Special Issue

Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions for Shoulder Pain

Introduction. A structured and rigorous methodology was developed for the formulation of evidence-based clinical practice guidelines (EBCPGs), then was used to develop EBCPGs for selected rehabilitation interventions for the management of shoulder pain. Methods. Evidence from randomized controlled trials (RCTs) and observational studies was identified and synthesized using methods defined by the Cochrane Collaboration that minimize bias by using a systematic approach to literature search, study selection, data extraction, and data synthesis. Meta-analysis was conducted where possible. The strength of evidence was graded as level I for RCTs or level II for nonrandomized studies. Developing Recommendations. An expert panel was formed by inviting stakeholder professional organizations to nominate a representative. This panel developed a set of criteria for grading the strength of both the evidence and the recommendation. The panel decided that evidence of clinically important benefit (defined as 15% greater relative to a control based on panel expertise and empiric results) in patient-important outcomes was required for a recommendation. Statistical significance was also required but was insufficient alone. Patient-important outcomes were decided by consensus as being pain, function, patient global assessment, quality of life, and return to work, providing that these outcomes were assessed with a scale for which measurement reliability and validity have been established. Validating the Recommendations. A feedback survey questionnaire was sent to 324 practitioners from 6 professional organizations. The response rate was 51%. Results. Only 1 positive recommendation of clinical benefit was developed. Ultrasound provided clinically important pain relief relative to a control for patients with calcific tendinitis in the short term (less than 2 months). There was good agreement with this recommendation from practitioners (75%). For several interventions and indications (eg, thermotherapy, therapeutic exercise, massage, electrical stimulation, mechanical traction), there was a lack of evidence regarding efficacy. Conclusions. This methodology of developing EBCPGs provides a structured approach to assessing the literature and developing EBCPGs that incorporates clinicians' feedback and is widely acceptable to practicing clinicians. Further well-designed RCTs are warranted regarding the use of several interventions for patients with shoulder pain where evidence was insufficient to make recommendations. [Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions for Shoulder Pain. *Phys Ther.* 2001;81:1719–1730.]

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Key Words: *Clinical practice guidelines, Evidence-based practice, Meta-analysis, Physical therapy, Rehabilitation, Shoulder pain.*

INTRODUCTION

Shoulder pain is among the most common reasons for visits to a general practitioner. The prevalence of shoulder pain accompanied by disability is approximately 20% in the general population.[1] Prospective studies in Europe have shown that approximately 11 out of 1,000 patients seen by a family practitioner have shoulder pain. Over 50% of patients diagnosed by a general practitioner to have shoulder tendinitis are referred for physical therapy.[2]

Numerous rehabilitation interventions are available for the management of shoulder pain, including thermotherapy, therapeutic ultrasound, transcutaneous electrical nerve stimulation (TENS), and therapeutic exercises. Among general practitioners, there is a wide variety of treatment approaches, likely related to uncertainty about the efficacy of these multiple interventions.[3] Furthermore, the interpretation of shoulder pain research is complicated by the broad inclusion criteria that allow mixed populations with different etiologies of shoulder pain.

Two systematic reviews of randomized controlled trials (RCTs) of physical treatments for shoulder pain reported no evidence of benefit for shoulder pain.[4,5] Evidence-based treatment guidelines for certain interventions have been published in the *British Medical Journal* (BMJ) clinical series for nonspecific shoulder pain.[6]

The purpose of this article is to describe the evidence-based clinical practice guidelines (EBCPGs) developed by the Philadelphia Panel regarding rehabilitation interventions for shoulder pain. The aim of developing the EBCPGs was to improve appropriate use of rehabilita-

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Table 1.
Details of Philadelphia Panel Classification System

	Clinical Importance	Statistical Significance	Study Design[a]
Grade A	>15%	$P<.05$	RCT (single or meta-analysis)
Grade B	>15%	$P<.05$	CCT or observational (single or meta-analysis), with a quality score of 3 or more the 5-point Jadad methodologic quality checklist
Grade C+	>15%	Not significant	RCT or CCT or observational (single or meta-analysis)
Grade C	<15%	Unimportant[b]	Any study design
Grade D	<0% (favors control)		Well-designed RCT with >100 patients

[a] RCT=randomized controlled trial, CCT=controlled clinical trial.
[b] For grade C, statistical significance is unimportant (ie, clinical importance is not met; therefore, statistical significance is irrelevant).

