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SYSTEMATIC REVIEW

Exploring the Effectiveness of Acupuncture as an Adjunct to Physiotherapy in the Treatment of Musculoskeletal Conditions: A Systematic Review

Ana Anjos^{1,2,*}, Soraya Mart², Nuno Goncalves³, Pedro Borrego^{4,5} and Lieselotte Corten⁶

¹Fatima College of Health Sciences (Physiotherapy), Abu Dhabi, UAE

²Faculty of Health Sciences (Physiotherapy), University of Cape Town, Cape Town, South Africa

³Dubai Physiotherapy and Family Medicine Clinic, Dubai, UAE

⁴Department of Health Sciences and Education, Universidad a Distancia de Madrid UDIMA, Madrid, Spain

⁵Fisiomed Polyclinic, Salamanca, Spain

⁶School of Health Sciences (Physiotherapy), University of Brighton, Eastbourne, United Kingdom

Abstract:

Background:

Acupuncture is one of the most popular forms of complementary and alternative medicine, and its usage is linked to an improvement of physical and psychological symptoms.

Main Objectives:

Determine whether the use of acupuncture as an adjunct to physiotherapy treatment is more effective than physiotherapy alone or acupuncture alone in MSK conditions.

Methodology:

A systematic review of the literature was conducted using three major databases, from March 2019 to May 2019, *i.e.*, Cochrane Library, PubMed, and PEDro (Physiotherapy Evidence Database). The inclusion criteria were limited to randomized controlled trials (RCT) published in English, only studies published within the past decade, and investigating adult populations with MSK conditions.

Results:

From the 227 titles and abstracts that were identified, 75 were duplicates, leaving us with 152 studies for the initial screening. Eight studies [13-20] were included in this review for qualitative analysis. The studies that assessed pain did not find statistically significant results that support the combination of physiotherapy and acupuncture, the same results were also obtained for Range of motion in knee osteoarthritis. Muscular tension was found statistically significant within-group improvements for all parameters in comparison with the baseline. For Isometric Neck Muscle Strength (INMS), the studies reported significant improvements within the groups, with Physiotherapy combined with Acupuncture being more effective than Acupuncture or Physiotherapy alone. The Constant Shoulder Assessment (CSA), for shoulder function, was significantly higher in the exercise plus acupuncture group compared with the exercise group.

Conclusion:

As an integrative or complementary therapy for pain, acupuncture has been increasingly used. However, this review did not find significant evidence to support that the addition of acupuncture to physiotherapy treatment has an added benefit to pain relief. However, this review did find the benefits of adding acupuncture to treatment to reducing neck disability and improving muscular strength and shoulder function.

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1. INTRODUCTION

‘It is arguable whether a 21st- century physiotherapist should be concerned with the philosophies and beliefs of another culture with more than three thousand years? Arguably, there is no reason at all. Despite this, an increase in the interest in acupuncture among physiotherapists has increased over the last few years [1 - 3]. This is evident in the research conducted by physiotherapists, demonstrating the effectiveness of acupuncture in the management of various clinical conditions, especially musculoskeletal (MSK) conditions, which is a key scope of practice in physiotherapy [2].

Acupuncture emphasizes the analysis of the human body as a whole, and it is considered a set of interdependent, interconnected systems [4, 5]. The existence of acupuncture dates back to the beginnings of Chinese civilization. Its discovery was attributed to the Yellow Emperor in 2797 before Christ (BC), and it is a set of theoretical-empirical knowledge within Traditional Chinese Medicine (TCM) [6]. Despite its antiquity, acupuncture continues to evolve along with modern technological advancement [7, 8].

An initial review of the literature revealed the existence of several gaps in the research, with several questions remaining unanswered that warrants investigation and has therefore motivated the present study. The core purpose of this research was, therefore, to systematically review and critically appraise the evidence for the use of acupuncture as an adjunctive modality to physiotherapy in the treatment of MSK conditions. The aim of this review is to investigate whether acupuncture is an effective strategy that should be incorporated into contemporary physiotherapy. Findings of the current research are essential to practitioners in the field of physiotherapy, in particular, evidence indicating that acupuncture to be an effective strategy, it can also give practitioners more leverage in incorporating the technique in their clinical practice.

