Chronic Shoulder Pain of Myofascial Origin: A Randomized Clinical Trial Using Ischemic Compression Therapy

Guy Hains, DC,[a] Martin Descarreaux, DC, PhD,[b] and François Hains, DC, MSc[c]

Abstract

Objective: The aim of this clinical trial was to evaluate the effect of 15 myofascial therapy treatments using ischemic compression on shoulder trigger points in patients with chronic shoulder pain.

Methods: Forty-one patients received 15 experimental treatments, which consisted of ischemic compressions on trigger points located in the supraspinatus muscle, the infraspinatus muscle, the deltoid muscle, and the biceps tendon. Eighteen patients received the control treatment involving 15 ischemic compression treatments of trigger points located in cervical and upper thoracic areas. Of the 18 patients forming the control group, 16 went on to receive 15 experimental treatments after having received their initial control treatments. Outcome measures included a validated 13-question questionnaire measuring shoulder pain and functional impairment. A second questionnaire was used to assess patients' perceived amelioration, using a scale from 0% to 100%. Outcome measure evaluation was completed for both groups at baseline after 15 treatments, 30 days after the last treatment, and finally for the experimental group only, 6 months later.

Results: A significant group × time interval interaction was observed after the first 15 treatments, indicating that the experimental group had a significant reduction in their Shoulder Pain and Disability Index (SPADI) score compared with the control group (62% vs 18% amelioration). Moreover, the patients perceived percentages of amelioration were higher in the experimental group after 15 treatments (75% vs 29%). Finally, the control group subjects significantly reduced their SPADI scores after crossover (55%).

Conclusion: The results of this study suggest that myofascial therapy using ischemic compression on shoulder trigger points may reduce the symptoms of patients experiencing chronic shoulder pain. (J Manipulative Physiol Ther 2010; xx:1-8)

Key Indexing Terms: *Shoulder Pain; Myofascial Pain Syndromes; Musculoskeletal Manipulations; Chiropractic*

Shoulder pain is a common musculoskeletal complaint; nearly half the population has at least one episode of shoulder pain per year.[1] The prevalence among 9696 adults of working age was 14.4%.[2] Upper extremity pain and injury account for (8.6%) of the chief complaints among chiropractic patients.[3] Painful or stiff shoulder may be caused by neurologic or vascular disorders, neoplasms, myofascial trigger points, referred pain from internal organs, and disorders of the cervical spine.[4-6]

Both the etiology and pathogenesis of shoulder disorders tend to remain enigmatic. The complex anatomical and functional structure of the shoulder joint often complicates diagnosis and clinical management of shoulder lesion. This has resulted in much confusion and a lack of consensus regarding the classification and diagnostic criteria of shoulder disorders.[1,4,7,8] Different pathologic conditions often coexist at the shoulder, either as a consequence of shared causes or because the presence of one disorder predisposes to the occurrence of another.[2]

The partial or complete tearing of the rotator cuff is often asymptomatic.[9] Ninety-six asymptomatic patients were examined using magnetic resonance imagery; 15% had complete tearing of the rotator cuff and 20% had partial tearing. The frequency of rotator cuff tearing seems to increase with age. Of the 46 patients older than 60 years who were examined, 28% had a complete tear of the rotator cuff and 26% had partial tears. On the basis of these results, the authors concluded that tears of the rotator cuff are often compatible with normal painless functional activity and occur with more frequency in older individuals.[9] In a

[a] Private practice, Trois-Rivières Québec, Canada.
[b] Professor, Université du Québec à Trois-Rivières, Québec, Canada.
[c] Associate Researcher, Canadian Memorial Chiropractic College, Toronto, Ontario, Canada.
Submit requests for reprints to: Guy Hains, DC, 2930 Côte Richelieu, Trois-Rivières, Québec, Canada, G8Z 3Y8 (e-mail: *guy.hains@cgocable.ca*).
Paper submitted May 16, 2007; in revised form November 27, 2009; accepted February 11, 2010.
0161-4754/$36.00

doi:10.1016/j.jmpt.2010.05.003

comprehensive study of an asymptomatic population, ultrasound examination revealed the presence of ruptures in more than 50% of the dominant shoulders among a population in their seventies.[10] Although it is mostly asymptomatic,[11] calcific tendonitis is often considered as a possible cause of shoulder pain.[12,13] However, in a study of 925 symptomatic patients, 63 (6.8%) patients had some evidence of calcification. In another group of 200 asymptomatic patients, 7.5% had calcified deposits in the shoulder. The investigators concluded that the frequency of shoulder calcification is virtually the same in both symptomatic and asymptomatic patients.[12]In another trial, it was said that the relationship between the calcium deposit and the shoulder pain was unclear.[14]