Table 2.
Master Grid of Shoulder Pain Guidelines[a]

	Calcific Tendinitis	Capsulitis, Bursitis, Tendinitis, Nonspecific Pain
Exercise	nd	↙ ID
Therapeutic ultrasound	↙ A, I	↙ C, I
TENS	nd	↙ ID
Massage	nd	↙ ID
Thermotherapy	nd	↙ ID
EMG biofeedback	nd	nd
Electrical stimulation	nd	nd
Combined rehabilitation interventions	nd	nd

[a] TENS=transcutaneous electrical nerve stimulation, EMG=electromyographic, nd=no data, ID=insufficient data, A=benefit demonstrated, C=no benefit demonstrated, level I=evidence from randomized controlled trials.

tion interventions for shoulder pain. The target users of these guidelines are physical therapists, physiatrists, orthopedic surgeons, rheumatologists, family physicians, and neurologists.

METHODS

The detailed methods of the EBCPGs development process are summarized in an accompanying paper in this issue (see article titled "Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions: Overview and Methodology"). Briefly, an *a priori* protocol was defined that was followed for the conduct of separate systematic reviews for each intervention.

Studies were eligible if they were RCTs, nonrandomized controlled clinical trials (CCTs), or case control or cohort studies that evaluated the interventions of interest in a population with shoulder pain. *Shoulder pain* was defined as nonspecific shoulder pain, calcific tendinitis, bursitis, and capsulitis. Rheumatoid arthritis and osteoporotic shoulder pain were excluded from these guidelines because the underlying cause of pain is different. The outcomes of interest were chosen by consensus by the panel and included functional status, pain, ability to work, patient global assessment, patient satisfaction, and quality of life. The interventions assessed were massage, thermotherapy (hot or cold packs), electrical stimulation, TENS, therapeutic ultrasound, therapeutic exercises, and combinations of these rehabilitation interventions. Iontophoresis was excluded because it includes a mix of medication and ultrasound, and medication is not a physical rehabilitation intervention. Acceptable control groups received either a placebo therapy or no therapy. Only English-, French-, and Spanish-language articles were accepted. Abstracts were not included.

A structured literature search was developed based on the sensitive search strategy for RCTs recommended by the Cochrane Collaboration[7] and modifications proposed by Haynes et al.[8] The search strategy was expanded to identify case control, cohort, and nonrandomized studies. The search was conducted in the electronic databases of MEDLINE, EMBASE, Current Contents, CINAHL, and the Cochrane Controlled Trials Register up to July 1, 2000. In addition, the registries of the Cochrane Field of Rehabilitation and Related Therapies and the Cochrane Musculoskeletal Group and the Physiotherapy Evidence Database (PEDro) were searched. The references of all included trials were searched for relevant studies. Content experts were contacted for additional studies.

Two independent reviewers (VAR, JP) appraised the titles and abstracts of the literature search, using a checklist with the *a priori* defined selection criteria. Relevant studies were retrieved and the full articles were assessed by 2 independent reviewers for inclusion. Data were extracted by 2 independent reviewers from included articles, using predetermined extraction forms regarding the population characteristics, details of the interventions, trial design, allocation concealment, and outcomes. Methodological quality was assessed with on a 5-point validated scale that assigns 2 points each for

Table 3.
Grade A Guideline: Clinically Important Benefit Demonstrated[a]

Guideline	Recommendation	Outcomes	Relative Difference	Study Design
Therapeutic ultrasound for calcific shoulder tendinitis	Grade A Grade A Grade A	Pain, 8 wk Function, 8 wk Quality of life, 8 wk	77% 15% 25%	1 RCT (N=61)

[a] RCT=randomized controlled trial.

randomization and double-blinding and 1 point for description of withdrawals.[9,10] Differences in data extraction and quality assessment were resolved by consensus.

Data were analyzed at 3 approximate time points post-therapy: 1 month, 6 months, and 12 months. If outcomes were reported at different intervals, the closest time was used for these time points.

Data were analyzed using the Review Manager (RevMan) computer program, Version 4.1 for Windows.* Continuous data were analyzed using weighted mean differences (WMDs) between the treatment and control groups at the end of study, where the weight is the inverse of the variance. Where an outcome was measured with different scales (eg, pain, functional status), the data were analyzed with standardized mean differences, calculated using the mean and standard deviation. Dichotomous data were analyzed using relative risks. Heterogeneity was tested using a chi-square statistic. When heterogeneity was not significant, fixed-effects models were used. With significant heterogeneity, random-effects models were used.

To calculate clinical improvement (defined as 15% improvement relative to a control), the absolute benefit and the relative difference in the change from baseline were calculated. Absolute benefit was calculated as the improvement in the treatment group less the improvement in the control group, in the original units. Relative difference in the change from baseline was calculated as the absolute benefit divided by the baseline mean (weighted for the treatment and control groups). For dichotomous data, the relative percentage of improvement was calculated as the difference in the percentage of improvement in the treatment and control groups.

The recommendations were graded by their level of evidence (I or II) and by the strength of evidence (A, B, or C). This grading system is shown in Table 1 and is described more fully elsewhere (see article titled "Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions: Overview and Methodology"). A master grid showing each rehabilitation intervention assessed and the strength and level of evidence is shown in Table 2. For those interventions for which 1 or more eligible studies were found, the results follow the same order as this grid (from left to right, top to bottom).