2. METHODOLOGY

This study is a systematic review of the literature that was guided by the recommendations of the Collaboration Cochrane [9, 10]. The review question, based on the PICO strategy, was: “Is the use of acupuncture as an adjunct to physiotherapy more effective than physiotherapy alone in MSK conditions?”

The protocol is registered under the number CRD42019122567, in the Prospero – International Prospective Register of Systematic Reviews website.

2.1. Eligibility Criteria

Inclusion Criteria:

- Studies published in English.
- Studies published within the past decades from 2000-2019, this restriction was chosen in order to analyse the most updated studies and in order to have a relevant number of studies,

- Studies investigating adult populations with MSK conditions.

Exclusion Criteria:

- Studies published in other languages,
- Studies focussing on paediatric populations,
- Studies in non-MSK conditions,
- Studies comparing two different forms of Acupuncture, and animal studies were excluded from the systematic review.

The search began in March 2019, and the last search was in May 2019.

2.2. Information Sources

Data used in this review were obtained from randomized controlled trials (RCTs) and cross-sectional studies. An electronic database search was conducted in PubMed, Cochrane Library and PEDro, using a set of keywords (Mesh and other) combined by Boolean operators AND and OR. The following keywords were used: Acupuncture, Physiotherapy, Manual Therapy, Rehabilitation, Musculoskeletal conditions, Combination. The reason why these databases, PubMed, Cochrane Library and PEDro, were chosen is that they represent sources of primary selection.

2.3. Study Selection

Once PubMed, Cochrane Library and PEDro databases were searched using the keywords, two independent reviewers reviewed titles and abstracts of identified studies for eligibility. The full texts of the studies were then identified for further review, by two independent reviewers. Any dispute experienced in the review was resolved through discussion between the involved parties. In instances where no agreement could be reached between the two parties, a third party was consulted to provide a solution to the issue. This process was repeated for the full-text screening of potentially relevant studies.

2.4. Risk of Bias in Individual Studies

For the various studies included in the systematic review, the risk of bias was assessed using the Pedro Quality Scale [6]. The questions used in the PEDro Quality scale assess the risk of bias and the quality of the included studies. Furthermore, the quality of the outcome measure of each study was assessed by two independent reviewers. That helped in lowering the risk of bias in the current review by ensuring consensus between the reviewers. Disagreement among the reviewers was resolved by communication or contacting the third party.

2.5. Outcome Measures

The current review seeks to identify the impact of Acupuncture and Physiotherapy in managing MSK conditions on pain and range of movement (ROM), which are the primary outcome measures of this review. The secondary outcome measures being investigated by the present review are strength, functional outcomes, and the quality of life, which have been evaluated using a valid questionnaire.

* Address correspondence to this author at the Fatima College of Health Sciences, PO Box. 3798 Abu Dhabi, UAE; Tel: 0561849994; E-mail: ana.anjos@fchs.ac.ae

3. RESULTS

3.1. Study Selection

From the electronic search, 227 titles and abstracts were identified, 189 in PubMed, 9 in Cochrane Library and 29 in PEDro. Of these 227 articles, 75 were duplicates, leaving us with 152 studies for the initial screening. After evaluating these 152 abstracts, it was revealed that 21 studies were not related to MSK conditions, and 116 did not combine Physiotherapy with Acupuncture treatment. Fifteen full-text studies were screened by the two independent examiners, of which seven were excluded based on the eligibility criteria (Fig. 1).

3.2. Study Characteristics

A total of 960 patients were included from 8 studies, from countries such as Hong Kong [13, 19], Brazil [14], Sweden [15], USA [16, 17] and UK [18, 20], 349 of which were in the intervention groups and 611 in the control groups. Gender was specified in all articles accounting for 223 males and 418 females (35% and 65%, respectively). The clinical MSK conditions included in the studies were: knee osteoarthritis (3 studies) (Tsang *et al.* [13] Chen *et al.* [15], Foster *et al.* [18]), tension neck syndrome (1 article) (Franca *et al.* [14]), subacromial impingement (1 article) (Johansson *et al.* [15]), low back pain (two studies) (Kizhakkeveetil *et al.* [17], Bishop *et al.* [20]), and frozen shoulder (one article) (Sun *et al.* [19]). The outcome measures used in the respective studies were pain [13, 16 - 18, 20]; range of movement (ROM) [13]; mobility [13, 16]; muscular tension [14]; functional disability [14, 17, 20]; muscular strength [14]; shoulder function [15]; WOMAC score [16]; Constant Shoulder Assessment (CSA) [19] and medication effects [13].

