Deep transverse friction massage for treating tendinitis (Review)

Brosseau L, Casimiro L, Milne S, Welch V, Shea B, Tugwell P, Wells GA

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2009, Issue 1

http://www.thecochranelibrary.com

TABLE OF CONTENTS

[Intervention Review]

Deep transverse friction massage for treating tendinitis

Lucie Brosseau[1], Lynn Casimiro[2], Sarah Milne[3], Vivian Welch[4], Beverley Shea[5], Peter Tugwell[4], George A Wells[6]

[1]School of Rehabilitation Sciences, Faculty of Health Sciences, University of Ottawa, Ottawa, Canada. [2]School of Rehabilitation Sciences, University of Ottawa, Ottawa, Canada. [3]Rehabilitation Center, Children's Hospital of Eastern Ontario, Ottawa, Canada. [4]Centre for Global Health, Institute of Population Health, University of Ottawa, Ottawa, Canada. [5]Institute of Population Health, University of Ottawa, Ottawa, Canada. [6]Cardiovascular Research Reference Centre, University of Ottawa Heart Institute, Ottawa, Canada

Contact address: Lucie Brosseau, School of Rehabilitation Sciences, Faculty of Health Sciences, University of Ottawa, 451 Smyth Road, Ottawa, Ontario, K1H 8M5, Canada. lbrossea@uottawa.ca.

Editorial group: Cochrane Musculoskeletal Group.
Publication status and date: Edited (no change to conclusions), published in Issue 1, 2009.
Review content assessed as up-to-date: 18 August 2002.

Citation: Brosseau L, Casimiro L, Milne S, Welch V, Shea B, Tugwell P, Wells GA. Deep transverse friction massage for treating tendinitis. *Cochrane Database of Systematic Reviews* 2002, Issue 4. Art. No.: CD003528. DOI: 10.1002/14651858.CD003528.

ABSTRACT

Background

Deep transverse friction massage (DTFM) is one of several physiotherapy interventions suggested for the management of tendinitis pain.

Objectives

To assess the efficacy of DTFM for treating tendinitis.

Search strategy

We searched the MEDLINE, EMBASE, HealthSTAR, Sports Discus, CINAHL, the Cochrane Controlled Trials Register, PEDro, the specialized registry of the Cochrane musculoskeletal group and the Cochrane field of Physical and Related Therapies up to the end of June 2002. The reference list of the trials and key experts in the area were also consulted for additional studies.

Selection criteria

All randomized controlled trials (RCTs) and controlled clinical trials (CCTs) comparing therapeutic ultrasound with control or another active intervention in patients with all types of tendinitis, such as iliotibial band friction syndrome and extensor carpi radialis tendinitis (i.e. tennis elbow or lateral epicondylitis or lateralis epicondylitis humeri), were selected.

Data collection and analysis

Two reviewers determined the studies to be included based upon the inclusion and exclusion criteria (LB, VR). Data were independently abstracted by two reviewers (VR, LB), and checked by a third reviewer (BS) using a pre-developed form of the Cochrane Musculoskeletal Group.

The two reviewers, using a validated checklist, assessed the methodological quality of the RCTs and CCTs independently. The pooled analysis was performed using weighted mean differences (WMDs) for continuous outcomes.

Main results

One RCT included patients with ITBFS. DTFM combined with rest, stretching exercises, cryotherapy and therapeutic ultrasound was compared to the control group (rest, stretching exercises, cryotherapy and therapeutic ultrasound only). This trial showed no statistical difference in the three types of pain relief measured after four consecutive sessions of DTFM combined with other physiotherapy modalities for runners. There was a clinically important relative percentage difference in pain while running of 22%. A RCT on ECRT showed no statistical difference in pain relief, grip strength and the three types of functional status measured after 9 consecutive sessions within 5 weeks of DTFM compared with other physiotherapy modalities.

Authors' conclusions

DTFM combined with other physiotherapy modalities did not show consistent benefit over the control of pain, or improvement of grip strength and functional status for patients with ITBFS or for patients with ECRT. These conclusions are limited by the small sample size of the included RCTs. No conclusions can be drawn concerning the use or non use of DTFM for the treatment of ITBFS. Future trials, utilizing specific ITBFS methods and adequate sample sizes are needed, before conclusions can be drawn regarding the specific effect of DTFM on tendinitis.

PLAIN LANGUAGE SUMMARY

Deep transverse friction massage for the treatment of tendinitis

This is a systematic review of two randomised clinical trials (RCTs) on the efficacy of deep transverse friction massage in the treatment of tendinitis. These RCTs showed no benefit of deep transverse friction massage combined with concurrent physiotherapy modalities, when compared to either a control group with the same physiotherapy modalities, excluding deep transverse friction massage, or other active therapies such as phonophoresis or therapeutic ultrasound combined to placebo ointment, for the following outcomes: pain relief involved in the iliotibial band friction syndrome in runners, pain relief, improved functional status and increased grip strength involved in extensor carpi radialis tendinitis. These conclusions are limited by the lack of studies available, the use of subjective and non-validated scales for measuring pain, the combination of several physiotherapy modalities and the low sample size of the RCTs included in this systematic review.

BACKGROUND

Extensor carpi radialis tendinitis (ECRT) (i.e. tennis elbow or lateral epicondylitis or lateralis epicondylitis humeri) is a local inflammation near the proximal attachments of wrist extensors, characterised by pain in palpation of the lateral epicondyle of the humerus and in resisted movements against wrist extension (Struijs 2002). The prevalence of ECRT varies between 1 and 10% and occurs between the ages of 34 and 74 years (Allander 1974). Stratford 1989 reported that ECRT does not seem to be a degenerative condition, as its prevalence declines after the age of 42 (Allander 1974). It is a syndrome of overuse (e.g. use of computer mouse or during racquet sports) that can result in considerable socioeconomic costs due to prolonged leave of absence from work (Struijs 2002).