Clinically important benefit was shown for therapeutic ultrasound for calcific tendinitis (Tab. 3). There is no evidence of clinically important benefit for therapeutic ultrasound for other types of shoulder pain (capsulitis, bursitis, tendinitis) (Tab. 4).

Therapeutic exercises, TENS, thermotherapy, and massage have limited evidence available, but the trials available were insufficient to draw conclusions[11–16] (Tab. 5). The Philadelphia Panel EBCPGs are compared with other published guidelines in Appendix 1.

A survey questionnaire was sent to 324 practitioners for feedback on the 9 grade A or B recommendations. Their comments were reviewed by the Philadelphia Panel and were incorporated in this EBCPG document.

RESULTS

Literature Search

The electronic literature search and hand-searching identified 2,496 citations that pertained to shoulder pain. Of these, 54 were retrieved for closer examination after screening the titles and abstracts. Of these, only 23 met the inclusion criteria, and 12 citations that met the inclusion criteria were excluded due to irrelevant outcomes or lack of appropriate control group (Fig. 1).

CALCIFIC SHOULDER TENDINITIS

Eligible studies were identified only for therapeutic ultrasound.

Therapeutic Ultrasound for Calcific Shoulder Tendinitis, Level I (RCT), Grade A for Pain and Function (Clinically Important Benefit)

Summary of Trials: One RCT (N=61) was included of therapeutic ultrasound versus a placebo for calcific tendinitis of the shoulder.[17] One CCT was excluded because no outcomes of interest were reported[18] (only range of motion [ROM] and size of calcified deposit were reported). One RCT (N=22) was excluded because acetic acid iontophoresis was combined with therapeutic ultrasound.[19]

* Oxford, England: The Cochrane Collaboration, 2000.

Table 4.
Grade C Rehabilitation Interventions: No Evidence of Clinically Important Benefit[a]

Guideline	Recommendation	Outcomes	Relative Difference	Study Design
Therapeutic ultrasound for nonspecific shoulder pain (capsulitis, bursitis, tendinitis)	Grade C Grade C Grade C	Pain Function Patient global assessment	No benefit demonstrated	3 RCTs, 3 CCTs (N=376)

[a] RCT=randomized controlled trial, CCT=nonrandomized controlled clinical trial.

Table 5.
Rehabilitation Interventions With Insufficient Data[a]

Intervention and Indication	Details
Therapeutic exercises for nonspecific shoulder pain	Two trials with poorly defined diagnosis (Ginn et al[11] defined nonspecific shoulder pain as "unilateral shoulder pain," and Pearlmutter et al[12] looked at nonspecific shoulder pain and nonvalidated outcomes [pain and function scale] in women with osteoporosis)
Thermotherapy for nonspecific shoulder pain	1 CCT (N=20) with no relevant outcomes (range of motion only)[13] and 1 head-to-head CCT of ice versus therapeutic ultrasound (N=31)[14]
Massage for nonspecific shoulder pain	Head-to-head RCT (N=24) of massage, strengthening, and stretching versus a different exercise program[15]
TENS for nonspecific shoulder pain	Head-to-head RCT (N=29) of therapeutic ultrasound versus TENS[16]

[a] TENS=transcutaneous electrical nerve stimulation, CCT=nonrandomized controlled clinical trial, RCT=randomized controlled trial.

Efficacy: Clinically important benefit demonstrated. There was a clinically important and statistically significant reduction in pain (77% relative to the control group) and improvement in functional status (15% relative to the control group) after 2 months of therapy (Tab. 6, Fig. 2). There was also a decrease in calcification of 37% relative to placebo[17] (Tab. 7) ($P<.05$). There were no differences between groups at 9 months posttherapy.[17]

Strength of Published Evidence in Comparison With Other Guidelines: The Philadelphia Panel found good evidence (level I, RCT) of benefit with therapeutic ultrasound at 2 months, but no difference after the end of 9 months of therapy.

Clinical Recommendation in Comparison With Other Guidelines: The Philadelphia Panel recommends there is good evidence to include continuous therapeutic ultrasound (5 times per week) as an intervention for short-term pain relief of calcific shoulder tendinitis (level I, grade A for pain and function) for a 2-month period.

Practitioner Agreement

- Response rate for this EBCPG: 49%
- Percentage of practitioners giving comments for this EBCPG: 32%
- Agree with recommendation: 76%
- Think a majority of my colleagues would agree: 61%
- Will (or already) follow this recommendation: 81%

Practitioner Comments

1. No difference at 9 months, so why recommend?

2. Frequency of treatment was very high in study by Ebenlicher et al[17] (5 times per week for 3 weeks).

3. Exercise is very helpful for these patients. Why was it not evaluated?

Panel's Response: The EBCPG clearly specifies the lack of effect at 9 months, so that clinicians can decide whether a short-term benefit is desirable. The frequency of treatment is now specified in the EBCPG. No trials of exercise for shoulder tendinitis met the inclusion criteria for the EBCPG development process, as described in Table 5.