For most patients experiencing shoulder pain, a detailed case history and clinical examination enable the clinician to make appropriate clinical decisions regarding management and prognosis.[4] Imaging such as radiography, arthrography, computed tomographic scanning, and magnetic resonance imaging should be reserved for difficult cases where the diagnosis is insufficiently clear and conservative measures have not been successful.[15,16] For instance, radiographic evidence for degenerative arthritis can be found in 24% patients with shoulder pain, but it cannot be considered an adequate predictive value.[17]

Common treatments for shoulder pain include physiotherapy, antiinflammatory drugs, cryotherapy, local anesthetic or steroid infiltrations, needling, and radiation therapy.[18] In a cohort study of 127 patients reporting shoulder disability, injection was a common treatment (58%), whereas capsulitis was the most common diagnosis (39%). In the same study, roughly one quarter (22%) of patients reported a previous episode of shoulder pain.[19] In a group of 349 patients with shoulder pain, treated by 11 general practitioners, surgery was performed on 4 patients only, in the following year.[20] For these authors, an initial wait-and-see policy may prove to be the preferred treatment strategy.

Ultrasound therapy is associated with short-term clinical improvement. In a study where 32 shoulders were treated using ultrasound and 29 receiving a sham treatment, after 6 weeks of treatments, patients who received ultrasound treatment had a greater decrease in pain and a better quality of life than those who had received sham treatment. However, at 9 months, the differences between the groups were no longer significant. The conclusion of the authors was that ultrasound therapy is associated with short-term clinical improvement for shoulder pain.[13]

The natural history of shoulder pain is frequently considered self-limiting. However, a 3-year follow-up report found that 54% of patients had persistent pain, whereas 90% of them had chronic disability.[21] In another trial, 101 patients with shoulder pain were assessed, using a pain questionnaire and a physical examination. Fifty-one percent of them still experienced pain after 26 weeks and 41% after 12 to 18 months. The authors concluded that patients seen for shoulder complaints in general practice experience recurrence.[22] In another study of 92 subjects, 50 reported shoulder pain at a follow-up 3 years later.[21]

A systematic review of 31 clinical trials was conducted to evaluate the effectiveness of various therapeutic interventions for shoulder pain. The different clinical interventions included antiinflammatory medications, intraarticular cortisone injections, physiotherapy, manipulation under anesthesia, hydrodilation, and surgery. Of all these interventions, only subacromial cortisone injections were found to be more effective than placebos to increase abduction. The investigators concluded that there is little scientific evidence to support the effectiveness of the most commonly used therapies for shoulder pain.[7] There are no reports in the literature describing the efficacy of various treatment interventions in cases of calcific tendonitis based on controlled clinical trials,[23] and there are no randomized clinical trials of surgical interventions.[7]

The treatment of shoulder pain by using ischemic compression on trigger points located in structures surrounding the shoulder is based on the scientific rationale that shoulder trigger points may be located in muscles, ligaments, tendons, and articular capsules.[24] Patients with trigger points in the supraspinatus muscle complain of a deep aching pain in the middeltoid region.[5] Causes of these shoulder trigger points include traumatisms and overuse mechanisms.[25] A study has shown that myofascial therapy (friction massage) seems to relieve pain in patients experiencing chronic shoulder bursitis.[26] Its author suggested that eliminating the trigger points located around the shoulder area might be helpful for patients with shoulder pain. The present authors hypothesize that eliminating the trigger points in the shoulder area would normalize the function and eliminate the pain.

The aim of this study was to evaluate the effect of 15 myofascial therapy treatments using ischemic compression on trigger points located in the shoulder area in patients with from chronic shoulder pain.

Method

This prospective randomized clinical trial was conducted in a private clinic located in Trois-Rivières, Québec, Canada. The study was approved by the ethics committee of the Université du Québec à Trois-Rivières. All subjects were recruited through local advertising. To take part in the trial, participants had to be aged between 30 and 60 and to have experienced shoulder pain on a daily basis for at least the previous 3 months. *Shoulder pain* was defined as pain in the shoulder and upper arm, at rest or caused or aggravated by movement.[27] Participants also had to be able to raise the arm vertically above the head. The intensity of the pain had to be at least 5, on a 10-cm visual analog pain scale. All

participants agreed to receive 15 chiropractic treatments, without charge, at a rate of 3 times a week, and written informed consent was obtained from each participant. The exclusion criteria included past surgery to the shoulder, injection to the shoulder in the month preceding the trial, a diagnosis of rheumatoid arthritis or any other systemic disorders affecting the joints, local tumors or infections, and acute bursitis or capsulitis of the shoulder. Pain from a herniated cervical disk may not only radiate sharply into the trapezius and shoulder area but also all the way down to the hand, causing numbness and tingling.[28] In our study, shoulder pain was deemed to be referred from the spinal structures if it was activated by active neck movement (flexion, rotation, and lateral flexion),[29] and subjects with such presentation were excluded from the trial.

