° of shoulder flexion) (Souza 1994).
(iv) Theraband exercises into abduction and external rotation to Pl with the arm remaining in a neutral/anatomical position (Souza 1994; Owens-Burkhart 1997).

Control group

The subjects in the control group received no physiotherapy treatment. They were allowed to seek treatment from a non-physiotherapy health care provider if they chose to do so. At the end of the 8-week period, subjects in the control group were reassessed then crossed over to the NT group at which time they began the same 8-week aforementioned NT intervention and reassessments.

Statistical analyses

For all data description and analyses an intention-to-treat analysis was performed where missing values were substituted with the previous assessment score.

Data were described using absolute scores and relative percentage change scores. The latter was calculated from the difference, divided by the initial score for each of the outcome measures.

Median values and inter-quartile ranges (IQR) were recorded for all variables and represented using boxplots with 10th and 90th percentile limits.

To determine the baseline stability of the pain and functional disability scores a Wilcoxon rank test was performed across the baseline measures for the control group.

A Friedman's tests was performed to determine changes over the treatment period (pre- mid- and post-treatment) for each of the pain and functional disability measures (SF-MPQ, VAS and NPQ). If a significance difference was found a Wilcoxon rank test was performed to contrast differences between assessments.

Mann–Whitney rank tests were performed for comparisons between treatment groups at each assessment stage.

Statistical significance was accepted at the 0.05 level of confidence.

RESULTS

The age, gender and duration of symptoms of the subjects allocated to each group are shown in Table 1. It is clear that many individuals reported duration greater than 2 years. The majority of subjects had long-term problems, had poorly defined onsets and often described the duration as 'years'. The shorter duration in the NT group (later combined with the control group) was considered an artefact of randomization. Post hoc analyses (Spearman rank correlations) revealed that there were no significant relationships between the duration of the symptoms and the initial score or change in score of any outcome variable.

The median, IQR of the absolute change in score and relative percentage change of pre- and post-treatment SF-MPQ, NPQ and Pain VAS scores for the NT, AT and control group are outlined in Table 2.

No significant difference were found for the baseline scores for the SF-MPQ ($Z_{(1,9)} = -0.91$, $P = 0.3598$), VAS ($Z_{(1,9)} = -0.059$, $P = 0.9519$) or NPQ ($Z_{(1,9)} = -0.254$, $P = 0.7959$). The baseline values ($B1$ and $B2$) for each parameter are illustrated in Figs. 1A–C where the baseline measures are shown for the control group prior to being combined with the NT group.

Table 1. Mean and standard deviation (SD) for the variable age (years) and duration of symptoms (months) for all groups

	Age (years)				Duration of symptoms (months) Median (IQR)
Group*	*N*	Females	Median (IQR)	Range	
NT	10	6	50.0 (19.5)	33.0	12 (48)
AT	10	8	61.0 (8.5)	23.0	72 (72)
CG	10	6	52.5 (10.0)	30.0	12 (91)
All groups	30	20	54.0 (13.5)	40.0	36 (72)

*Group refers to random allocation prior to the control group crossover. NT – neural tissue Manual Therapy Group, AT – Articular treatment Group, CG Control group.

Table 2. Median, Inter quartile range (IQR) of the absolute change in median score and relative percentage change in score (relative per cent change) of pre- and post-treatment (*Rx*) pain and disability scores for treatment groups[†]

Group	*N*	Pre-*Rx* median (IQR)	Post-*Rx* median (IQR)	Absolute change	Relative % change
SF-MPQ					
NT	17	9.5 (10.0)	3.2 (6.0)	6.3**	66
AT	9	11.5 (16.0)	7.0 (6.0)	4.5*	39
CG#[‡]	10	10.0 (9.0)	7.5 (4.0)	2.5ns	25
NPQ					
NT	17	12.0 (5.0)	9.5 (8.5)	2.5*	21
AT	9	12.5 (6.0)	11.0 (7.0)	1.5*	12
CG[‡]	10	12.5 (4.0)	11.5 (6.0)	1.0ns	8
VAS					
NT	17	4.6 (3.1)	2.1 (2.5)	2.5**	54
AT	9	5.1 (2.0)	3.4 (2.9)	1.7*	33
CG[‡]	10	3.3 (3.5)	3.8 (3.9)	−0.5	−15

[†]ns = non-significant, *$P<0.05$, **$P<0.001$. *N* is the number of subjects refers to the sample size of the post-treatment scores. All subjects had pre-treatment scores and missing values were substituted from prior assessments using an intention to treat principle.
[‡]CG – Control group data represents the base line scores. SF-MPQ – Short form McGill Pain questionnaire Score out of 45. NPQ – Northwick Park Questionnaire. Score out of 36. VAS – Pain Visual Analogue Score. Score out of 10.