Iliotibial band friction syndrome (ITBFS) is an overuse musculoskeletal injury, frequently observed in long distance runners, cyclists, football players and military personnel. The incidence of ITBFS varies between 1.6%-52% depending upon the population studied (Kirk 2000, Jordaan 1994, Pinshaw 1984). The mechanism of ITBFS appears to be the repetitive friction of the iliotibial band moving over the lateral femoral condyle during knee flexion/extension (Schwellnus 1991). The etiology of the ITBFS is multifactorial (Messier 1988). Three main factors have been identified in current literature: 1) biomechanical factors such as maximum normalized braking force (Messier 1995) 2) anthropometric factors such as leg length discrepancy and width of the ilotibial band (Messier 1988, Orchard 1996) and 3) training factors such as weekly distance and downhill running (Messier 1995, Messier 1988, Orchard 1996).

Treatment of tendinitis consists of a medical, surgical or rehabilitation approaches. The medical approach encompasses rest, and the prescription of anti-inflammatory agents combined with anti-inflammatory/analgesic medication (Kirk 2000, Schwellnus 1991).

For example, the surgical approach includes the resection of the impinging portion of the iliotiabial band (Kirk 2000, Martens 1989). The goals of the rehabilitation approach to the treatment of ITBFS includes: 1) the control of pain and inflammation (Cyriax 1975 a, Cyriax 1975 b, Thaunton 1987); 2) the correction of biomechanical deficiencies (Thaunton 1987); 3) the restoration of motion (Hart 1994) and 4) the increase in strength, endurance and function (Hart 1994, Thaunton 1987); 5) the prevention of re-injury (Hart 1994) and 6) the gradual return to training (Thaunton 1987).

Deep transverse friction massage (DTFM) is a technique popularised by Dr. James Cyriax (Cyriax 1975 a, Cyriax 1975 b) for pain and inflammation relief in musculoskeletal conditions. DTFM may be part of a physiotherapy program offered in the treatment of various musculoskeletal conditions. DTFM is a technique that attempts to reduce abnormal fibrous adhesions and makes scar tissue more mobile in sub-acute and chronic inflammatory conditions by realigning the normal soft tissue fibres (Schwellnus 1992, Walker 1984). It has been indicated that DTFM also enhances normal healing conditions by breaking cross bridges and preventing abnormal scarring. Its mechanical action causes hyperaemia, which results in increased blood flow to the area (Schwellnus 1992).

To our knowledge, no meta-analysis or literature reviews have reported the efficacy of this type of massage in their scientific reports (Chapman 1991, Furlan 2001, Green 1998, van der Heijden 1997). The American Physical Therapy Association (APTA) guidelines (1998) recommend massage for musculoskeletal conditions, though the APTA guidelines do not differentiate between types of massage. However, these guidelines are not based on evidence from comparative controlled trials. There is a need to provide clinicians with evidence that will enable them to make informed decisions regarding treatment options.

This systematic review of DTFM for ITBFS was initially conducted as part of a guideline development project entitled the Philadelphia Panel Guidelines on Rehabilitation Interventions (Philadelphia 2001). The Philadelphia Panel recommends that there is insufficient evidence to include or exclude DTFM in the treatment of ITBFS (level I, grade C for pain). Other guidelines such as ACR (ACR 1996, ACR 2000), BMJ (BJM 2000) and Manal and Snyder-Mackler (Manal 1996) did not evaluate any type of massage, as a treatment intervention for knee conditions. To our knowledge, there is no existing guidelines on massage for ECRT.

OBJECTIVES

To assess the effectiveness of DTFM for treating tendinitis.

METHODS

Criteria for considering studies for this review

Types of studies

According to a priori protocol, all randomized controlled trials (RCT), controlled clinical trials without randomization (CCT), case-control and cohort studies were included. The results were graded according to the strength of the study design.
No language limitations were imposed. Abstracts were accepted.

Types of participants

Only trials with subjects aged 18 years and over, with clinical confirmation of the diagnosis of tendinitis (For instance: ITBFS and ECRT) were included. Inclusion criteria for ITBFS were comprised of 1) the history of pain on the lateral aspect of the knee during running; 2) tenderness over the lateral femoral condyle at rest and 3) aggravation of symptoms at 30 degrees of knee flexion. For ECRT, inclusion criteria comprised of 1) tenderness in palpation over the lateral aspect of the elbow; 2) pain in the lateral aspect of the elbow during resisted wrist extension.

Types of interventions

Trials comparing DTFM to placebo, no therapy or active treatments were accepted. Concurrent therapy was accepted, providing that it was given equally to all treatment groups.

Types of outcome measures

The primary measure of effectiveness was pain relief, as suggested by the third conference of Outcome Measures in Rheumatology (OMERACT) (Bellamy 1997). In addition to these outcomes, one of the authors (LB) has developed a theoretical framework for important outcome measures for physiotherapy interventions (Morin 1996). These outcomes were assessed as secondary measures of effectiveness and include: 1) Joint range of motion (ROM); 2) Muscle strength; 3) Endurance; 4) Functional status.

Search methods for identification of studies

We searched MEDLINE, EMBASE, HealthSTAR, Sports Discus, CINAHL, the Cochrane Controlled Trials Register (CCTR), PEDro, the specialized registry of the Cochrane musculoskeletal group and the Cochrane field of Physical and Related Therapies were searched using the keyword and textword search strategy shown below up to and including June 2002 according to the exhaustive search strategy for RCTs designed for the Cochrane Collaboration (Dickersin 1994), with modifications proposed by Haynes 1994. Additional terms for study design were used to identify observational studies including: case-control, cohort, comparative study and clinical trials.

The electronic search was complemented by the following hand searches: 1) Bibliographic references; and 2) Current Contents up to November 2000 (to identify articles not yet indexed in MEDLINE).

Nineteen references were retrieved by search. Only one study was included (Schwellnus 1992, Stratford 1989).