Outcome Measures

Shoulder pain and related disabilities were measured using the Shoulder Pain and Disability Index (SPADI) questionnaire. This consists of a self-administered questionnaire, grouping 13 questions, 5 of which measure the severity of pain caused by various arm movements involving the shoulder, the pain being assessed on a numeric pain scale ranging from 0 to 10. Eight additional questions related to functional impairments of the shoulder are assessed with a numeric scale.[30]

The SPADI questionnaire has provided good psychometric values with a test-retest reliability of total and subscale scores ranging from 0.6377 to 0.6552. Internal consistency ranged from 0.8604 to 0.9507.[31,32] Patients perceived improvement was also measured using a numerical scale from 0% to 100%. Some authors have suggested that pain and disability questionnaires may be the most valid form of outcome measurement in the treatment of shoulder pain.[30,31]

Randomization

Randomized allocation of the participants was managed by an independent research assistant. Upon recruitment, each participant was assigned a random allocation number generated from a 2/3-1/3 random table, two thirds being even numbers and 1/3 odd numbers, jumbled together in an opaque envelope. The assistant pulled a number and assigned the patient to either the experimental group or the control group. The patient was not aware whether he was in the experimental or in the control group.

Sixty-three patients met the inclusion requirements, but because of transportation problems, 4 of them did not complete the initial 15 treatments. Forty-one participants in the experimental group and 18 in the control group completed the questionnaires at different intervals. In the experimental group (n = 41), data from the SPADI questionnaire was collected at baseline, after 15 treatments, 30 days after the treatments, and 6 months later. The patients perceived improvement score was obtained after 15 treatments, 30 days after the treatments, and 6 months later. For the control group (n = 18), data from the SPADI questionnaire was obtained at baseline and after the initial 15 treatments. The patients perceived improvement questionnaire was also filled after 15 treatments. For the crossover group (n = 16), the SPADI and the patients' perceived improvement questionnaires were filled out after the 30 treatments (15 control + 15 experimental). Both questionnaires were mailed to the experimental group 6 months after the last treatment.