Short-form McGill pain questionnaire

The data from the short-form McGill pain questionnaire illustrate a significant improvement over the period of the intervention for both groups (NT$\chi_{(2,56)}=18.328$, $P=0.0001$, AT $\chi_{(2,56)}=7.294$, $P=0.0261$). This is illustrated in Figure 1A. Post hoc comparison demonstrated a statistical significance for the mid-treatment assessment and the post-treatment assessment for the NT group ($Z_{(1,19)}=-2.643$, $P=0.0082$). No significant differences between the groups were observed for any of the assessment periods (pre: $Z_{(1,29)}=-0.925$, $P=0.3547$; mid: $Z_{(1,29)}=-1.213$, $P=0.2253$ and post: $Z_{(1,29)}=-1.430$, $P=0.1514$).

Northwick Park questionnaire

Figure 1B shows the boxplots for the Northwick Park questionnaire data. A significant improvement over the period of the intervention for both groups (NT $\chi_{(2,56)}=8.400$, $P=0.0150$, AT$\chi_{(2,56)}$ 8.00, $P=0183$) was demonstrated. Although graphically there is a trend for a improvement throughout treatment this reached statistical significance for the initial 4 weeks for the AT group ($Z_{(1,9)}$ = -2.264, P = 0.0235) and for the mid-treatment assessment and the post-treatment assessment for the NT group ($Z_{(1,19)}$ = -2.019, $P=0.0435$).

No statistical differences were found between groups at any assessment period.

Visual analogue scale

Both treatment groups showed significant improvements over the treatment period (NT$\chi_{(2,56)}=19.60$, $P<0.0001$, AT $\chi_{(2,56)}=9.60$, $P=0.0082$) (see Fig. 1C). The NT group showed statistically significant improvements at each assessment (pre to mid, $Z_{(1,19)}$ = -3.024, $P=0.0025$, mid to post $Z_{(1,19)}=-3.158$, $P=0.0016$). The AT group demonstrated a significant change during the initial 4 weeks of treatment ($Z_{(1,9)}=-2.703$, $P=0.0069$). A significant group difference was found at the end of the treatment period with the NT group reporting lower pain scores that the AT group ($Z_{(1,19)}$ = -2.115, $P=0.0344$).

DISCUSSION

Although there are numerous studies that have addressed the issue of manual therapy in chronic

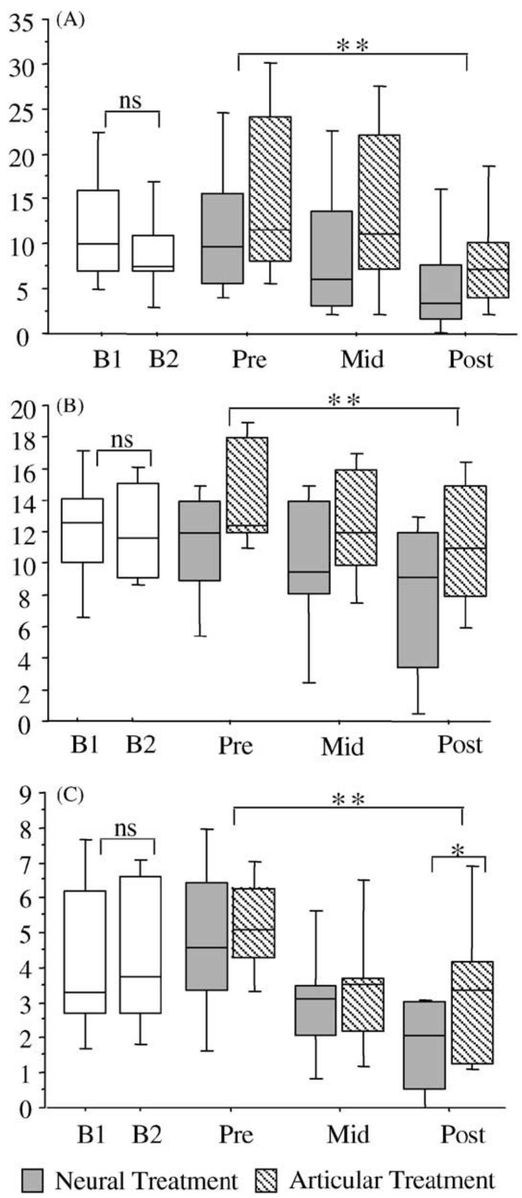

Fig. 1—Boxplots (Median, Interquartile Range and 10th and 90th percentiles) of the three outcome measures: (A). The short-form McGill Pain questionnaire, (B) Northwick Park questionnaire and (C) Pain visual analogue scale for past week. Control group ($n=10$) baseline assessments ($B1$ and $B2$) shown non-significant difference. Both groups, Neural treatment ($n=20$ shaded) and articular treatment ($n=10$ striped) show significant improvements (**). Only Pain VAS shows significant group difference (*).