The strategy is as follows

Database: MEDLINE <1960 to June 2002>

Set Search Results

---

1 pain.tw,hw. 35196
2 activities of daily living/ 4866
3 (joint$ adj4 (mobility or flexibility)).tw. 197
4 (return$ adj3 (work or leisure)).tw. 781
5 (function$ adj2 (status or abilit$)).tw. 3151
6 (stiffness or swelling or swollen or tender 7925
7 (flexion or extension or abduction or adduc 12214
8 range of motion, articular/ 3237
9 (range adj2 motion).tw. 1338
10 (strength or power).tw. 21995
11 (grip$ or force or rotation).tw. 14952
12 (dynamomet$ or goniomet$).tw. 543
13 absenteeism/ or absenteeism.tw. 549
14 (sick leave or sick day$ or absence).tw. 44482
15 sick leave/ 217
16 (disabilit$ or (work$ adj compensation)).tw 7547
17 cost$.tw. 26237
18 exp economics/ or ec.fs. 40580
19 or/1-18 189590
20 exp exercise therapy/ 1527
21 (exercis$ or aerobic$).tw. 18114
22 (ergometer$ or pulley$).tw. 1083
23 (weights or hydraulics or robotics).tw. 5300
24 (elastic or ergonomic$).tw. 3114
25 body mechanic$.tw. 22
26 (posture or kinesthetic or stretch$).tw. 5805
27 (propriocept$ or development$).tw. 110911
28 (balance or coordination).tw. 11503
29 (gait or locomotion or sensory).tw. 13473
30 (perceptual or resistance).tw. 36548
31 (neuromuscular or muscular).tw. 8345
32 (flexibil$ or torque).tw. 3446
33 (force or extensibilit$).tw. 10232
34 strength$.tw. 14523
35 continuous passive motion.tw. 42
36 motion therapy, continuous passive/ 63
37 or/20-36 217565
38 heat/tu 113
39 (heat or hot or ice).tw. 15919
40 cryotherapy.sh,tw. 598
41 diathermy.sh,tw. 224
42 hydrotherapy.tw,sh. 92
43 (vapocoolant or phonophoresis).tw. 24
44 (aquatic or whirlpool or bath$).tw. 4608
45 balneotherapy.tw. 33
46 exp hyperthermia, induced/ 1645
47 (hypertherm$ or thermotherapy).tw. 2663
48 (fluidotherapy or compression).tw. 5607
49 (table or taping).tw. 3207
50 or/38-49 32466
51 exp ultrasonography/ 21742
52 ultrasonic therapy/ or us.fs. 24879
53 (ultrasound$ or ultrasonic$).tw. 14151
54 short wave therapy.tw. 3
55 ultrasonograph$.tw. 8440
56 or/51-55 39268
57 exp electric stimulation therapy/ 1322
58 ((electric$ adj nerve) or therapy).tw. 91184
59 (electric$ adj (stimulation or muscle)).tw. 3520
60 electrostimulation.tw. 221
61 electroanalgesia.tw. 2
62 (tens or altens).tw. 410
63 electroacupuncture.tw. 112
64 neuromusc$ electric$.tw. 25
65 (high volt or pulsed or current).tw. 50816
66 (electromagnetic or electrotherap$).tw. 1124
67 iontophoresis.tw. 339
68 or/57-67 141997
69 "biofeedback (psychology)"/ 399
70 biofeedback.tw. 353
71 facilitation.tw. 1881
72 bobath.tw. 12
73 adaptive shortening.tw. 2
74 or/69-73 2397
75 traction.sh,tw. 988
76 massage.tw,hw. 554
77 percussion/ 95
78 (percussion or petrissage or tapotement).tw 266
79 or/75-78 1857
80 knee.sh,tw. 6312
81 knee injuries/ 1185
82 exp knee joint/ 3485
83 (menisci or meniscus).tw. 552
84 semilunar cartilag$.tw. 1
85 medial collateral ligament, knee/ 110
86 medial collateral ligament$.tw. 164
87 anterior cruciate ligament/ 1092
88 cruciate ligament$.tw. 1241
89 patella$.tw. 1185
90 or/80-89 8332
91 74 or 37 219264
92 50 or 79 34132
93 56 or 68 176207
94 or/91-93 387530

95 19 and 94 71170
96 95 and 90 1934
97 back.hw,tw. 9994
98 neck.tw,hw. 14164
99 shoulder.hw,tw. 3639
100 or/97-99 26934
101 96 not 100 1804
102 animal/ not (human/ and animal/) 308797
103 101 not 102 1618
104 limit 103 to (english or french or spanish) 1510
105 randomized controlled trial.pt. 34706
106 controlled clinical trials/ 718
107 exp cross-sectional studies/ 11456
108 controlled clinical trial.pt. 7191
109 cross-section$.tw. 10510
110 prospective.tw. 28589
111 retrospective.tw. 19762
112 exp cohort studies/ 93292
113 exp case-control studies/ 56573
114 random$.tw. 53902
115 control$.tw. 205497
116 (compare or comparative).tw. 35970
117 comparative studies/ 166899
118 experiment$.tw. 97917
119 or/105-118 535035
120 104 and 119 919

Data collection and analysis

Two independent reviewers (VR, LB) examined the titles and abstracts of the trials identified by the search strategy to select trials that met the inclusion criteria. All trials classified as relevant by at least one of the reviewers, were retrieved. The retrieved articles were re-examined to ensure that they met the inclusion criteria.
The results of the individual trials were extracted from each of the included trials using pre-determined extraction forms by two independent reviewers (LB, VR). The data was cross-checked by a third reviewer (BS). The extraction forms were developed and pilot-tested, based on other forms used by the Cochrane musculoskeletal review group. The extraction form documented specific information about DFTM including 1) the characteristics of the technique; 2) methods of therapeutic application such as the duration, frequency, rhythm, pressure, and total number of sessions. The final data values were based on consensus of the two reviewers.
Data analysis: For continuous data, weighted mean differences (WMDs) were calculated. The pooled analysis was performed using WMDs for pain relief as described as 1) daily pain; 2) pain while running and 3) percentage of maximum pain when running for ITBFS and 4) pain intensity; 5) grip strength and 6) functional status (3 different measurements) for ECRT. For dichotomous data, relative risk ratios were calculated. The data analysis was performed using relative risk ratios for the number of patients with improved function.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.
No studies were pooled, therefore heterogeneity and subgroup analyses were not possible.
The search strategy identified 19 possible studies. Seven trials were excluded for reasons outlined below: 1) Crosman 1984: healthy subjects; 2) Feehan 1989: not tendinitis; 3) Chiarello 1997: healthy subjects; 4) Pellecchia 1994: combined modalities; 5) Zhang 1987: excluded study design; 6) Bischoff (1995): not massage; 7) Balke 1989: not tendinitis; 8) Thomee 1997: not massage.
Only two trials met the inclusion criteria (Schwellnus 1992, Stratford 1989). The first RCT (Schwellnus 1991) compared two groups: one received combined physiotherapy interventions and DTFM, and the other received combined physiotherapy interventions without DTFM. The study duration was four consecutive treatment sessions. A total of 17 patients with ITBFS were randomized. All patients in this study were prescribed rest, stretching exercises, cryotherapy and therapeutic ultrasound . The mean age was 27.6 years old, the disease duration was 48.5 weeks, the years of running experience were 6.6, and the weekly distance in kilometres was 54.5 for both groups. The injury severity was 3.4 out of a maximum possible of four.
The second included RCT on efficacy of DTFM examined the treatment of DTFM for ECRT (Stratford 1989) and had several comparison groups: 1) DTFM combined with therapeutic ultrasound and placebo ointment (n=11) versus therapeutic ultrasound combined with placebo ointment (n=9) and 2) DTFM compared to phonophoresis (n=10) versus phonophoresis alone (n=10) were included in the analysis. All comparison groups including no massage in combination with other interventions were not taken into account in the present systematic review. No concurrent treatment was involved. The mean age was 43.3 years old and the symptom duration was 4.25 weeks.