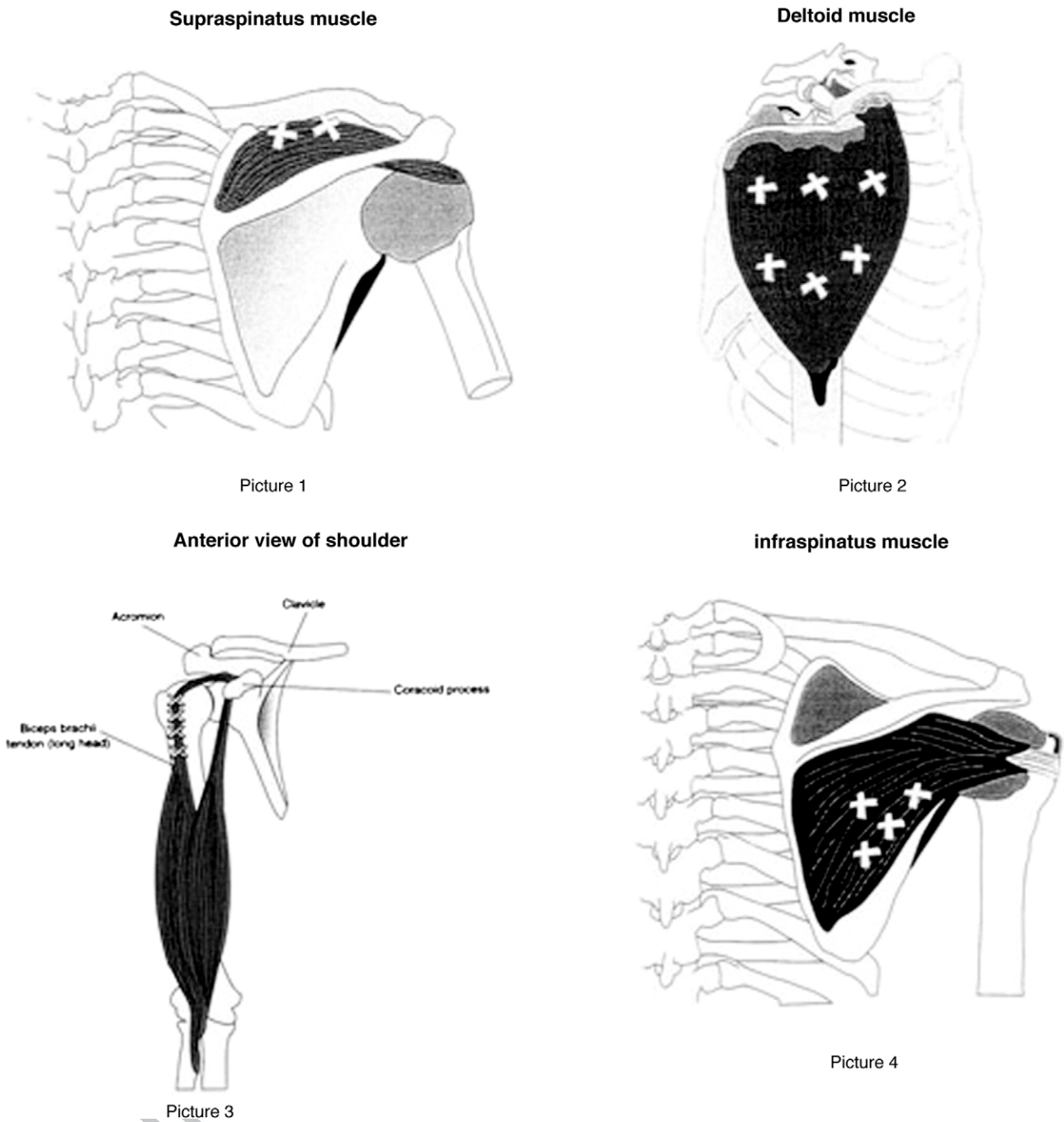
Clinical Interventions

The experimental treatment consisted of a 15-second thumb pressure (one thumb on the other) on myofascial trigger points located in the following muscles and tendons: the supraspinatus muscle, the deltoid muscle, the infraspinatus muscle, and the biceps tendon (Fig 1).[33] The pressure was applied only to hyperirritable trigger points; if there was none in 1 of these 4 areas, there was no treatment on that area.

Trigger points were treated using a light pressure, which was gradually increased to the participant's maximum pain tolerance level. The pressure was painful but bearable. The control treatment consisted of 15-second pressure on trigger points located in muscles of the cervical and upper dorsal areas. The authors suspected that this control treatment had no influence on the shoulder pain. The pressure also had to be painful but bearable. Sixteen patients of the control group agreed to receive 15 more experimental treatments. All the treatments were given by the same experienced chiropractor (GH). The patients were invited to stop taking any analgesic medication as soon as possible. A flowchart describing the clinical trial is presented in Figure 2.

Statistical Analysis

Results were analyzed according to the "intention to treat" approach. Questionnaire scores of the experimental group and control group (including the crossover) were first submitted to a repeated measure 1-way analysis of variance (ANOVA) (time intervals). When a main effect of time intervals was observed for the experimental group, post hoc comparisons were performed using Tukey tests. The questionnaire scores were then submitted to a repeated measure 2-way ANOVA (group × time intervals). This analysis tested for the main effect treatment (experimental or control), the main effect of time intervals (baseline evaluation and after 15 treatments), and the interaction. A *t* test for independent samples was used to compare the patients perceived amelioration percentage after 15



Q1 **Fig 1.** *Trigger points treated in this study. (Reprinted with permission from the Journal of the Canadian Chiropractic Association.[33])*

treatments. Statistical significance was set at $P < .05$ for all analyses.

Results

Fifty-nine patients were assessed and treated between September 2003 and December 2006. Patients' characteristics at baseline evaluation were similar in both groups (independent t test, $P > .05$); see Table 1. The mean scores and standard deviations for the SPADI questionnaire are presented in Table 2. A significant group × time interval interaction was observed ($F_{1, 57} = 9.8$; $P = .003$) after the first 15 treatments indicating that the experimental group had a significant reduction in their SPADI scores compared with the control group. A main significant effect of time intervals was also observed in the experimental group for