NONSPECIFIC SHOULDER PAIN

Therapeutic Ultrasound for Nonspecific Shoulder Pain (Capsulitis, Bursitis, Tendinitis), Level I (RCT), Grade C for Pain, Patient Global Assessment, and Function (No Evidence of Benefit)

Summary of Trials: Four RCTs[20–23] and 3 CCTs[24–26] were identified that compared therapeutic ultrasound with a placebo. Three trials were excluded due to lack of a placebo (or untreated) control group.[14,16,27] One retrospective study of therapeutic ultrasound versus no intervention was excluded.[28]

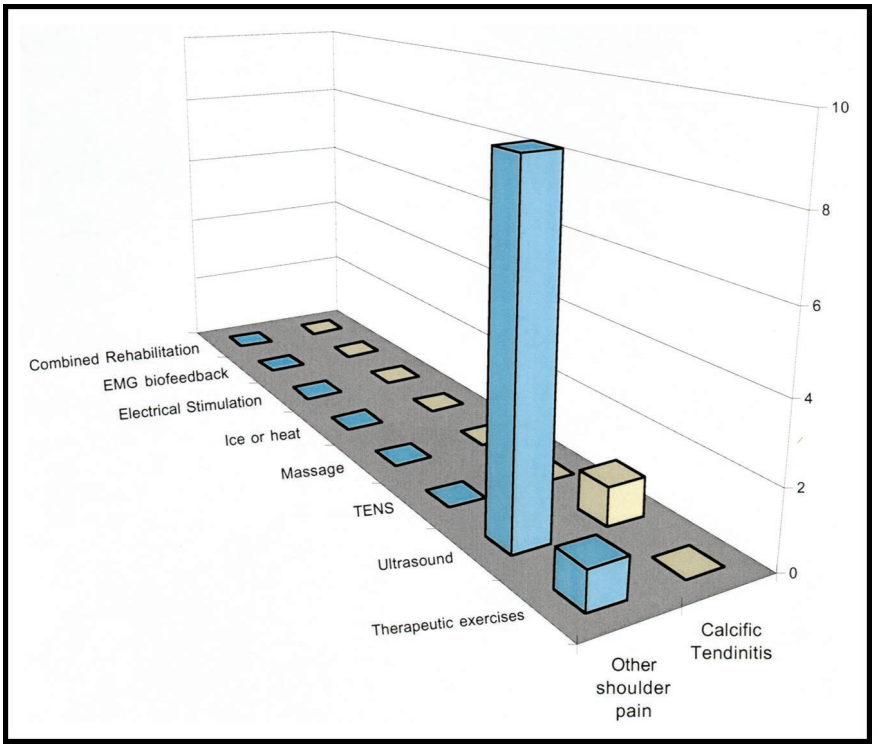

Figure 1.
Cityscape of number of trials identified for shoulder pain. EMG=electromyographic, TENS=transcutaneous electrical nerve stimulation.

Interventions With Insufficient Evidence

For therapeutic exercises, 2 CCTs were identified of therapeutic exercises versus a control for shoulder pain, but these trials were excluded due to nonvalidated outcomes[11] and poorly defined diagnoses.[12] One RCT (N=80) compared a group that received exercise with a control group that received detuned laser.[29] There was better functional status (as indicated by the Neer shoulder score) and less pain in the exercise group at both 3 and 6 months; however, no variance was available, so the data could not be analyzed.[29] Several trials without control groups were excluded that compared different types of exercise.[30–33]

For thermotherapy, one CCT of ice versus a control was excluded because no outcomes of interest were measured (ROM only).[34]

For TENS, one comparative RCT versus therapeutic ultrasound was excluded.[16]

Efficacy: None demonstrated. Two RCTs (N=40) compared continuous therapeutic ultrasound with a placebo.[20,21] Meta-analysis of pain and function showed no evidence of benefit at 2, 4, or 8 weeks. Two RCTs (N=253) compared pulsed therapeutic ultrasound with a palcebo and found no difference in pain or function.[22,23] The results from 2 CCTs (N=50) also failed to show a significant or minimal clincally important benefit of therapeutic ultrasound on pain, patient global assessment, or function as measured by activities of daily living (ADL).[24–26] The pooled results for pain and ADL are shown in Figure 3. One CCT (n=20) demonstrated a 37% relative difference in pain between therapeutic ultrasound (81%, 9 out of 11 patients) and placebo (44%, 4 out of 9 patients) 3 weeks posttherapy, but this difference was not staistically significant.[25]

Strength of Published Evidence in Comparison With Other Guidelines: The Philadelphia Panel found good scientific evidence (level I, RCTs), which showed no evidence of benefit.