Risk of bias in included studies

Methodological quality was assessed using a validated checklist (Jadad 1996, Clark 1999). Components of quality included the quality of randomisation, double-blinding and description of withdrawals. Two independent reviewers (LB, VR) assessed quality and differences were resolved by consensus. This scale includes

items pertaining to the description of randomization, the appropriateness of blinding, and dropouts and withdrawals. Differences in scoring were resolved by consensus. A third reviewer (BS) was consulted, when necessary.

Effects of interventions

The methodological quality of the RCT for ITBFS included in this systematic review (Schwellnus 1992), scored a total of two points. This study scored half a point for randomisation, no points for double-blinding, and full points for the reporting of withdrawals and dropouts.

The methodological quality of the RCT for ECRT included in this systematic review (Stratford 1989), scored a total of four points. This study scored total points for randomisation and double-blinding, and no points for the reporting of withdrawals and dropouts.

The RCT for ITBFS (Schwellnus 1992) showed no statistical significant difference in the three types of pain relief measured after four consecutive sessions of DTFM combined with physiotherapy modalities for runners. Weighted mean differences (WMDs) were obtained for daily pain (WMDs 0.40, 95% CI: 0.00, 0.80), pain while running (WMDs 3.00, 95% CI: -5.08, 11.08) and percentage of maximum pain when running (WMDs 0.10, 95% CI: -3.77, 3.97) assessments. These correspond to a relative difference in the change between groups of 0% for daily pain, 22% for pain while running and 12% for % maximum pain while running.

The RCT for ECRT (Stratford 1989) showed no statistically significant difference in pain intensity, grip strength and functional status (3 different measurements) after nine consecutive sessions of DTFM combined with physiotherapy modalities. Weighted mean differences (WMDs) and relative risk ratios (RR) were computed for the comparison group: DTFM combined with therapeutic ultrasound and placebo ointment (n=11) versus therapeutic ultrasound combined to placebo ointment (n=9) for pain (WMDs 16.50, 95% CI: -6.15, 39.15), grip strength (WMDs 0.10, 95% CI: -0.16, 0.36), function (VAS 0-100) (WMDs -1.80, 95% CI: -18.64, 15.04), pain-free function (WMDs 1.10, 95% CI: -1.00, 3.20) and functional status (RR 3.3, 95% CI: 0.4, 24.3) assessments. WMDs and OR were also calculated for the comparison group: DTFM compared to phonophoresis (n=10) versus phonophoresis alone (n=10) for pain (WMDs 2.8, 95% CI: -19.96, 25.56), grip strength (WMDs -0.20, 95% CI: -0.46, 0.06), function (VAS 0-100) (WMDs 3.70, 95% CI: -14.13, 21.53), pain-free function (WMDs 0.10, 95% CI: -2.27, 2.47) and functional status (RR 0.67, 95% CI: 0.1, 3.2) assessments.

DISCUSSION

Deep transverse friction massage combined with additional physiotherapy modalities did not demonstrate a consistent clinically important benefit when compared to a control in the treatment of ITBFS (Schwellnus 1992) and of ECRT (Stratford 1989). However, there was a clinically important difference of 22% in pain, while running in presence of symptomatic ITBFS, though not statistically significant. The effect of DTFM was not specific, as combined interventions were used in the involved comparison groups.

Confounding variables, such as characteristics of the device, characteristics of the therapeutic application, characteristics of the population, characteristics of the disease and methodological considerations might have contributed to the lack of effect (Morin 1996). The characteristics of the technique described by Cyriax (Cyriax 1975 a, Cyriax 1975 b), such as years of experience of the therapist; characteristics of the application (pressure, rhythm and progression, and frequency), duration of the treatment sessions and the treatment schedule; characteristics of the population (age, gender); characteristics of the disease (chronic vs acute conditions) and weakness of methodological considerations (randomization method, non proper comparison groups, sample size, study duration, non validated outcome measures) (Schwellnus 1992, Stratford 1989) in combination with poor quality of the trial (Schwellnus 1992), may have contributed to the non conclusive results on the effectiveness of DTFM for tendinitis. The RCT conducted by Stratford 1989 was very well conducted and it provided a good description of the method. However, no 'massage only' group was included to measure the specific effect of DTFM. The RCTs included in this systematic review highlights a common problem of the trials of rehabilitation interventions: difficulty or inability to double blind, which contributes to the low methodological quality.

A recent meta-analysis on massage for low back pain found non conclusive results (Furlan 2001). However, it was not the same type of massage or area treated. The Philadelphia Panel (2001) recommends that there is poor evidence to include or exclude DTFM alone as therapy intervention for treating tendinitis (level I, grade C for pain) (Philadelphia 2001).

In the current RCTs (Schwellnus 1992, Stratford 1989), DTFM was performed to reduce tendinitis symptoms. The inflammation and pain observed in tendinitis are frequently due to three main factors: 1) biomechanical factors; 2) anthropometric factors and 3) training factors. Pain is an indirect symptom. Based on the identified factors, pain could therefore be controlled more effectively through other physiotherapy interventions such as strengthening and postural exercises, or changes in functional and sporting activities that correct biomechanical deficiencies (Thaunton 1987); restore motion (Hart 1994); increase strength, endurance and function (Hart 1994, Thaunton 1987); and gradually return to training (Thaunton 1987).