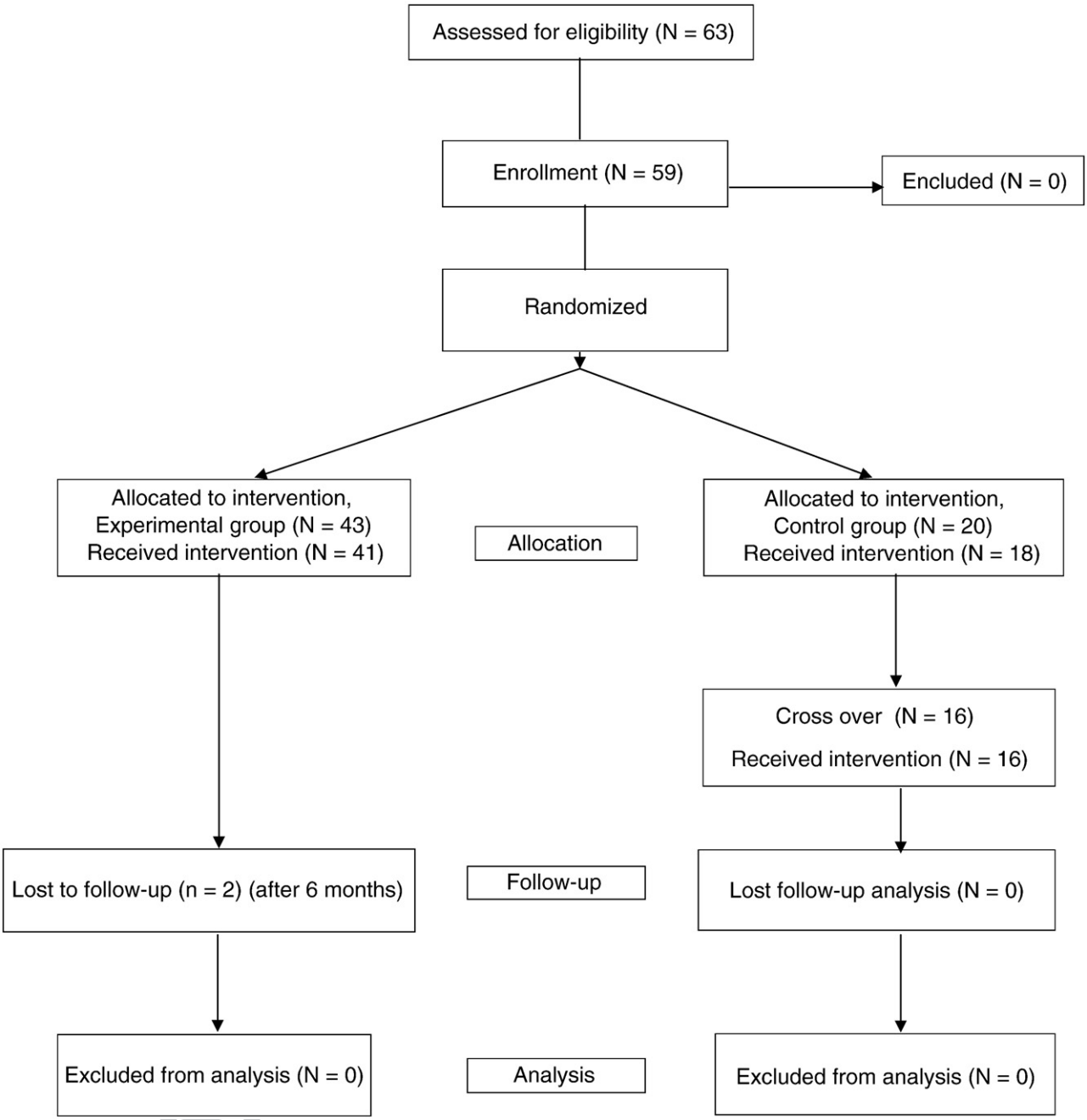


Fig 2. *Flowchart for study.*

the SPADI questionnaire ($F_{3,\ 114} = 49.88$; $P < .001$), and post hoc analysis revealed a significant decrease of SPADI scores after 15 treatments. This reduction in SPADI scores was still present after 6 months (Tukey $P < .001$). Figure 3 illustrates the results of the SPADI questionnaire for the experimental group.

The patients perceived percentages of amelioration are presented in Table 3. The *t* test for independent samples yielded a significant difference between the 2 groups ($P < .001$). The experimental group scored 74.5% (21.7) after 15 treatments, whereas the control group scored 28.9% (27.4). For the experimental group, the mean percentage of amelioration was 73.9% (28.5) 30 days after the treatments and 66.3% (32.6) 6 months later. For the crossover group, it was 78.9% (15.4) after receiving 15 placebo treatments + 15 experimental treatments.

Table 1. *Characteristics of assessable subjects: pretreatment values*

	Experimental group (n = 41)	Control group (n = 18)
Men	21	5
Women	20	13
Mean age	46.5 (8.8)	45.6 (7.4)
Mean duration of symptoms (y)	4.0 (3.9)	4.9 (4.2)
Right shoulder involved	26	10
Left shoulder involved	15	8

For the 16 patients who received 30 treatments (15 control + 15 experimental), the repeated measure 1-way ANOVA yielded a significant difference between the different time intervals, and post hoc analysis revealed a significant reduction of the SPADI scores after the last 15 treatments (experimental treatment). No significant side effects were seen during or after treatments. Fifty-nine of the 63 patients accepted at the beginning of the trial have received the prescribed 15 treatments. Four patients did not complete the initial treatments because they had traveling problems.