Clinical Recommendation in Comparison With Other Guidelines: The Philadelphia Panel recommends there is poor evidence to include or exclude either continuous or pulsed therapeutic ultrasound alone (grade C for pain, patient global assessment, and function) as an intervention for nonspecific shoulder pain (due to capsulitis, bursitis, or tendinitis).

Therapeutic massage was used as a cointervention in a physical therapy group, but the effects of the individual massage component of the program could not be determined.[15]

Electromyographic (EMG) biofeedback was superior to traditional exercises for anterior shoulder instability in one RCT.[32] However, because there was no control group, it is impossible to draw conclusions about the efficacy of EMG biofeedback.

Electrical stimulation was not used in any of the studies identified.

DISCUSSION

A thorough literature search, data synthesis using meta-analysis, quality assessment, and consensus panel assessment have reviewed the evidence for 7 rehabilitation interventions for shoulder pain. Only 1 intervention (therapeutic ultrasound for calcified shoulder tendinitis) was shown to have a clinically important benefit.

As with other systematic reviews and guideline development projects, there are methodologic limitations. These limitations are discussed in the accompanying methodology article (see article titled "Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions: Overview and Methodology" in this issue).

Table 6.
Pain, Function, and Quality of Life After 2 Months of Therapeutic Ultrasound for Calcific Shoulder Tendinitis[a]

Study	Treatment Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
Ebenbichler et al[17]	E: therapeutic ultrasound 2.2 W/cm^2	Pain, 0–15, 15 better	32	5.6	12	4.80 (I) on 15-point Likert scale	77%(I)
	C: placebo		29	6.9	8.5		
Ebenbichler et al[17]	E: therapeutic ultrasound 2.2 W/cm^2	Function: ADL index, 0–20, 20 better	32	15.0	18.6	2.20 (I) on 20-point scale	15%(I)
	C: placebo		29	14.6	16		
Ebenbichler et al[17]	E: therapeutic ultrasound 2.2 W/cm^2	Quality of life, 0–10 cm VAS	32	6.1	8.1	1.60 (I) on 10-cm VAS	25%(I)
	C: placebo		29	6.6	7		

[a] E=exercise group, C=control group, ADL=activities of daily living, VAS=visual analog scale.

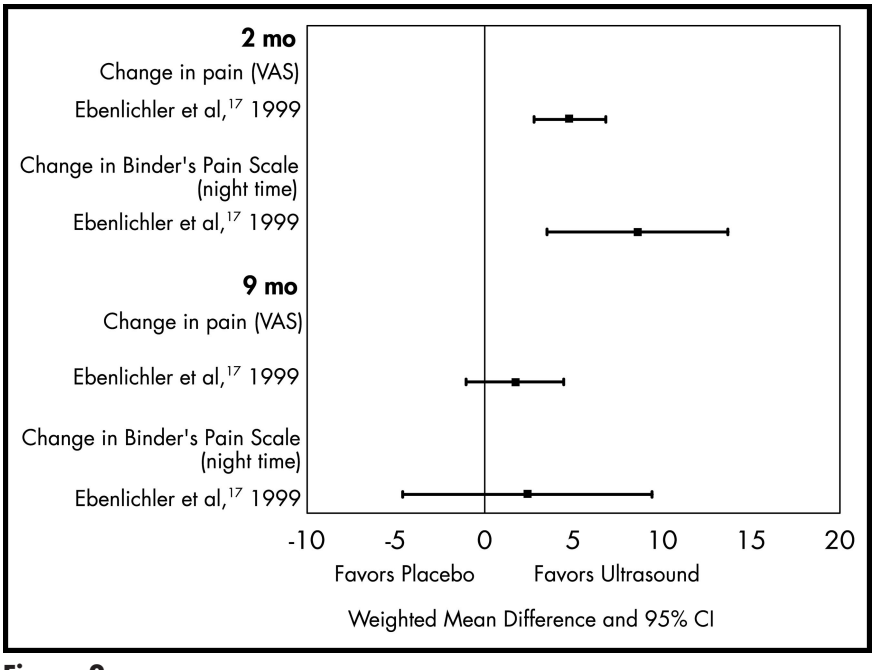

Figure 2.
Therapeutic ultrasound versus placebo for calcific shoulder tendinitis: pain at 2 and 9 months. VAS=visual analog scale, CI=confidence interval.