3.3. Quality of Studies

Quality assessment of each study was evaluated based on the PEDro Quality Assessment Scale. All eight included studies were categorized as high quality (three studies graded 9/10, two studies graded 8/10, and three graded 7/10) (Table 3). The mean PEDro Quality Assessment Scale score of the eight papers was 8.125, which is considered above an average score.

3.4. Interventions used in the Included Studies

The interventions in included studies varied widely, using medication and physiotherapeutic treatment, Acupuncture, placebo and sham. Two studies compared Physiotherapy with Acupuncture to Physiotherapy with Sham Acupuncture (Tsang *et al.* [13]; Franca *et al.*, 2008 [14]). One study made a comparison between Physiotherapy as a sole intervention compared to Physiotherapy with Acupuncture [17]. Another study tried to establish a significant difference in outcomes between the intervention groups, which was treated with Corticosteroids plus home exercises, in contrast to a control group that was treated with Acupuncture and home exercises [15]. The remaining four studies compared three groups: two studies compared Acupuncture alone [13, 14], Physiotherapy alone and Acupuncture combined with Physiotherapy [15, 18]; the other two studies compared Physiotherapy alone [16, 19], Physiotherapy plus sham Acupuncture and Physiotherapy plus real Acupuncture [20]. Studies described 16 different Acupuncture points. The decision on Acupuncture points was based on, e.g., the location of the disease, the experience of the team of researchers or reports of evidence based on the use of the chosen points in the treatment of the respective conditions studied.

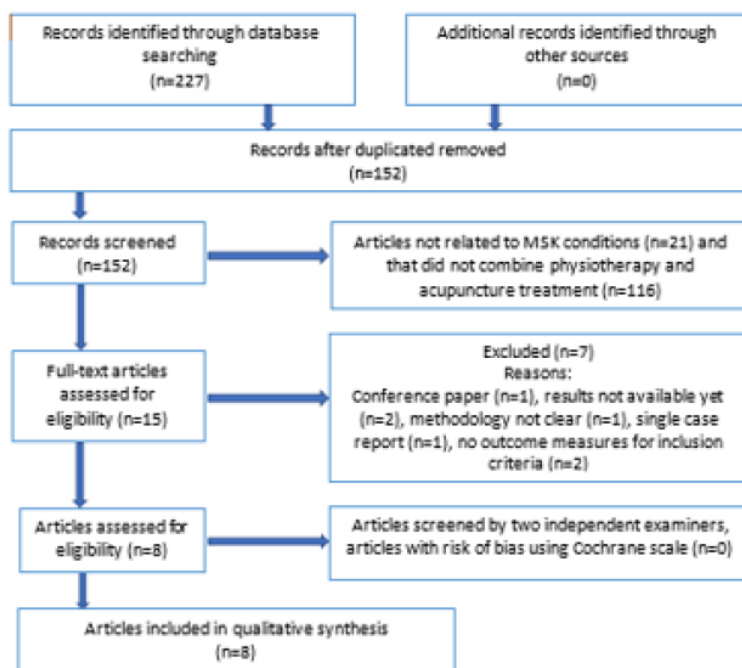


Fig. (1). Flowchart: search strategy and relevant yield studies included in the review.