Discussion

There is growing interest within the chiropractic profession concerning the management of soft tissue disorders.[25] Ischemic compression of trigger points is one of the most popular treatment methods used by chiropractors to treat myofascial pain.[3,25] Recent data indicate that trigger points are treated by 91% of chiropractors.[3] Ischemic compression is also known as *Nimmo technique*, *trigger point therapy*, or *acupressure*.[3] The most pathognominic symptom of myofascial pain syndrome is the presence of pressure-sensitive palpable nodules that reproduce the chief complaint; they are called *trigger points*.[34] Trigger points may be located in muscles, ligaments, tendons, fascias, and articular capsules,[24] and myofascial pain therapy using ischemic compression may be beneficial for patients with low back pain,[35] shoulder pain,[33] and fibromyalgia.[36]

Multiple options exist for the treatment of shoulder pain and disability, and Gimblett et al[37] have successfully treated 2 cases of calcification tendinitis of the shoulder, using ultrasound, range of motion exercise, and cross-friction massage of the supraspinatus tendon. Kozin[38] believes that it is sometimes useful to inject steroids in tender points, especially when more conservative approaches have failed. Patients usually prefer natural approaches for shoulder pain. In a trial comparing shock wave therapy vs conventional surgery in the treatment of calcifying tendinitis of the shoulder, most of the patients refused consent to being randomly assigned to a surgical procedure, as long as there still was the possibility of being treated nonoperatively with shock waves.[18]

An extensive review of the literature was performed by a Logan Chiropractic College librarian to find clinical trials where myofascial trigger points in the shoulder area were treated to relieve shoulder pain. Only one was found. It was carried out by Andersen and Parkin-Smith[39] who wanted to observe the effect of cryotherapy combined with passive stretching, and moist heat combined with passive stretching, respectively, on active myofascial trigger points of the shoulder girdle. Each patient was treated 5 times within a 3-week period, with a 1-month follow-up assessment. Thirty patients were equally randomized in 2 groups. Self-administered questionnaires and objective testing were used. Both groups showed an improvement that persisted through the 1-month follow-up consultation.

Our own study shows a decline of 44 points in the experimental group 30 days after the end of treatments. Usually, a SPADI score decline of greater than 10 points is highly significant for improved shoulder function.[32] Thus, the results of the present study suggest that ischemic compression therapy around the shoulder may be an effective treatment.

Limitations

Limitations of this study include the unequal distribution of subjects over the 2 groups. This 2/3-1/3 randomization strategy was used for ethical reasons as we wished for a maximum number of subjects to be included in the experimental treatment group. Cointervention was not accounted for after the 15th treatment because all control group participants were offered 15 experimental treatments after the control treatments. This strategy was chosen because the authors did not wish to let these patients go without offering them the opportunity of receiving the experimental treatments. Having only one treating doctor, there could be a practitioner bias. The sample size is rather small. Our control group is not really a placebo group even if treating the latent trigger points of the neck and upper thoracic by ischemic compression was quite unrelated to the shoulder pain, especially because, from the beginning, the patients with cervical pain radiating to the shoulder were excluded. This control treatment was seen as highly plausible by the patient.

In the experimental and the control groups, the mean duration of pain was, respectively, 4 and 4.9 years, and thus, one cannot assume that the pain would have ceased without treatments over the following months. In the experimental group, 35 of 41 or 85% of the participants felt an evident amelioration within 6 treatments. Either they spontaneously said so or they were asked at the sixth treatment.

Further studies are needed to examine the cost-effectiveness of this approach and how ischemic compression compares to physiotherapy, pharmaceutical interven-

Table 2. *Mean (SD) score from the SPADI questionnaire*

Groups	Baseline	After 15 treatments	30 d after treatments	6 mo after treatments	15 control + 15 experimental
Experimental (n = 41)	67 (25.3)	25.5 (24.3)	22.9 (24.5)	28.8 (29.1)	
Control (n = 18)	71.5 (24.1)	58.4 (21.7)			
Crossover (n = 16)	72.8 (24.7)				32.6 (26.8)

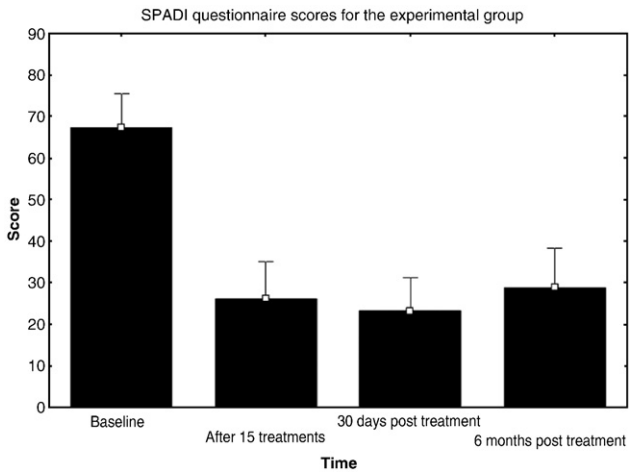


Fig 3. *Results of the SPADI questionnaire for the experimental group.*

Table 3. *Mean (SD) score from the patients perceived amelioration numerical scale (%)*