neck pain, few studies have utilized mechanosensitivity of the neural structures as a primary inclusion criterion for an intervention study in neck/shoulder pain. This study attempted to identify a specific subgroup of individuals with chronic neck pain using this diagnostic focus and determine the efficacy of two active manual therapy techniques. One technique followed the diagnostic criteria of a mechanosensitivity of the neural structures and the other technique focused more on the joint mobilizations. Positive benefits of neural tissue mobilization techniques have been reported in two case studies of cervico-brachial pain syndrome (Kaye & Mason 1989) and mechanical allodynia of the upper quarter following a hand injury (Sweeney & Harms 1996). This current study suggests that the two approaches (local/neural and indirect articular focus) combined with passive and active movement techniques in a home exercise programme resulted in an overall improvement in function and pain scores reported by subjects with cervico-brachial pain syndrome. This is also consistent with other studies that have demonstrated manual therapy treatments for neck/shoulder pain (Brewerton & Nichols 1966; Koes et al. 1992).

Other studies are difficult to compare since they may test immediate effects of a single manipulation (Cassidy et al. 1992a,b Vernon et al. 1990). The assessment of short-term changes following manipulation may not necessarily reflect the clinical practice in the chronic cervico-brachial pain syndrome population. The interventions in this study, in comparison, were a more realistic representation of a pragmatic approach of the management of cervico-brachial pain syndrome practiced by the therapists in the study. Both interventions also had components of a home programme of exercise and stretching and it is acknowledged that this common component may account for the improvement in both groups.

This study clearly demonstrated significant improvements in pain (short-form McGill pain questionnaire, VAS) and disability (Northwick Park questionnaire) following both manual therapy interventions. The NT group had significantly lower pain levels by 8 weeks compared to the AT group. The magnitudes of these differences however were clinically small. This study had a small sample size that may be an issue in interpreting the findings when comparing between the interventions since the power analysis was performed to provide sufficient power to determine a treatment effect. Delineating clear statistical differences between the interventions would require greater subject numbers.

It is of interest to note that the initial scores may also impact on the findings of the study with a tendency for subjects with the greatest disability and or pain having the potential to show the greatest improvements. In considering this Vickers and Altman (2001) suggested utilizing a covariance (regression model) in determining the outcome of clinical trials. In studies with greater numbers this may be the choice of statistical analysis. Interestingly, post hoc analysis found that the initial value was a significant covariant for the SFMPQ and the VAS. Only the VAS demonstrated a significant difference between groups. This reflects the findings of the non-parametric analyses performed in this study.

In designing this study the use of the AT (indirect) intervention parallels the use of a placebo manual therapy intervention. The use of the term placebo in this context however, is controversial. This is specifically of concern when the placebo group demonstrates significant improvements since some readers may assume that a placebo is a false or purely psychological treatment or devalues the validity of the comparative therapy (Wall 1992; 1993). All treatments have specific and non-specific effects. The use of an indirect or non-specific intervention (articular treatment) in this study relates to the authors' decision to focus on the purported specificity of the intervention and diagnosis. This is related directly to two concepts. The first concept involves the diagnostic classification. The sample in this study was identified within a framework of neural provocation testing and increased sensitivity to mechanical stimuli of the brachial plexus. Clearly, not all therapists would consider the cervico-brachial pain syndrome to be predominantly neurogenic in origin and therefore may question the validity of this argument. However, if one was to accept the concept of this diagnostic principle, then the most appropriate indirect therapy would be one that mimics the manual therapy hands-on component yet lies outside the neural tissue treatment framework. Joint mobilizations, as opposed to detuned electrotherapy modalities acting as a placebo, best fulfill these criteria although clearly joints are innervated and are not excluded from influencing the neural structures.