In one study, both groups received a standard postoperative Physiotherapy program; however, each patient was also given either ten sessions of Acupuncture or sham Acupuncture within two weeks [13]. In a ten-week study, Franca *et al.* [14] classified participants into 3 groups for different treatments. Physiotherapy and Acupuncture were administered to Group-1, Group-2 received Acupuncture only, and Physiotherapy alone was administered to Group-3. In a study by Johansson *et al.* [15], patients diagnosed with subacromial impingement syndrome (SIS) were randomized to either subacromial corticosteroid injection(s) or 10 Acupuncture treatments combined with home-exercises. Chen *et al.* [16] conducted a study in which Acupuncture was performed at the same nine points dictated by the Traditional Chinese “Bi” syndrome approach to knee pain, using either standard needles or Streitberger non-skin puncturing needles. Kizhakkeveetil *et al.* [17] randomized participants with acute or chronic lower back pain to three groups: (1) Acupuncture, (2) spinal manipulative therapy (SMT), or (3) integrative Acupuncture and SMT groups. Foster *et al.* [18] designed a study, which investigated the benefit of adding Acupuncture to a course of advice and exercise delivered by physiotherapists for pain reduction in patients with osteoarthritis of the knee. Interventions included (1) advice and exercise, (2) advice and exercise plus true Acupuncture, and (3) advice and exercise plus non-penetrating Acupuncture. In a separate study by Sun *et al.* [19], 35 patients with frozen shoulder complications were randomly selected for six weeks of Acupuncture group treatment. Lastly, Bishop *et al.* [20] conducted a study in which groups were categorized into three treatments: (1) standard care, (2) standard care plus real Acupuncture or (3) standard care plus non-penetrating Acupuncture.

4. RESULTS OF INDIVIDUAL OUTCOME MEASURES

4.1. Qualitative Analysis

4.1.1. Range of Movement (ROM)

Although ROM was one of our primary outcome measures, it was only assessed in one study [13], comparing physiotherapy with real acupuncture to physiotherapy with sham acupuncture. The study did not find a significant effect on ROM, which was found between the groups, with a P-value ranging between 0.09 and 0.75 (Table 1).

4.1.2. Mobility Measure

The effectiveness of combining Physiotherapy with Acupuncture on Mobility measures was assessed in two studies [13, 16]; however, they used different outcome measures in their studies, for which pooling of the data was not possible. In the study by Tsang *et al.* [13], using the TUG test, significant differences were found between the groups after eight weeks of intervention, benefiting the group of Physiotherapy treatment in combination with real acupuncture, however, this difference disappeared after 15 weeks of intervention. Furthermore, comparing the results between the 8th and the 15th week, there are no significant differences between the intervention and the control group. The study by Chen *et al.* [16], when analyzing the 6-minute walk test (6MWT), did not find significant differences between the two groups (Table 2). The non-significance might be because the participants were not equal at baseline, this might have an effect on treatment, and we cannot attribute the non-significance effect to the ineffectiveness of the treatment.

Table 1. Results of effects on range of motion.

First Author (Year)	OM	Group	Baseline (Pre Intervention)				Post-Intervention					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Mean difference	95% CI of the mean difference
Tsang <i>et al.</i> ⁶²	AROM (Right Knee)	PT+ACUP	15	100.9	27.3	0.464	15	94.0	15.0	0.745	1	-11.74 to 9.74
		PT+SHAM	15	107.0	16.0		15	93.0	13.7			
	AROM (Left Knee)	PT+ACUP	15	101.7	31.9	0.441	15	96.5	17.1	0.098	-3.2	-8.9 to 15.30
		PT+SHAM	15	109.0	17.3		15	99.7	15.2			
	PROM (Right Knee)	PT+ACUP	15	108.8	29.6	0.462	15	107.9	11.3	0.729	6.4	-15.08 to 2.28
		PT+SHAM	15	115.3	16.5		15	101.5	11.9			
	PROM (Left Knee)	PT+ACUP	15	110.6	35.4	0.434	15	107.3	15.9	0.320	1.3	-12.75 to 10.15
		PT+SHAM	15	118.7	17.2		15	106.0	14.7			

*OM = Outcome measure; ROM = Range of motion; SD = Standard deviation; CI = Confidence Interval; AROM = Active range of Motion; PROM = Passive Range of Motion; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group.

Table 2. Results of effects on gait assessment.