In conclusion, deep transverse friction massage combined with other physiotherapy modalities did not significantly reduce tendinitis symptoms compared to control group. More well-designed

RCTs are needed before including or excluding this specific type of massage in the treatment of this condition.

AUTHORS' CONCLUSIONS

Implications for practice

There is no evidence of clinically important benefit of deep transverse friction massage for treating tendinitis. It is clear that more well designed studies are necessary before drawing conclusions about the efficacy or lack of efficacy of deep transverse friction massage for treating symptomatic tendinitis.

Implications for research

In order to justify the use of deep transverse friction massage in the treatment of tendinitis, a high quality randomized trial, using validated outcome measures and high quality reporting methods is needed.

ACKNOWLEDGEMENTS

The authors thank Judith Robitaille, Michel Boudreau and Michael Saginur for help with the data extraction and literature retrieval and the editorial team of the Cochrane Musculoskeletal Group for valuable comments on early drafts.

REFERENCES

References to studies included in this review

Schwellnus 1992 ***{published data only}***
* Schwellnus MP, Mckintosh L, Mee J. Deep Transverse Frictions in the Treatment of Iliotibial Band Friction Syndrome in Atletes: A Clinical Trial.. *Physiotherapy* 1992; **78**(6):564–568.

Stratford 1989 ***{published data only}***
Stratford PW, Levy DR, Gauldie S, Miseferi D, Levy K. The evaluation of phonophoresis and friction massage as treatments for extensor carpi radialis tendinitis: a randomized controlled trial. *Physiotherapy Canada* 1989;**41** (2):93–99.

References to studies excluded from this review

Balke 1989 ***{published data only}***
* Balke B, Anthony J, Wyatt F. The effects of massage treatment on exercise fatigue. *Clinical Sports Medicine* 1989; **1**:189–196.

Chiarello 1997 ***{published data only}***
* Chiarello CM, Gundersen L, O'Halloran T. The effect of continuous passive motion duration and increment on range of motion in total knee arthroplasty patients.. *Journal of Orthopaedic & Sports Physical Therapy* 1997;**25**(2):119–127.

Crosman 1984 ***{published data only}***
* Crosman LJ, Chateauvert SR, Weisberg J. The effects of massage to the hamstring muscle group on range of motion. *J Orthop Sport Phys Ther* 1984;**6**:168–172.

Feehan 1989 ***{published data only}***
* Feehan RC. The efficacy of using transverse friction massage on improving active and passive range of motion in the client with chronic knee dysfunction. *The Union Institute* 1989:64.

Pellecchia 1994 ***{published data only}***
* Pellecchia GL, Hamel H, Behnke P. Treatment of infrapatellar tendinitis: a combination of modalities and transverse friction massage versus iontophoresis. *Journal of Sport Rehabilitation* 1994;**3**(2):135–145.

Thomee 1997 ***{published data only}***
* Thomee R. A. A comprehensive treatment approach for patellofemoral pain syndrome in young women. *Physical Therapy* 1997;**77**(12):1690–1703.

Zhang 1987 ***{published data only}***
* Zhang ZB, Carter RM, Minikin BR, Telford RD. The influence of repeated massage on leg strength. *Australian Institute of Sport Canberra* 1987:5.

Additional references

ACR 1996
American College of Rheumatology Ad Hoc Committee on Clinical Guidelines. Guidelines for the management of Rheumatoid arthritis. *Arthritis and Rheumatism* 1996;**39**: 713–722.

ACR 2000
ACR: American College of Rheumatology Subcommittee on Osteoarthritis Guidelines. Recommendations for the medical management of osteoarthritis of the hip and knee. *Arthritis and Rheumatism* 2000;**43**:1905–1915.

Allander 1974
Allander E. Prevalence, incidence and remission rates of some common rheumatic diseases or syndromes.. *Scandinavian Journal of Rheumatology* 1974;**3**:145–153.

APTA 2001
American Physical Therapy Association. *Guide to Physical Therapist Practice: Part One: A Description of Patient/Client Management*. Alexandria, Va: American Physical Therapy Association, 2001.

BJM 2000
BJM. Clinical Evidence: A Compendium of the Best Available Evidence for Effective Health Care. *BJM*. BMJ Publishing Group; [www.clinicalevidence.org, 2000]. Vol. **Issue 4**, London, England: BJM, 2000.

Chapman 1991
Chapman CE. Can the use of physical modalities for pain control be rationalized by the research evidence?. *Can J Physiol Pharmacol* 1991;**69**:704–712.

Clark 1999
Clark HD, Wells GA, Huet C, et al.Assessing the quality of randomized trials: reliability of the Jadad scale. *Control Clin Trials.* 1999;**20**:448–452..

Cyriax 1975 a
Cyriax J. Diagnosis of soft tissue lesions. In: Cyriax J editor (s). *Textbook of Orthopaedic Medicine*. 9th Edition. Vol. **1**, Baltimore: Williams and Wilkins, 1975.

Cyriax 1975 b
Cyriax J. Treatment by manipulation, massage and injection. In: Cyriax J editor(s). *Textbook of Orthopaedic Medicine*. 9th Edition. Vol. **2**, Baltimore: Williams and Wilkins, 1975.

Furlan 2001
Furlan AD, Brosseau L, Robinson V, Irvin E, Imamura M. Massage for Low Back Pain. *Cochrane Database of Systematic Reviews* 2001, Issue 4.

Green 1998
Green S, Buchbinder R, Glazier R, Forbes A. Systematic review of randomised controlled trials of interventions for painful shoulder: selection criteria, outcomes assessment, and efficacy. *BMJ* 1998;**316**:354–360..

Hart 1994
Hart LE. Exercises and soft tissue injury. *Ballieres Clinical Rheumatology* 1994;**8**(1):137–148.

Haynes 1994
Haynes R, Wilczynski N, Mckibbon KA, Walker CJ. Developing optimal search strategies for detecting clinically sound studies in MEDLINE. *Journal of the American Medical Information Association* 1994;**1**:447–458..

Jadad 1996
Jadad A, Moore A, Carrol Dea. Assessing the quality of randomized trials: Is blinding necessary?. *Controlled Clinical Trials.* 1996;**17**:1–12.

Jones 1987
Jones DC, James SL. Overuse injuries of the lower extremity: shin splints, iliotibial band friction syndrome and exertional compartment syndromes: a review. *Clinics in Sports Medicine* 1987;**6**(2):273–290.