The second factor in determining the techniques used in the AT was the fact that the subjects were volunteers and had chronic problems. The chronicity of the problem (half of the subjects >3 years) may indicate that very few subjects would have been naïve to manual therapy interventions and would have not tolerated 8 weeks of a passive inert 'placebo' intervention. Similarly, the nature of volunteers may infer that they were expecting an active treatment and would respond to a therapeutic relationship (Wall & Wheeler 1996). Therefore, this would necessitate the use of a 'real' intervention that also had the elements of therapist contact, treatment progressions and home exercises. In the end the use of the AT in this study attempted to address a primary dilemma associated with manipulative and manual therapy research. That is, the difficulty in mimicking the actual therapy and maintaining some credible therapist–client relationship over a prolonged period. The other manual therapy intervention tested used a specific neural tissue focus therefore the corollary of this is that joint mobilizations of the AT reflect a non-specific intervention. Trials with placebo treatment that closely resemble the actual treatment, compared to obviously different types of treatment or inert procedures, were less likely to demonstrate an advantage over the real treatment especially if the subjects were not naïve (Wall 1992; Turner et al. 1994). The fact that the AT intervention was matched for treatments and duration and comprised essentially hands-on treatment also controls for important non-specific clinical benefit of 'hands-on' therapy.

The clinical importance of the findings of this study would suggest that both interventions (with associated home exercise regimens) as defined in this study had a significant improvement in pain and function in the selected population. This suggests that less direct manual therapy techniques may also impact on the mechanosensitive neural structures. This may be particularly true if combined with other treatment elements such as home exercise programmes. Similarly, the findings could also suggest that the interventions were not as specific to the respective targeted structural tissues or impairments; and/or the cervico-brachial pain population may have had underlying joint signs in addition to the dominant specific neural signs.

The most obvious explanation of the common effect of both interventions is that there is an inextricable link between the joint, soft tissue and neural structures of the upper quarter and upper thoracic spine and that there is a large crossover in both diagnostic and therapeutic domains. Some clinicians would argue that mobilizing the thoracic spine (T2–T5) does not constitute an indirect treatment protocol. It is clear that the inter-relationships between all the elements have implications in both diagnosis and the selection of the optimal treatment choices. This inter-relationship supports the common clinical practice of assessing (and provoking) nerves, soft tissues and joints as one important element of the clinical reasoning process performed by the manual therapist.

Although this study allowed some flexibility in the treatment protocol, in a real clinical setting continued assessment may have changed from dominant neural signs to dominant joint signs (or vice versa). These changes in the normal clinical setting may have redirected the treatment strategies during the intervention period. It has been hypothesized that joint and peripheral tissue pain may be maintained in circumstances where there is both peripheral and central neurogenic pain (Arroyo & Cohen 1992; Cohen et al. 1992). It is possible that individuals with chronic cervico-brachial pain syndrome had improvement in symptoms by treatment of the joints but this may have had a ceiling effect since the neural component was not specifically targeted. This however is only supported with the VAS scores at 8 weeks and not the other outcome assessments. Therefore, it would have been of interest if the individuals had clear joint signs as described by Maitland (1988) and these were used to direct treatment. The only impairments recorded during the intervention period were associated with the responses to neural provocation testing. These responses are subject to further analysis, however when compared to functional outcome measures (i.e. NPQ), they are less important in judging clinical efficacy.

CONCLUSION

This study investigated direct and indirect forms of active manual therapy interventions combined with home exercises in individuals with cervico-brachial pain syndrome. Both interventions demonstrated significant improvements in pain and disability and therefore both interventions had a significant therapeutic overlap. Further studies may require more regular assessments during the intervention period to determine the timeframe of improvements. Furthermore, studies are necessary to investigate the delineation between the specific and non-specific elements of manual therapy and the rationale for adapting the specific intervention according to the repeated assessment findings. This latter research direction is more likely to reflect the ability of skilled manual therapists to select and modify their choice of treatment to match the variance within any one diagnostic group or individual over the intervention period.

References

Arroyo JF, Cohen ML 1992 Unusual responses to electrocutaneous stimulation in refractory cervicobrachial pain: clues to a neuropathic pathogenesis. Clinical Experimental Rheumatology 10: 475–482

Berg HE, Berggren G, Tesch PA 1994 Dynamic neck strength training effect on pain and function. Archives of Physical Medicine and Rehabilitation 75: 661–665

Bovim G, Schrader H, Sand T 1994 Neck pain in the general population. Spine 19: 1307–1309

Brewerton DA, Nichols PJ 1966 Pain in the neck and arm: a multicentre trial of the effects of physiotherapy. British Medical Journal 1: 253–258

Cassidy JD, Lopes AA, Yong-Hing K 1992a The immediate effect of manipulation versus mobilization on pain and range of motion in the cervical spine: a randomized controlled trial. Journal of Manipulative and Physiological Therapeutics 15: 570–575