First Author (Year)	OM	Int. or Ctrl Group	Pre-Intervention			8 th week Post-Intervention				15 weeks Post-Intervention					
			N. in group	Mean	SD	N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference
Tsang <i>et al.</i> ⁶²	TUG ¹	PT+ACUP	15	29.9	15.6	15	78.4	30.7	0.028	15	45.8	31.1	0.929	6	-22.46 to 10.46
		PT+SHAM	15	19.4	7.0	15	67.5	48.8		15	39.8	33.4			
			Pre-Intervention				12 weeks Post-Intervention								

First Author (Year)	OM	Int. or Ctrl Group	Pre-Intervention			8 th week Post-Intervention				15 weeks Post-Intervention						
			N. in group	Mean	SD	N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference	
Chen et al. ⁶⁵	6MWT	PT+ACUP	105	1032 [#]	314	0.027					71	1119 [#]	Not given	0.562	-28	1046-1195 [#]
		PT+SHAM	109	1126 [#]	289					82	1147 [#]	1086-1209 [#]				

OM = Outcome Measure; Int = Intervention group; Ctrl = Control group; SD = Standard Deviation; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group; TUG = Time-up-go test; 6MWT = 6 minutes' walk test.

Table 3. Results on muscular tension within groups, based on the paired t-test.

First Author (Year)	OM	Groups	Pre Intervention				After 6 months of treatment				
			N. in group	Mean	SD	P Value (within group)	N. in group	Mean	SD	P Value (within group)	Effect size
Franca et al. ⁶³	VAS _{mt}	PT + ACUP	16	90.0	14.81	0.053	16	15.0	14.81	<0.000	PT/ACUP= -5
		ACUP	15	80.0	22.2		15	20.0	14.81	<0.000	ACUP/PT+ACUP= -10
		PT	15	70.0	22.2		15	30.0	14.81	<0.000	PT/PT + ACUP= -15

OM = Outcome Measures; SD = Standard Deviation; VAS = Visual Analogic Scale; PT+ACUP = Physiotherapy group; PT = Acupuncture group; ACUP = Acupuncture group.

Table 4. Results of effect on functional disability.

First Author (Year)	OM	Groups	Pre Intervention			Post-Intervention					
			N. in group	Mean	SD	N. in group	Mean	SD	Effect size	95% CI of the mean	
Bishop et al. ⁶⁹	ODI	PT	32	34.1	11.4	32	32.2	18.8	PT+ACUP/ACUP = 10.9	25.5-36.9	
		PT + ACUP	32	29.1	10.9	32	21.3	17.7	ACUP/PT = -4.9	17.5-28.8	
		PT+ SHAM	27	33.9	13.6	27	26.2	14.4	PT+ACUP/PT = 6	19.1-31.3	
First Author (Year)	OM	Groups	Pre Intervention			After 6 months of treatment					
			N. in group	Mean	SD	N. in group	Mean	SD	Effect size	95% CI	
Kizhakkeveettil et al. ⁶⁶	Disability Level	ACUP	34	10.8	5.6	34	6.3		6.16	ACUP/SMT= 3.2	4.1-8.4
		SMT	36	11.1	6.0	36	3.1		5.9	SMT/ACUP+SMT = -0.9	1.1-5.1
		ACUP+SMT	31	9.7	6.4	31	4.0		5.18	ACUP/SMT = 2.3	2.1-5.9

*OM = Outcome Measures; SD = Standard Deviation; NDI-BR(%) = Neck Disability Index: Brazilian Portuguese Version; ODI = Oswestry Disability Index; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group; PT+SHAM = Physiotherapy plus Sham Acupuncture group.

4.1.3. Muscular Tension

Franca et al. [16] assessed muscular tension using VAS_{mt}. They observed the patients for six months and found statistically significant improvements within the groups for all parameters in comparison with the baseline (p<0.000) (Table 3).

4.1.4. Functional Disability

Three of the included studies assessed Functional Disability as an outcome measure [14, 17, 20]. Franca et al. [14] used the Neck Disability Index (NDI), and found significant differences between groups after 6-months follow-up favouring the Acupuncture + Physiotherapy group (Table 4). The Kruskal-Wallis test was used to evaluate differences of the medians and of the individual characteristics among them at baseline, which were not significant in this study. The improvements in outcome in the Physiotherapy combined with Acupuncture group were superior to the Acupuncture alone

group and Physiotherapy alone group in reducing functional disability (p<0.05) in comparison with baseline. Additionally, The Kruskal-Wallis Test (KWT) and Dunn's Multiple Comparison Test (DMCT), as post-test, were used to assess the significant differences of the parameters of the intra-groups among three groups after six months of treatment. There was a significant difference in median functional disability (p = .0018) (Table 4).