Groups	After 15 treatments	30 d after treatments	6 mo after treatments	15 control + 15 experimental treatments
Experimental (n = 41)	75% (21.7)	74% (28.5)	66% (35.6)	
Control group (n = 18)	29% (27.4)			
Crossover (n = 16)				79% (15.5)

tion, and placebo treatment. These studies should include a larger patient population, longer term follow-up, many clinicians, and a blinded evaluator. Pre and postorthopedic tests could be used.

Conclusion

The results of this trial suggest that myofascial therapy using ischemic compression on trigger points on different sites surrounding the shoulder may reduce the symptoms of patients with chronic shoulder pain. In this trial, a decline of 44 points in the SPADI questionnaire is highly significant when we consider that, in the literature, anything in excess of a 10 points decline is already highly specific for improved shoulder function. The authors hope that this trial will encourage practitioners to treat myofascial trigger points in cases of shoulder pain and to promote future research in that field.

Practical Applications

- Overwork and trauma are possible causes of trigger points.
- Ischemic compression appears to be helpful in the treatment of trigger points.

Funding Sources and Potential Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

References

1. Brox JI. Shoulder pain. Best Pract Res Clin Rheumatol 2003; 1:33-56.
2. Walker-Bone K, Palmer KT, Reading I, et al. Prevalence and impact of musculoskeletal disorders of the upper limb in general population. Arthritis Rheum 2004;51:642-51.
3. Christensen MG, Kollasch MW, Ward DA. Job analysis of chiropractic. Greeley (Colo): National Board of Chiropractic Examiners; 2005. p. 98.
4. Van der Windt DA, Koes BW, de Jong BA, et al. Shoulder disorders in general practice, incidence, patient characteristics, and management. Anna Rheum Dis 1995; 54:959-64.
5. Travel JG, Simons DG. Myofascial pain and dysfunction; the trigger point manual, vol. 1. Philadelphia: Williams and Wilkings; 1983. p. 368.
6. Kalb RL. Evaluation and treatment of shoulder pain. Hosp Pract 1998:119-22.
7. Green S, Buchbinder R, Glazier R, et al. Systematic review of randomized controlled trials of interventions for painful shoulder: selection criteria, outcome assessment, and efficacy. BMJ 1998;316:354-60.
8. Coari G, Paoletti F, Iagnocco A. Shoulder involvement in rheumatic diseases. Sonographic findings. J Rheumatol 1999; 26:668-73.
9. Sher JS, Uribe JW, Posada A, et al. Abnormal findings on magnetic resonance images of asymptomatic shoulders. J Bone Joint Surg Am 1995;77A:10-5.
10. Milgrom C, Schaffler MG, Gilbert S, et al. Rotator cuff change in asymptomatic adults. J Bone Joint Surg 1999;340: 1533-8.