Cassidy JD, Quon JA, LaFrance LJ, Yong-Hing K 1992b The effect of manipulation on pain and range of motion in the cervical spine: a pilot study. Journal of Manipulative and Physiological Therapeutics 15: 495–500

Cohen ML, Arroyo JF, Champion GD, Browne CD 1992 In search of the pathogenesis of refractory cervicobrachial pain syndrome. A deconstruction of the RSI phenomenon. Medical Journal of Australia 156: 432–436

Davis H 1994 Increasing rates of cervical and lumbar spine surgery in the United States, 1979–1990. Spine 19: 1117–1123; discussion 1123–1124

Elvey RL 1986 Treatment of arm pain associated with abnormal brachial plexus tension. The Australian Journal of Physiotherapy 32: 225–230

Elvey RL 1994 The investigation of arm pain: signs of adverse responses to the physical examination of the brachial plexus and related neural tissues. Grieve's Modern Manual Therapy: The Vertebral Column. Churchill Livingstone, New York, pp. 577–606

Elvey RL 1997 Physical evaluation of the peripheral nervous system in disorders of pain and dysfunction. Journal of Hand Therapy 10: 122–129

Elvey RL, Hall TM 1997 Neural tissue evaluation and treatment. Physical Therapy of the Shoulder. Churchill Livingstone, New York

Grieve GP 1988 Common Vertebral Joint Problems. Churchill Livingstone, Melbourne

Grubbs N 1993 Frozen shoulder syndrome: a review of literature. Journal of Orthopaedics and Sports Physical Therapy 18: 479–487

Hurwitz EL, Aker PD, Adams AH, Meeker WC, Shekelle PG 1996 Manipulation and mobilization of the cervical spine. A systematic review of the literature. Spine 21: 1746–1759; discussion 1759–1760

Kaye S, Mason E 1989 Clinical implications of the upper limb tension test. Physiotherapy 75: 750–752

Keneally M, Rubenach H, Elvey RL 1988 The upper limb tension test: the straight leg raise of the arm. In: Grant R (ed) Physical Therapy of the Cervical and Thoracic Spine. Churchill Livingstone, New York, pp. 167–194

Koes BW, Bouter LM, van Mameren H, et al. 1992 The effectiveness of manual therapy, physiotherapy, and treatment by the general practitioner for nonspecific back and neck complaints. A randomized clinical trial. Spine 17: 28–35

Leak AM, Cooper J, Dyer S, et al. 1994 The Northwick Park Neck Pain questionnaire, devised to measure neck pain and disability. British Journal of Rheumatology 33: 469–474

Maitland GD 1988 Vertebral Manipulation. Butterworth and Company, Sydney, p. 390

Makela M, Heliovaara M, Sievers K, et al. 1991 Prevalence, determinants, and consequences of chronic neck pain in Finland. American Journal of Epidemiology 134: 1356–1367

Melzack R 1987 The short-form McGill Pain questionnaire. Pain 30: 191–197

Owens-Burkhart H 1997 Frozen shoulder. Physical Therapy of the Shoulder. Churchill Livingstone, New York

Quintner J, Cohen ML 1994 Referred pain of peripheral nerve origin: an alternative to myofascial pain construct. The Clinical Journal of Pain 10: 243–251

Souza TA 1994 Frozen shoulder. Sports Injuries of the Shoulder. Churchill Livingstone, New York

Sweeney J, Harms A 1996 Persistent mechanical allodynia following injury of the hand. Treatment through mobilization of the nervous system. Journal of Hand Therapy 9: 328–338

Turner JA, Deyo RA, Loeser JD, Von Korff M, Fordyce WE 1994 The importance of placebo effects in pain treatment and research. JAMA 271: 1609–1614

van der Heide B, Allison GT, Zusman M 2001 Pain and muscular responses to a neural tissue provocation test in the upper limb. Manual Therapy 6: 154–162

Vernon HT, Aker P, Burns S, Viljakaanen S, Short L 1990 Pressure pain threshold evaluation of the effect of spinal manipulation in the treatment of chronic neck pain: a pilot study. Journal of Manipulative and Physiological Therapeutics 13: 13–16

Vickers AJ, Altman DG 2001 Statistics notes: analysing controlled trials with baseline and follow up measurements. British Medical Journal 323: 1123–l124

Wall M, Wheeler S 1996 Benefits of the placebo effect in the therapeutic relationship. Complementary Therapy and Nursing Midwifery 2: 160–163

Wall PD 1992 The placebo effect: an unpopular topic. Pain 51: 1–3

Wall PD 1993 Pain and the placebo response. Ciba Foundation Symposium 174: 187–211