Jordaan 1994
Jordaan G, Schwellnus MP. The incidence of overuse injuries in military recruits during basic military training. *Military Medicine* 1994;**159**(6):1994.

Kirk 2000
Kirk KL, Kuklo T, Klemme W. Iliotibial band friction syndrome: a review. *Orthopedics* 2000;**23**(11):1209–1217.

Manal 1996
Manal RJ, Snyder-Mackler L. Manal RJ, Snyder-Mackler L. Practice guidelines for anterior cruciate ligament rehabilitation: criterion-based rehabilitation progression. Operative Techniques in Orthopaedics. 1996, 6:190-196. Practice guidelines for anterior cruciate ligament rehabilitation: criterion-based rehabilitation progression.. *Operative Techniques in Orthopaedics* 1996;**6**:190–196.

Martens 1989
Martens M, Libbrecht P, Burssens A. Surgical treatment of the iliotibial band friction syndrome. *American Journal of Sports Medicine* 1989;**17**(5):651–654.

Messier 1988
Messier SP, Pittala KA. Etiologic factors associated with selected running injuries. *Medicine & Science in Sports and Exercise* 1988;**20**(5):501–505.

Messier 1995
Messier SP, Edwards DG, Martin DF, Lowery RB, Cannon DW, James MK, Curl WW, Read HM, Hunter DM. Etiology of iliotibial friction syndrome in distance runners. *Medicine and Sciences in Sports and exercises* 1995;**27**(7): 951–960.

Morin 1996
Morin M, Brosseau L, Quirion-DeGrardi C. A theoretical framework on low level laser therapy (classes I, II and III) application for the treatment of OA and RA. *Proceedings of the Canadian Physiotherapy Association.* 1996:1.

Philadelphia 2001
The Philadelphia Panel. The Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions for Knee Pain. *Physical Therapy* 2001;**81**(10):1–300.

Pinshaw 1984
Pinshaw R, Atlas V, Noakes TD. The nature and response to therapy of 196 consecutive injuries seen at a runners clinic. *South African Medical Journal* 1984;**65**(8):291–298.

Schwellnus 1991
Schwellnus MP, Theunissen L, Noakes TD, Reinach SG. Anti-inflammatory and combined anti-inflammatory/ analgesic medication in the early management of iliotibial band friction syndrome: a clinical trial. *South Africa Medical Journal* 1991;**79**(10):602–606.

Struijs 2002
Struijs PAAA, Smidt N, Arola H, Dijk van CN, Buchbinder R, Assendelt WJJ. Orthotics devices for tennis elbow (Cochrane Review). *Cochrane Database of Systematic Reviews* 2002, Issue 2.

Thaunton 1987
Thaunton JE, Clement DB, Smart GW, McNicol KL. Non-surgical management of overuse knee injuries in runners. *Canadian Journal of Sprot Sciences* 1987;**12**(1):1987.

van der Heijden 1997
van der Heijden GJ, van der Windt DA, de Winter AF. van der Heijden GJ, van der Windt DA, de Winter AF. Physiotherapy for patients with soft tissue shoulder disorders: a systematic review of randomised clinical trials. BMJ 1997, 315(7099):25-30. Physiotherapy for patients with soft tissue shoulder disorders: a systematic review of randomised clinical trials. *BMJ* 1997;**315**(7099):25–30.

Walker 1984

Walker JM. Deep transverse frictions in ligament healing. *JOSPT* 1984;**6**(2):89–94.

* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Schwellnus 1992

Methods	Randomized, assessor-blinded trial. Sample size at entry: deep transverse friction (DTF) 10, ctrl 10 Treatment duration: 10 days Follow-up: 14 days Exclusions: DTF 1, ctrl 2
Participants	visitors to a sports injury clinic with unilateral chronic (>4wks) iliotibial band syndrome causing pain severe enough to restrict running distance or speed (grade 3), or to prevent it altogether (grade 4) exclusions: <18 yrs old, history of previous knee surgery, concomitant medical therapy Age (SE?): mass 25 (6), ctrl 29 (5)--p=0.20 student t-test Weeks injured (SE?): mass 23 (17), ctrl 74 (95) Years running (SE?): 7.7 (5.5), 5.4 (6.2) Km run per weeks (SE?): 45 (15), 64 (30) Grade of injury (SE?): 3.4 (0.5), 3.4 (0.5)
Interventions	Deep transverse friction: treated anatomical area: most tender area treatment duration: 2min of light friction, then 8min of harder friction pressure: constant, such that discomfort was experienced, but not severe pain. technique: pressure was applied with the index finger and reinforced with ring finger, thumb pivot; brisk motion was intiated from shoulder, wrist flexible, hand stiff Concurrent treatment (2wks): rest apart from 3 * 30min treatmill tests ice 20min twice daily stretch of iliotibial band, daily ultrasound: 1MHz, 0.5W/cm/cm (continuous), 5-7min * 6 days
Outcomes	Mean pain daily recall, total pain while running, % max pain experienced while running
Notes	R: 1 B: 1 W: 0 Total = 2/5 one patient excluded for refusal to comply