The effectiveness of rehabilitation interventions for the management of shoulder pain is a complex issue. Rehabilitation specialists use concomitant treatment interventions in daily practice.[15,35] The therapeutic application of several concurrent rehabilitation interventions are based on empirical experience,[35–37] and the measurement of their effects is complex.[38] The practice of rehabilitation requires a better theoretical basis[39,40] and well-designed controlled trials.[41]

The Philadelphia Panel EBCPGs for the management of shoulder pain are largely in agreement with previous and recent EBCPGs[6] for shoulder joint pain exhibited in Appendix 1. The Philadelphia Panel EBCPGs for shoulder joint pain have the advantage that they were developed based on a systematic grading of the evidence determined by an expert panel, and the evidence was derived from systematic reviews and meta-analyses using the Cochrane Collaboration methodology. The finalized EBCPGs were circulated for feedback from practitioners to verify their applicability and ease of use for practicing clinicians. This rigorous methodological procedure provides considerable credibility for rehabilitation specialists who intend to use these EBCPGs for the management of shoulder joint pain in their daily practice.

There are very few published guidelines for the management of shoulder pain. Managed care guidelines have been developed based on observations and expert opinion.[42] Preferred conservative treatment programs are described by the American Physical Therapy Association.[43] However, these guidelines are vague concerning which interventions should be used and are not based on a scientific review of the evidence.

There are several rehabilitation interventions that were not assessed by this panel, such as the use of intra-articular corticosteroid injections. There is evidence from meta-analysis and clinical trials that these interventions may offer clinically important benefit on shoulder function and pain relief.[44,45] The practitioner managing a patient needs to consider other interventions that have not been assessed by this EBCPG development project.

Table 7.
Calcification 9 Months After Therapeutic Ultrasound for Calcific Shoulder Tendinitis[a]

Study	Treatment Group	Outcome	No. Improved	No. of Patients	Risk (% of Occurrence)	Risk Difference
Ebenbichler et al[17]	E: therapeutic ultrasound 2.2 W/cm^2	Decreased calcification	15	32	47%	37%
	C: placebo		3	29	10%	

[a] E=exercise group, C=control group.

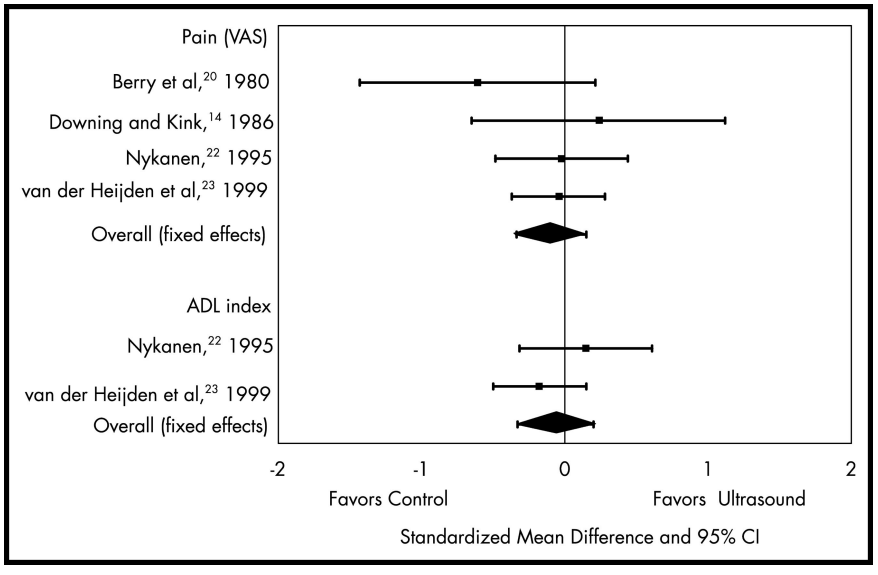

Figure 3.
Therapeutic ultrasound for shoulder capsulitis, bursitis, or tendinitis: pain and function at 1 month. VAS=visual analog scale, ADL=activities of daily living, CI=confidence interval.

Therapeutic Ultrasound

Therapeutic ultrasound showed clinically important benefit for calcified shoulder tendinitis.[17] However, ultrasound was not shown to provide clinically important benefit for nonspecific shoulder pain such as capsulitis, bursitis, or tendinitis. Phonophoresis was not considered in our systematic review. The Philadelphia Panel recommendation regarding nonspecific shoulder pain (level I, grade C) agrees with the BMJ guidelines, which also concluded that evidence for the effectiveness of ultrasound is lacking. It is suggested that therapeutic ultrasound is one of the rehabilitation interventions that is selectively effective, depending on the condition treated or the characteristics of therapeutic application.[46,47]