11. Leduc BE, Caya J, Tremblay S, et al. Treatment of calcific tendonitis of the shoulder by acetic acid iotophoresis: a double blind randomized controlled study. Arch Phys Med Rehabil 2003;84:1523-7.
12. Welfling J, Kahn MF, Desroy M, et al. Les calcifications de l'épaule. Revue Rhumatisme 1965;32:325-34.
13. Ebenbichler GR, Erdogmus CB, Resch KL, et al. Ultrasound therapy for calcific tendinitis of the shoulder. N Engl J Med 1999;340:1533-8.
14. Wang CJ, Ko JY, Chen HS. Treatment of calcific tendinitis of the shoulder with shock wave therapy. Clinical Orthop 2001; 387:83-9.
15. Connelly JF. Unfreezing the frozen shoulder. J Musculoskelet Med 1998:47-57.
16. Daigneault J, Cooney LM. Shoulder pain in older people. J Am Geriatr Soc 1998;46:1144-51.
17. Petri M, Dubrow R, Neiman R, et al. Randomized, double-blind, placebo-controlled study of the treatment of the painful shoulder. Arthritis Rhum 1987;30:1040-5.
18. Rompe JD, Zoellner J, Nafe B. Shock wave therapy versus conventional surgery in the treatment of calcifying tendonitis of the shoulder. Clin Orthop Relat Res 2001;387:72-82.
19. Croft P, Pope D, Silman A. The clinical course of shoulder pain: prospective cohort study in primary care. BMJ 1996; 313:601-2.
20. Van der Windt DA, Koes BW, de Jong BA, et al. Shoulder disorders in general practice: prognostic indicators of outcome. Br J Gen Pract 1996;46:519-23.
21. Macfarlane GJ, Hunt IM, Silman AJ. Predictors of chronic shoulder pain: a population based prospective study. J Rheumatol 1998;25:1612-5.
22. Winters JC, Sobel JS, Groenier KH, et al. The long-term course of shoulder complaints: a prospective study in general practice. Rheumatology (Oxford) 1999;38:160-3.
23. Wainner RS, Hasz M. Management of acute calcific tendinitis of the shoulder. Clinical Commentary. J Orthop Sports Phys Ther 1998;27:231-7.
24. Travel JG, Simons DG. Myofascial pain and dysfunction; the trigger point manual, vol. I. Philadelphia: Williams and Wilkins; 1983. p. 19.
25. Schneider M. Tender points (fibromyalgia vs trigger points) myofascial pain syndrome: a need for clarity in terminology and diagnosis. J Manipulative Physiol Ther 1994;18:398-406.
26. Hammer WI. The use of transverse friction massage in the management of chronic bursitis of the hip or shoulder. J Manipulative Physiol Ther 1993;16:107-11.
27. Bergman GJ, Winters JC, van der Heijden GJ, Postema K, Meyboom-de Jong B. Shoulder girdle as additional treatment for symptom relief and for prevention of chronicity or recurrence of shoulder symptoms. Design of a randomized controlled trial within a comprehensive prognostic cohort study. J Manipulative Physiol Ther 2002;25:543-9.
28. Curtis AS, Wilson P. Shoulder pain in the work place. Orthop Clin North Am 1996;27:763-81.
29. Grinn KA, Herbert RD, Khouw W, et al. A randomized, controlled clinical trial of a treatment for shoulder pain. Phys Ther 1997;77:802-9.
30. Aina R, Cardinal E, Bureau NJ, et al. Calcific shoulder tendinitis: treatment with modified US-guided fine-needle technique. Radiology 2001;221:455-61.
31. Roach KE, Budiman-Mak E, Songsiridej N, et al. Development of a shoulder pain and disability index. Arthritis Care Res 1991;4:143-9.
32. Williams JW, Holleman DR, Simel DL. Measuring shoulder function with the shoulder pain and disability index. J Rheumatol 1995;22:727-32.
33. Hains G. Chiropractic management of shoulder pain and dysfunction of myofascial origin using ischemic compression techniques. J Can Chiropr Assoc 2002;46:192-200.
34. Borg-Stein J, Stein J. Trigger points and tender points. Rheum Dis Cli North Am 1996;22:305-23.
35. Hains G. Locating and treating low back pain of myofascial origin by ischemic compression. J Can Chiropr Assoc 2002; 46:257-64.
36. Hains G, Hains F. Combined ischemic compression and spinal manipulation in the treatment of fibromyalgia. J Manipulative Physiol Ther 2000;24:225-30.
37. Gimblett PA, Saville J, Ebrall P, et al. A conservative management protocol for calcific tendonitis of the shoulder. J Manipulative Physiol Ther 1999;22:622-7.
38. Kozin F. Two unique shoulder disorders. Postgrad Med 1983; 73:207-16.
39. Andersen MS, Parkin- Smith GF. A clinical trial investigating the possible effect of cryotherapy and moist heat on active myofascial trigger points of the shoulder girdle: a pilot study. Eur J Chiropr 2003;50:53-60.

AUTHOR QUERY FORM

ELSEVIER	**Journal: YMMT** **Article Number: 956**	**Please e-mail or fax your responses and any corrections to:** **Marla Kipp** **E-mail: kippm@cadmus.com** **Tel: 717-738-9302** **Fax: 717-738-9478**

Dear Author,

Any queries or remarks that have arisen during the processing of your manuscript are listed below and highlighted by flags in the proof. Please check your proof carefully and mark all corrections at the appropriate place in the proof (e.g., by using on-screen annotation in the PDF file) or compile them in a separate list.

For correction or revision of any artwork, please consult http://www.elsevier.com/artworkinstructions.

Articles in Special Issues: Please ensure that the words 'this issue' are added (in the list and text) to any references to other articles in this Special Issue.

Uncited references: References that occur in the reference list but not in the text – please position each reference in the text or delete it from the list.

Missing references: References listed below were noted in the text but are missing from the reference list – please make the list complete or remove the references from the text.

Location in article	Query / remark **Please insert your reply or correction at the corresponding line in the proof**
Q1	Please provide a copy of the permission to reprint Figure 1.

Electronic file usage
Sometimes we are unable to process the electronic file of your article and/or artwork. If this is the case, we have proceeded by:

☐ Scanning (parts of) your article ☐ Rekeying (parts of) your article ☐ Scanning the artwork

Thank you for your assistance.