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

Stratford 1989

Methods	Randomized controlled trial, parallel group, combination of interventions Gr 1: ultrasound and placebo ointment without frictions Gr 2: Ultrasound and placebo ointment with frictions Gr 3: phonophoresis without frictions Gr 4: phonophoresis with frictions Sample size at entry: 40 Gr 1: 9 Gr 2: 11 Gr 3: 10 Gr 4: 10 # male / # female Total: 20 / 20 Gr 1: 2 / 7 Gr 2: 5 / 6 Gr 3: 5 / 5 Gr 4: 8 / 2
Participants	Inclusion: those that complained of discomfort at or about the lateral epicondyle; pain at the lateral aspect of the elbow during resisted wrist extension; radial deviation during complete elbow extension; tenderness in palpation over, or at one of the following areas: 1. origin of extensor carpi radialis longus tendon 2. origin of extensor carpi radialis brevis tendon 3. extensor carpi radialis brevis at tendon body 4. extensor carpi radialis brevis tendon with tendreness extending from origin to the tendon body Exclusion: combined lesions; bilateral elbow problems at initial assessment; history of prior surgery; history of an injection to the elbow within the past 6 months Age (mean, SD) Gr 1: 43.8 , 9.8 Gr 2: 44.6 , 9.8 Gr 3: 40.1 , 8.3 Gr 4: 44.7 , 8.7 Disease duration (months: mean , SD) Gr 1: 4.3 , 3.2 Gr 2: 2.1 , 1.2 Gr 3: 5.2 , 7.2 Gr 4: 5.4 , 4.1
Interventions	Deep transverse friction. Anatomical area: elbow Duration: 10 minutes, 3 x week , 9 treatment sessions. Position of patient: for lesion at origin of the extensor carpi radialis longus or brevis tendon, elbow flexed at 90 degrees with forearm fully supinated; if lesion at or included tendon body or extensor carpi radialis brevis tendon: elbow flexed at 45 degrees with forearm pronated Concurrent treatment for Gr 2 and Gr 4: Gr 2: ultrasound and placebo ointment + massage ultrasound: dosage varied from 1.3 w/cm2 continous outpout to 0.5 w/cm2 pulsed (1:4). Application technique: soundhead moved in slow concentric circles, while maintaining soundhead contact with the patient at the same time. 6 minutes. Gr 4: phonophoresis + massage. Phonophoresis: 10% hydrocortisone ointment used with ultrasound treatment

Stratford 1989 (*Continued*)

Outcomes	1. Pain: - pain-free function (8 pain-free item, 8 = better) - pain VAS (0-100 mm; 0 = worst) 2. Grip strength - ration index of pain-free grip-strength (grip strength: kg force. Ratio is pain-free grip divided by the maximum grip of uninvolved limb) 3. Function: - function VAS (0-100 mm; 0 = worst) 4. Functional status (success or failure to perform pain-free strengthening program for the wrist extensor muscles, with the elbow extended, without subsequent regression within 2 weeks of follow-up)
Notes	R: 2 B: 2 W: 0 Total: 4 / 5

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Balke 1989	not tendinitis
Chiarello 1997	healthy subjects
Crosman 1984	healthy subjects
Feehan 1989	not tendinitis
Pellecchia 1994	combined modalities
Thomee 1997	not massage therapy
Zhang 1987	excluded due to study design

DATA AND ANALYSES

Comparison 1. Massage vs. Control - End of Treatment (2 weeks)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Daily pain	1	17	Mean Difference (IV, Fixed, 95% CI)	0.4 [0.00, 0.80]
1.2 Pain while running	1	17	Mean Difference (IV, Fixed, 95% CI)	3.00 [-5.08, 11.08]
1.3 % of maximum pain when running	1	17	Mean Difference (IV, Fixed, 95% CI)	0.10 [-3.77, 3.97]

Comparison 2. Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (VAS 0-100, 0 = worst)	1	20	Mean Difference (IV, Fixed, 95% CI)	16.50 [-6.15, 39.15]
2 Grip strength (ratio index, higher is better)	1	20	Mean Difference (IV, Fixed, 95% CI)	0.10 [-0.16, 0.36]
3 Function (VAS 0-100, 0 = worst)	1	20	Mean Difference (IV, Fixed, 95% CI)	-1.80 [-18.64, 15.04]
4 Function (pain-free function; average number of pain-free items; higher is better)	1	20	Mean Difference (IV, Fixed, 95% CI)	1.10 [-1.00, 3.20]
5 Functional status (number of successes to perform strengthening program)	1	20	Risk Ratio (M-H, Fixed, 95% CI)	3.27 [0.44, 24.34]

Comparison 3. Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (VAS 0-100, 0 = worst)	1	20	Mean Difference (IV, Fixed, 95% CI)	2.80 [-19.96, 25.56]
2 Grip strength (ratio index, higher is better)	1	20	Mean Difference (IV, Fixed, 95% CI)	-0.20 [-0.46, 0.06]
3 Function (VAS 0-100, 0 = worst)	1	20	Mean Difference (IV, Fixed, 95% CI)	3.70 [-14.13, 21.53]
4 Function (pain-free function; average number of pain-free items; higher is better)	1	20	Mean Difference (IV, Fixed, 95% CI)	0.10 [-2.27, 2.47]

5 Functional status (number of successes to perform strengthening program)	1	20	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.14, 3.17]

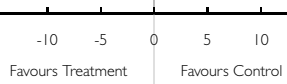
Analysis 1.1. Comparison 1 Massage vs. Control - End of Treatment (2 weeks), Outcome 1 Pain.

Review: Deep transverse friction massage for treating tendinitis

Comparison: 1 Massage vs. Control - End of Treatment (2 weeks)

Outcome: 1 Pain

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Daily pain							
Schwellnus 1992	9	-0.6 (0.3)	8	-1 (0.5)		100.0 %	0.40 [0.00, 0.80]
Subtotal (95% CI)	**9**		**8**			**100.0 %**	**0.40 [0.00, 0.80]**
Heterogeneity: not applicable							
Test for overall effect: Z = 1.97 (P = 0.049)							
2 Pain while running							
Schwellnus 1992	9	-20 (9)	8	-23 (8)		100.0 %	3.00 [-5.08, 11.08]
Subtotal (95% CI)	**9**		**8**			**100.0 %**	**3.00 [-5.08, 11.08]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.73 (P = 0.47)							
3 % of maximum pain when running							
Schwellnus 1992	9	-8 (5)	8	-8.1 (3)		100.0 %	0.10 [-3.77, 3.97]
Subtotal (95% CI)	**9**		**8**			**100.0 %**	**0.10 [-3.77, 3.97]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.05 (P = 0.96)							
Test for subgroup differences: Chi^2 = 0.42, df = 2 (P = 0.81), I^2 =0.0%							



Analysis 2.1. Comparison 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks), Outcome 1 Pain (VAS 0-100, 0 = worst).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks)

Outcome: 1 Pain (VAS 0-100, 0 = worst)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	11	44.8 (33.4)	9	28.3 (17)		100.0 %	16.50 [-6.15, 39.15]
Total (95% CI)	**11**		**9**			**100.0 %**	**16.50 [-6.15, 39.15]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.43 (P = 0.15)

Test for subgroup differences: Not applicable

Analysis 2.2. Comparison 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks), Outcome 2 Grip strength (ratio index, higher is better).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks)