The RCTs were of good quality (4 out of 5 on the Jadad scale[9,10]) (Appendix 2). The highest methodological quality was found in the more recent RCTs.[17,23] The type of therapeutic ultrasound was continuous in all trials, except for one trial[23] in which a pulsed therapeutic ultrasound type was used for a chronic shoulder condition. It is clinically recommended to use a continuous mode in chronic conditions.[48] There was a wide variety of diagnostic groups, therapeutic applications, and follow-up durations. Calibration of the therapeutic ultrasound device was not described in most studies. These results concur partially with previous systematic reviews[5,35,49] of nonspecific shoulder pain or soft tissue shoulder disorders. These 3 systematic reviews did not include the most recent trial on calcified shoulder tendinitis[17] in their analyses. Further investigations should be conducted on the optimal therapeutic application of therapeutic ultrasound in relation to the type of conditions managed.[35,48]

Therapeutic Exercises, EMG Biofeedback, TENS, Thermotherapy, Therapeutic Massage, Electrical Stimulation, and Combined Rehabilitation Interventions

Despite the fact there is a positive physiological effect of these interventions,[46,50–55] there are no clinical data or insufficient clinical information on the effectiveness of therapeutic exercises, EMG biofeedback, TENS, thermotherapy, therapeutic massage, electrical stimulation, and combined rehabilitation interventions for shoulder joint pain. These results concur with recent systematic reviews on physical rehabilitation interventions for painful shoulders.[4,5,44] These researchers included comparative trials as well as placebo-controlled trials. Conclusions of head-to-head comparison could lead to results that 2 rehabilitation interventions are equally effective or equally ineffective.[44] Firm conclusions of efficacy require comparison with a standard treatment. Is there a standard treatment in physical rehabilitation? Obviously, there is an urgent need to conduct well-designed studies on the effectiveness of these interventions for shoulder pain.

Special attention on the characteristics of the therapeutic application[39] is needed in the field of rehabilitation. For example, the types of exercises used, adequate exercise intensity, and progression need to be clarified according to patient-specific classification of physical

dysfunction, needs, treatment goals, and outcomes.[56,57] The effectiveness of massage could be influenced by the types of maneuvers used, the massage approach adopted, years of experience of the therapist, number and size of the muscles involved, the patient's position used, pressure exerted, rhythm and progression, and frequency and duration of the treatment sessions.[52] The characteristics of a specific clinical device and the selection of treatment variables are of key importance.[50,51,53,58–60]

The Philadelphia Panel was unable to make clinical recommendations regarding these interventions for shoulder pain. This is in agreement with the BMJ[6] for all of these rehabilitation interventions except for TENS. The BMJ[6] found good evidence regarding the effectiveness of TENS for the management of shoulder pain as opposed to the Philadelphia Panel, but this finding was based on the use of TENS during distension arthrography. This surgical intervention was excluded from the Philadelphia Panel review. For therapeutic exercises, the BMJ[6] reported no evidence for exercises compared with manual therapy for shoulder pain. No recommendation, however, was made for therapeutic exercises alone.

Overall

The main difficulty in determining the effectiveness of rehabilitation interventions is the lack of well-designed prospective RCTs. Future research in physical therapy should adopt rigorous methods such as the use of an appropriate placebo (and double-blind procedure), adequate randomization, homogeneous sample of patients based on rigorous selection and diagnosis criteria, and adequate sample size to detect clinically important differences with confidence.

There is an urgent need for RCTs to determine whether commonly applied rehabilitation interventions for shoulder pain are effective at reducing pain and improving long-term patient-important outcomes. This research should pay attention to the dosing schedule, in terms of device characteristics for electrical modalities and duration and frequency of sessions for physical treatments. Furthermore, the adherence to recommended therapy should be considered in the analysis.

CONCLUSION

There is evidence to support and recommend the use of therapeutic ultrasound for calcified shoulder tendinitis. There is a lack of evidence at present regarding whether to include or exclude the use of therapeutic exercises, thermotherapy, therapeutic massage, EMG biofeedback, TENS, electrical stimulation, and combined rehabilitation interventions for nonspecific shoulder pain in the daily practice of physical rehabilitation.

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Appendix 1.
Strength of Published Evidence and Clinical Recommendations of Previous Evidence-Based Clinical Practice Guidelines (EBCPGs) for Shoulder Pain[a]