Bishop et al. [20] used the Oswestry Disability Index Score (ODI). The results of Bishop et al. (2016) [20] seem to be inconclusive since the confidence intervals are overlapping. Therefore, no differences in the ODI can be found between the groups after eight weeks of treatment. These results are presented in Table 4 (21.3 (17.5-28.8)).

Kizhakkeveettil et al. [17] resorted to Roland-Morris LBP Disability Questionnaire to evaluate disability in patients with Low Back Pain. The study indicated that there was an improvement in the primary outcomes among the subjects in

the three groups. However, the research did not identify any differences in outcomes between the three groups. The study findings pointed to the feasibility of implementing a large-scale RCT examining the adoption of an integrative care model that involves the combination of SMT and acupuncture in improving the patient outcome in the management of lower back pain when compared to the implementation of the therapy alone (Table 4).

4.1.5. Muscular Strength

Another outcome measure analyzed by Franca *et al.* [14] was Isometric Neck Muscle Strength (INMS), using a pressure Biofeedback Device (Craneo-Cervical Flexion Test (C-CFT), Stabilizer, Chattanooga South Pacific, Australia). Significant improvements within the groups have been found, based on the paired t-test (p<0.05). The DMCT, also showed that the Physiotherapy + Acupuncture group was superior to the Acupuncture group and Physiotherapy group in INMS improvement (p<0.0001), after 10 weeks of treatment. The improvements in INMS of all groups were maintained (p=0.006) after 6 months of treatment, in comparison with baseline (Table 5).

4.1.6. Shoulder Function

In the study of Johansson *et al.* (2011) [15], significant improvement of shoulder function over time was found in both groups (p<0.001), according to the analysis of variance (ANOVA). However, the between-group variance for the ANOVA test indicated no significant differences in the effectiveness of the two combinations; Physiotherapy+Corticost and Physiotherapy + Acupuncture. These results implied that both techniques are effective in treating MSK complications (Table 6).

4.1.7. WOMAC Score

Chen *et al.* (2013) [16] evaluate the effectiveness of Physiotherapy combined with real or sham acupuncture in patients with osteoarthritis of the knee and hip, including pain, stiffness, and physical functioning of the joints. Both treatment groups showed improvement from combined therapy with no difference between real (31.6%) and non-penetrating Acupuncture (30.3%) in WOMAC response rate (p=0.148). Based on the cumulative distribution function curves displaying every possible definition of a clinical response on the WOMAC, no appreciable clinical or statistical differences were observed (Table 7).

Table 5. Results of effects on muscular strength.

First Author (Year)	OM	Groups	Pre Intervention			After 10 weeks of treatment					After 6 months of treatment						
			N. in group	Mean	SD	N. in group	Mean	SD	P Value within group	P value between group	Effect size	N. in group	Mean	SD	P Value within group	P value between group	Effect size
Franca et al ⁶³	C-CFT (mmHg) Isometric Neck Muscle Strength (INMS)	PT+ACUP	16	22.0	1.41	16	27.1	2	P<0.001	P<0.0001	PT+ACUP/ACUP= 3.4	16	26.1	2.4	P<0.0001	P=0.0006	PT+ACUP/ACUP = 4
		ACUP	15	22.0	1.41	15	23.7	1.4	P<0.001		ACUP/PT = 2.8	15	23.0	1.6	P=0.0004		ACUP/PT = -2
		PT	15	20.0	1.41	15	20.9	1.4	P<0.001		PT/PT+ ACUP =6.2	15	23.2	1.4	P<0.0001		PT/PT+ ACUP = 2

*OM = Outcome Measures; SD = Standard Deviation; C-CFT = Cranio-Cervical Flexion Test; INMS = Isometric Neck Muscle Strength; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group.

Table 6. Results of effects on shoulder function.

First Author (Year)	OM	GROUPS	Pre Intervention				12 month follow-up						
			N. in group	Mean	SD	P Value between groups	95% CI	N. in group	Mean	SD	P Value between groups	Effect size	95% CI of the mean
Johansson et al (2011) ⁶⁴	Shoulder Function	PT + Corticost	49	69	12	P<0.001	66-73	37	88	-19	P<0.001	-3	84-92
		PT+ACUP	42	70	12		67-74	32	91				88-95

*OM = Outcome Measures; SD = Standard Deviation; PT = Physiotherapy; ACU = Acupuncture; CI = Confident Interval; PT+Corticost = Physiotherapy plus Corticosteroids group; PT+ACUP = Physiotherapy plus Acupuncture group.