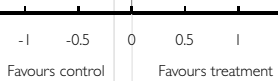
Outcome: 2 Grip strength (ratio index, higher is better)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	11	0.7 (0.3)	9	0.6 (0.3)		100.0 %	0.10 [-0.16, 0.36]
Total (95% CI)	**11**		**9**			**100.0 %**	**0.10 [-0.16, 0.36]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.74 (P = 0.46)

Test for subgroup differences: Not applicable



Analysis 2.3. Comparison 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks), Outcome 3 Function (VAS 0-100, 0 = worst).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks)

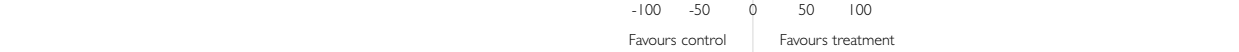
Outcome: 3 Function (VAS 0-100, 0 = worst)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	11	76.3 (21.9)	9	78.1 (16.5)		100.0 %	-1.80 [-18.64, 15.04]
Total (95% CI)	**11**		**9**			**100.0 %**	**-1.80 [-18.64, 15.04]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.21 (P = 0.83)

Test for subgroup differences: Not applicable



Analysis 2.4. Comparison 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks), Outcome 4 Function (pain-free function; average number of pain-free items; higher is better).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks)

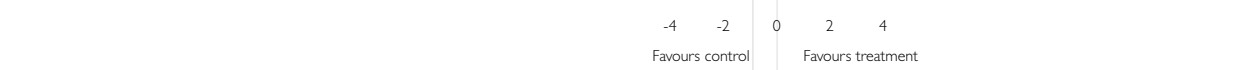
Outcome: 4 Function (pain-free function; average number of pain-free items; higher is better)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	11	3.8 (2.7)	9	2.7 (2.1)		100.0 %	1.10 [-1.00, 3.20]
Total (95% CI)	**11**		**9**			**100.0 %**	**1.10 [-1.00, 3.20]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.02 (P = 0.31)

Test for subgroup differences: Not applicable



Analysis 2.5. Comparison 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks), Outcome 5 Functional status (number of successes to perform strengthening program).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 2 Massage + us and placebo ointment vs control (us + placebo ointment only) (Follow-up 2 weeks)

Outcome: 5 Functional status (number of successes to perform strengthening program)

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Stratford 1989	4/11	1/9		100.0 %	3.27 [0.44, 24.34]
Total (95% CI)	**11**	**9**		**100.0 %**	**3.27 [0.44, 24.34]**
Total events: 4 (Treatment), 1 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.16 (P = 0.25)					

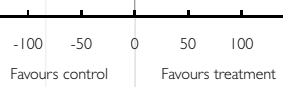
Analysis 3.1. Comparison 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks), Outcome 1 Pain (VAS 0-100, 0 = worst).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks)

Outcome: 1 Pain (VAS 0-100, 0 = worst)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	10	24.6 (20.6)	10	21.8 (30.4)		100.0 %	2.80 [-19.96, 25.56]
Total (95% CI)	**10**		**10**			**100.0 %**	**2.80 [-19.96, 25.56]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.24 (P = 0.81)							
Test for subgroup differences: Not applicable							



Analysis 3.2. Comparison 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks), Outcome 2 Grip strength (ratio index, higher is better).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks)

Outcome: 2 Grip strength (ratio index, higher is better)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	10	0.5 (0.3)	10	0.7 (0.3)		100.0 %	-0.20 [-0.46, 0.06]
Total (95% CI)	**10**		**10**			**100.0 %**	**-0.20 [-0.46, 0.06]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.49 (P = 0.14)

Test for subgroup differences: Not applicable

Analysis 3.3. Comparison 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks), Outcome 3 Function (VAS 0-100, 0 = worst).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks)

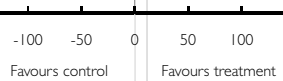
Outcome: 3 Function (VAS 0-100, 0 = worst)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	10	82.5 (16.3)	10	78.8 (23.7)		100.0 %	3.70 [-14.13, 21.53]
Total (95% CI)	**10**		**10**			**100.0 %**	**3.70 [-14.13, 21.53]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.41 (P = 0.68)

Test for subgroup differences: Not applicable



Analysis 3.4. Comparison 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks), Outcome 4 Function (pain-free function; average number of pain-free items; higher is better).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks)

Outcome: 4 Function (pain-free function; average number of pain-free items; higher is better)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Stratford 1989	10	3.7 (2.8)	10	3.6 (2.6)		100.0 %	0.10 [-2.27, 2.47]
Total (95% CI)	**10**		**10**			**100.0 %**	**0.10 [-2.27, 2.47]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.08 (P = 0.93)

Test for subgroup differences: Not applicable

Analysis 3.5. Comparison 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks), Outcome 5 Functional status (number of successes to perform strengthening program).

Review: Deep transverse friction massage for treating tendinitis

Comparison: 3 Massage + phonophoresis vs control (phonophoresis only) (Follow-up 2 weeks)

Outcome: 5 Functional status (number of successes to perform strengthening program)

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Stratford 1989	2/10	3/10		100.0 %	0.67 [0.14, 3.17]
Total (95% CI)	**10**	**10**		**100.0 %**	**0.67 [0.14, 3.17]**

Total events: 2 (Treatment), 3 (Control)

Heterogeneity: not applicable

Test for overall effect: Z = 0.51 (P = 0.61)

WHAT'S NEW

Last assessed as up-to-date: 18 August 2002.

Date	Event	Description
22 September 2008	Amended	Converted to new review format. C026-R

HISTORY

Review first published: Issue 1, 2002

CONTRIBUTIONS OF AUTHORS

LB, LC, SM was responsible for writing the manuscript, extracting and analyzing data and selecting trials of the initial review.

VR contributed data extraction, updated of the selection of the reference list, update of the analyses and update of the interpretation of results.

JM developed the search strategy.

BS, PT and GW contributed methodolical expertise and commented on early drafts.

DECLARATIONS OF INTEREST

None known

SOURCES OF SUPPORT

Internal sources

- Institute for Population Health, University of Ottawa, Canada.
- Ottawa Health Research Institute, Canada.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

*Ultrasonic Therapy; Clinical Trials as Topic; Combined Modality Therapy; Cryotherapy; Rest; Tendinopathy [*therapy]

MeSH check words

Humans