Rehabilitation Intervention		Philadelphia Panel (2001)	BMJ[6] (2000)
Therapeutic exercises	Strength of published evidence	Fair scientific evidence (level II) for therapeutic exercises for nonspecific shoulder pain	N/R
	Clinical recommendations	No evidence to include or exclude therapeutic exercises alone for shoulder pain	No evidence that therapeutic exercises combined with manual therapy is effective for shoulder pain
Therapeutic ultrasound	Strength of published evidence	Good scientific evidence (level I) for therapeutic ultrasound	N/R
	Clinical recommendations	Good evidence to include or exclude (grade A for pain and function) therapeutic ultrasound alone as an intervention for calcified shoulder Poor evidence to include or exclude (grade C for pain, patient global assessment, and function) therapeutic ultrasound alone as an intervention for nonspecific shoulder pain	Insufficient evidence of an effect of therapeutic ultrasound for shoulder pain
TENS	Strength of published evidence	Insufficient evidence	N/R
	Clinical recommendations	Insufficient evidence to include or exclude TENS alone as an intervention for shoulder pain (ID)	Good evidence on the effects of TENS on shoulder pain during distension arthrography
EMG biofeedback	Strength of published evidence	None found	N/R
	Clinical recommendations	No data found	N/C
Therapeutic massage	Strength of published evidence	Insufficient scientific evidence (level ID) for therapeutic massage	N/R
	Clinical recommendations	Insufficient evidence to include or exclude (grade ID) therapeutic massage alone as an intervention for shoulder pain	N/C
Thermotherapy	Strength of published evidence	Insufficient scientific evidence (level ID) for cyrotherapy	N/R
	Clinical recommendations	Insufficient evidence to include or exclude (grade ID) cryotherapy alone as an intervention for shoulder pain	Insufficient evidence on the effects of cryotherapy for shoulder pain
Electrical stimulation	Strength of published evidence	N/A	N/C
	Clinical recommendations	No data found	N/C
Combined rehabilitation interventions	Strength of published evidence	N/A	N/R
	Clinical recommendations	No data found	N/C

[a] N/A=not applicable, N/C=not considered, N/R=not reported, ID=insufficient data, TENS=transcutaneous electrical nerve stimulation, EMG=electromyographic, BMJ=*British Medical Journal*.

Appendix 2.
Characteristics of Included Trials[a]

Author/Year	Sample Size	Population Details	Symptom Duration	Age (Mean, SD for Control)	Treatment	Comparison Group	Concurrent Therapy	Sessions/ Week, No. of Weeks	Follow-up	Quality[9,10] (R, B, W)
Berry et al,[20] 1980	24	Rotator cuff lesion	Subacute to chronic	56.2 y (11.2 y)	Therapeutic ultrasound	Placebo therapeutic ultrasound	Paracetamol as required	2 ×/wk 4 wk	None	1, 0, 0
Brox et al,[29] 1993	Placebo (n=30) Exercise (n=50)	Shoulder pain >3 mo. resistant to physical therapy	>3 mo	48 y	Supervised exercises 2 ×/wk + home exercises (relaxed repetitive movements)	Detuned laser	None	2 ×/wk 12, 24 wk	None	1, 0, 1
Downing and Weinstein,[21]	20	Shoulder pain during at least one activity and at the end range of at least one ROM test	>1 mo and <1 y	52 y	Therapeutic ultrasound 1.2 W/cm^2 followed by active-assisted and passive ROM exercises	Placebo therapeutic ultrasound followed by active-assisted and passive ROM exercises	Home exercises, NSAIDS	3 ×/wk 4 wk	None	2, 2, 0
Ebenbichler et al,[17] 1999	61	Radiographically verified calcific tendinitis (type 1 or type 2)	>4 wk	54 (10) y	Therapeutic ultrasound 2.2 W/cm^2	Placebo therapeutic ultrasound	Occasional analgesics	5 for 3 wk, then 3 for 3 wk	None	2, 2, 1
Mueller et al,[24] 1954	14	Periarthritis	7 wk to 6 y	36–74 y	Therapeutic ultrasound 2 W/cm^2, 5 min frequency=10^6 cycles per second	Placebo therapeutic ultrasound	None, asked to forego other treatments	5×/wk 2 wk	2 wk	0, 2, 0
Munting,[25] 1978	29	Shoulder pain, limitation of active and passive ROM	Mean=6.2–9.2 mo	59.3 y	Therapeutic ultrasound 0.5 W/cm^2	Untreated	Home and supervised exercise	Week 1; 5×; week 2: 3×; week 3: 2×	12 wk	0, 0, 1
Nykanen,[22] 1995	73	Painful shoulder	>2 mo	67 (9) y	Therapeutic ultrasound 1 W/cm^2	Placebo	Massage, group gymnastics (stretching and strengthening), analgesics and anti-inflammatories allowed	3 ×/wk 4 wk	1 y	1, 2, 1
Roman,[26] 1960	36	Bursitic shoulder conditions	Not reported	Not reported	Therapeutic ultrasound	Placebo therapeutic ultrasound	Moist heat, mobilization exercises	Alternating days, 10 treatments	Not reported	0, 0, 0
van der Heijden et al,[23] 1999	180	Pain in deltoid region, aggravated by movement	17 mo	51 (14) y	Pulsed therapeutic ultrasound	Placebo therapeutic ultrasound	Exercise therapy, supervised and at home	2 ×/wk 6 wk	1 y	2, 2, 1

[a] R=randomization, B=blinding, W=withdrawals, ROM=range of motion, NSAID=nosteroidal anti-inflammatory drug.