Table 7. Results of effects on WOMAC score.

First Author (Year)	OM	GROUPS	Pre Intervention				26 weeks Post-Intervention				
			N. in group	Mean	SD	P Value	N. in group	Mean	P Value	Effect size	95% CI of the mean
Chen et al (2013) ⁶⁵	WOMAC	PT+ACUP	105	47.6	14.7	P=0.097	71	41.5	P=0.148	4.3	37.6-45.4
		PT+SHAM	109	44.0	15.7		82	37.2			32.8-41.6

*OM = Outcome Measures; SD = Standard Deviation; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group.

Table 8. Results of effects on CSA.

First Author (Year)	OM	GROUPS	Pre Intervention				20 weeks follow-up				
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size
Sun et al (2001) ⁶⁸	CSA	PT+ACUP	13	41.3	14.9	0.9651	13	67.3	11.5	0.048	9.4
		PT	22	42.8	14.0		22	57.9	15.1		

*OM = Outcome Measures; SD = Standard Deviation; CSA = Constant Shoulder Assessment; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT = Physiotherapy group.

Table 9. Results of effects on medication effects.

First Author (Year)	OM	Int. or Ctrl Group	Pre Intervention				Post-Intervention					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference
Tsang et al (2007) ⁶²	Analgesic Consumption	PT+ACUP	NOT MENTION				15	28.3	11.6	0.447	-3.6	- 13.2 to 6.0
		PT+SHAM					15	24.7	13.8			

*OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group.

4.1.8. Constant Shoulder Assessment (CSA)

The Constant Shoulder Assessment score is a scale ranging between 0 and 100 that is used to assess the functionality of a shoulder following shoulder injury treatment. The test has four primary outcome measures: activities of daily living, pain, range of motion, and strength with specific maximum scores of 20, 15, 40, and 25, respectively. To interpret the scale, the researcher simply looks at the score value for a specific outcome measure; the higher the outcome measure, the greater the quality of shoulder functionality. The frozen shoulder was studied by Sun *et al.* (2001) [19], using the CSA to evaluate the level of pain and the ability to carry out the usual daily activities of the patient. They have reported that CSA scores were significantly higher in the Physiotherapy plus Acupuncture group (Intervention) compared to the Physiotherapy alone group (Control) at 20 weeks (p=0.048) (.). Within each group, there was a significant difference among mean CSA scores measured at baseline, 6 weeks, and 20 weeks (p<0.001 by Friedman's test (Table 8).

4.1.9. Medication Effects

Tsang *et al.* (2007) [13], measured the analgesic consumption between the two groups. Although no significant difference in the analgesic consumptions between the two groups after the intervention (p=0.447); the authors failed to report baseline results, limiting the interpretability of the results (Table 9).

5. DISCUSSION

5.1. Summary of Findings

The purpose of this systematic review of RCT was to investigate the current knowledge regarding the application of Acupuncture as adjunctive therapy to Physiotherapy in the treatment of MSK conditions, aiming at improving the patient health outcome. Eight studies were included in this review, accounting for a total of 960 participants with clinical MSK conditions (knee osteoarthritis, tension neck syndrome, subacromial impingement, low back pain, and frozen shoulder).

The pain was the most commonly assessed outcome measure, reported in five of the eight included studies. This was analyzed by using various pain outcome measures: Visual Analogic Scale (VAS) [14], the Numeric Pain Rating Scale (NPRS) (Kizhakkeveetil *et al.*, 2017 [17]; Tsang *et al.* [13], 2007; Bishop, 2016 [20]); Adolffson-Lysholm shoulder assessment (AL-SCORE) for pain (Johansson *et al.*, 2011) [15]; and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) – pain subscale score (Chen *et al.*, 2013 [16]; Foster *et al.*, 2007) [18]. Other outcome measures used in the included studies were: quality of life using EQ-5D-5L Questionnaire, assessment of active and passive ROM, using a goniometer (Tsang *et al.*, 2007) [13]; ambulation measurement by the timed up and go test (TUG) (Tsang *et al.*, 2007) [13]; muscular tension by the Visual Analogue Scale for muscular tension (VASmt) assessment (Franca *et al.*, 2008) [14]; and shoulder assessment by the AL-SCORE (Johansson *et al.*, 2011) [15]; and the Constant Shoulder Assessment (CSA) (Sun *et al.*, 2001) [19].

5.2. Limitations of the Review and Included Studies

All studies selected for the systematic review were RCTs, with all clearly identifying methods of randomization. However, Sun *et al.* (2001) [19] failed to report concealment of allocation. Chen *et al.* [16] did not report similar groups at baseline. Several studies, such as Franca *et al.* [14], Kizhakkeveetil *et al.* [17], Foster *et al.* [18] and Bishop *et al.* [20] did not report blinding of the assessors; and Johansson *et al.* [15] did not report 85% of the outcome measures. Only Chen *et al.* (2013) [16] and Sun *et al.* (2001) [19] were able to record the blinding of Therapists to group allocation. This is because, for the therapist who performs the therapy, blinding is exceedingly difficult. It can be argued that if data collection is blinded, a bias is minimized; but if the therapist believes more in one of the techniques, he or she can influence the study results. Two independent reviewers assessed the risk of bias. The assessors found the risk of bias to be within acceptable limits. That helped in lowering the risk of bias in the current review by ensuring consensus between the reviewers. Nevertheless, the risks of bias found in the selected studies

reduce the reliability of the evidence found, demonstrating the need for future studies to be conducted on a large scale with representative samples of the population and with a low risk of bias.

5.3. Comparison with other Studies or Reviews

Other research has also shown that acupuncture is synergistic with conventional therapies, which is highly relevant for physiotherapists as they already combine various interventions [23]. However, as far as the literature review conducted is concerned, this is the first systematic review that was conducted specifically on the effectiveness of acupuncture combined with physiotherapy in MSK conditions. The researchers only obtained empirical studies that were used for the systematic assessment, which indicate the effectiveness of acupuncture.

5. RECOMMENDATIONS

Future research should ensure improved allocation and blinding of participants and narrow down their inclusion and exclusion criteria to reduce the heterogeneity of the populations being studied. Increasing the number of studies would increase the sample size and thus the power to study the effects of interest. Proper blinding is crucial to the studies. “Blinded” therapists ensure that therapists were unable to discriminate whether subjects received treatment. When therapists are “blinded”, the apparent effect (or lack of effect) of the treatment did not occur due to enthusiasm or lack of enthusiasm for treatment and control conditions. Lastly, including studies with less heterogeneity improves the validity of the findings, and the researcher is assured that the populations being investigated are similar.

6. IMPLICATIONS

The interest in acupuncture among physiotherapists has increased over the last few years [24]. This is evident in the research conducted by physiotherapists, particularly MSK conditions [25]. Only a few studies have investigated Physiotherapy treatment in combination with Acupuncture for MSK conditions. This systematic review found a significantly higher and positive effect in combining acupuncture and physiotherapy versus other interventions on NDI, neck strength, and CSA. Acupuncture, in addition to physiotherapy, could, therefore, be used in the management of neck and shoulder problems. However, more research is needed to confirm these results.

CONCLUSION

This study sought to systematically review and critically appraise the evidence for the use of acupuncture as an adjunctive modality to physiotherapy in the treatment of MSK conditions. As an integrative or complementary therapy for pain, acupuncture has increasingly been used. However, this review did not find significant evidence to support that the addition of acupuncture to physiotherapy treatment has an added benefit to pain relief. This review did, however, find benefits of adding acupuncture to treatment for improving shoulder function, reduce neck disability, low back pain and

muscular strength. Notwithstanding this, more research is needed to measure the effectiveness of the combination of acupuncture with physiotherapy. In the United States alone, more than \$30 billion were spent on alternative and complementary medicines such as acupuncture in 2012 [26]. Therefore, further research into the effectiveness of acupuncture is warranted.

CONSENT FOR PUBLICATION

Not applicable.

STANDARD OF REPORTING

PRISMA guidelines have been followed for this study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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SUPPLEMENTARY MATERIAL

Supplementary material is available on the publishers web site along with the published article.

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